QUANTIFYING EVAPORATION ON THE SURFACE OF SLIMES DAMS IN THE SOUTH EASTERN PART OF THE NORTH WEST PROVINCE

by

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THESIS

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ABSTRACT

Title: Quantifying evaporation on the surface of slimes dams in the south eastern part of the North West Province.

Study Leader: Dr. J.T. Harmse

Water can be regarded as a scarce commodity in South Africa and one cannot rely solely on the discovery of new water resources to meet the ever increasing demands.

Water is arguably the most precious resource in South Africa and its proper management in all spheres of activity is imperative (Middleton and Stern, 1987). This is no different in the mining industry where a primary consumptive use of water is in the tailings dams and associated return water.

Restricted implementation of Government water plans and a series of droughts has forced users of water to optimise their use of water .

A key to correct water management of a tailings disposal system on a gold mine lies in accurate and meaningful water balance. To provide an accurate water balance, quantifying the water loss is necessary. The water loss in a tailings system is mainly due to evaporation and interstitial flow.

For the purpose of this study, evaporation is dealt with in more detail.

Water loss through evaporation varies in quantity with the changing climate. In order to measure evaporation, standard Class A evaporation pans were set up on the penstock pipes of three slimes dam at Vaal Reefs Mining & Exploration Limited. The three slimes dams used are East slimes dam, Mispah slimes dam and West slimes dam. The study was conducted over one rainfall year, July 1994 to July 1995. The data from the evaporation pans were correlated with evaporation pan data measured in Potchefstroom by the Institute for Soil, Climate Water.

The data were applied to a regression analysis and an analysis of variance. The fresh water has low salt content in comparison to the slimes dam water, therefore, a predictive regression could be established.

Climatic data were obtained from the Weather Bureau. The climatic variables were correlated with the evaporation data in a regression analysis and an analysis of variance. The study area falls within the Highveld temperate climate. The data were divided into the Highveld seasons to aid the analysis with more observations as well as obtaining more applicable results for the management of the water on the slimes dams.

It was found that the evaporation on the slimes dam was influenced by three climatic variables, namely temperature, humidity and wind speed.

The optimal time for the conservation of water on the slimes dam in order to reticulate is during the winter months. The optimal time for the disposal of low quality water is during the spring and summer months.

The total evaporation on East slimes dam for the period July 1994 to July 1995 was 1 087 235.2 kilolitres. Mispah slimes dam had a total of 822 234.5 kilolitres and West slimes dam 407 707.09 kilolitres.

OPSOMMING

Titel : Die kwantifisering van verdamping op die oppervlak van slikdamme in die suid oostelike deel van die Noord-Wes Provinsie.

Studieleier: Dr. J.T. Harmse

Water kan as 'n skaars hulpbron in Suid Afrika beskou word. Ons kan nie op die ontsluiting van nuwe waterbronne staatmaak om die immer groeiende vraag te voldoen nie.

Sonder twyfel is water die mees kosbare hulpbron in ons land -daarom is die korrekte bestuur van hierdie kommoditeit in alle opsigte noodsaaklik (Middleton and Stern, 1987). Ook in die mynboubedryf is die bestuur van water noodsaaklik: hier word veral uitskot- en terugvoersisteme as primere verbruikers geidentifiseer.

Die toepassing van die Regering se Waterwetgewing, tesame met 'n paar jare van benede-normale neerslag in Suid-Afrika se somerreenvalgebiede, het alle waterverbruikers genoop om die gebruik van die beskikbare waterbronne te optimaliseer.

'n Sleutel tot die korrekte bestuur van die uitskotsisteem van 'n tipiese goudmyn lê in die opstel van 'n betekenisvolle waterbalans vir die betrokke sisteem. Ten einde 'n akkurate waterbalans te bereken, is die bepaling van die eksakte hoeveelhede waterverlies 'n voorvereiste. In die uitskotsisteem van 'n goudmyn word water hoofsaaklik deur verdamping en tussenruimtelike vloei (deur die partikel-poriee) bewerkstellig. Die doel van hierdie studie is om verdampingsaspek te kwantifiseer.

Die hoeveelheid waterverlies a.g.v. verdamping varieer tesame seisoenale skommeling. Om die verdamping vanaf die goudmynslikhope in die studiegebied te bepaal, is drie Klas A verdampingspanne op die sluiskleppe van drie slikdamme van die Vaal Reefs Goudmynkompleks opgestel. Hierdie slikdamme was die Oos-, Mispah-, en Wes-slikdam. Die studie is vir die duur van een reenvaljaar (Julie 1994 tot Julie 1995) onderneem. Data vanaf die verdampingspanne op die slikdamme is met data vanaf 'n verdampingpan te Potchefstroom (deur die Instituut vir Grond, Klimaat en Water bedryf) gekorreleer.

Daarna is die inligting aan variansie- en regressie-analise onderwerp. Omdat varswater 'n laer soutgehalte as slikdamwater het, kon voorspellende regressielyne gekonstrueer word.

Bykomende klimaatdata vir die matige Hoeveld is ook vanaf die Weerburo in Pretoria bekom. Hierdie is met die verdampingsdata vanuit die studiegebied in 'n regressie- en variansie-analise gekorreleer. Die data is volgens die Hoeveldseisoene ingedeel ten einde die analise daarvan meer sinvol te laat geskied; hierdie aksie het bygedra om meer sinvolle resultate te verkry vir die uiteindelike opstel van 'n waterbestuursplan vir die goudmyn.

Daar is vasgestel dat die verdamping van water vanaf die slikdamme deur *drie* klimatologiese veranderlikes bepaal word, nl. temperatuur, vogtigheid, en windsnelheid.

Daar word aanbeveel dat die optimale seisoen vir die bewaring van water op die slikdamme, waartydens water bloot gesirkuleer kan word, die wintermaande is. Daarenteen is die optimale tyd vir die verwydering van laekwaliteit water gedurende die lente en somer.

Daar is ook bereken dat, vir die tydperk, Oos-slikdam 1 087 235.2 kiloliter water deur verdamping verloor het, met Mispah-slikdam 822 234.5 kiloliter en Wes-slikdam 407 707.09 kiloliter.

Acknowledgements :

I would like to express my gratitude to the following persons for their continued assistance and patience during the research and compilation of this thesis. These persons are:

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- Dr J.T. Harmse for his guidance in the study,
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1. INTRODUCTION

South Africa is not richly endowed with abundant water resources and the problem is further exacerbated by an uneven geographical distribution of available water resources (Wagner and van Niekerk, 1987). Water can be regarded as the most precious resource in South Africa and its proper management in all spheres of activity is imperitive. This is no different in the gold mining industry in South Africa.

Due to this lack of water in the right place, and the awareness thereof, water resources in South Africa have always received important attention (Wagner , 1987). In fact, the Water Act, Act 54 of 1956, already made provision then for the optimal use of water, the control of pollution and disposal of waste waters. The introduction of Section 22A of the Water Act No. 54 of 1956 now imposes far greater consequences on the mining industry as the "Polluter Pays Principle" has expanded to involve the interested and affected parties as well as the past, current and future land owners and leasers (Webber Wentzel, 1993). The legislation pertinent to pollution makes it an offence to discharge water of the quality such as that which originates from the gold mining industry (Wates and Kelley, 1985).

A primary consumptive use of water in the gold mining industry is in the tailings dams and associated return water systems. Large water reticulation systems, where tailings systems play a large role, are being used in the gold mining industry to conserve water resources and reduce pollution in compliance to legislation. A key to the correct water management of a tailings system lies in an accurate and meaningful water balance.

The costs to the gold mining industry associated with poor waste water management, substandard water quality, and the purchase of potable water amount to an estimated R360 million per annum. Improved water quality management, including the implementation of large scale water reclamation, may realise cost benefits of between R230 million and R440 million per annum (Pulles, 1992).

However, the introduction and implemenatation of an effective water management strategy, incorporating optimum water reclamation, can realise significant cost and strategic benefits for the gold mining industry.

In order to implement and maintain an effective water management programme, a clear understanding of the plant and mine reticulation systems and networks is required. In this regard, networks and balances must be prepared and kept up to date. Thereafter, an understanding of the effluent generation and consumption problems must be sought. Given this information, the reticulation and storage facilities required to eliminate uncontrolled discharge, except in extreme weather conditions, can be designed. The tailings dams produce the most variable and unpredictable quantity of effluent on the mine. In order to understand the effluent generation problems hydrological models can be used. Elements of such a model are :

Inflows : water with the tailing
precipitation
any extraneous disposals such as sewage or concen-
treated effluents.

Outflows: return water re-use

evaporation

seepage losses

interstitial water (water retained in the pores of the tailing)

These water reticulation systems and the actual volumes of water circulated, consumed and discharged vary tremendously from one mine to the next. Figure 1 is a schematic diagram of a typical tailings system water network (Stanley, 1985).

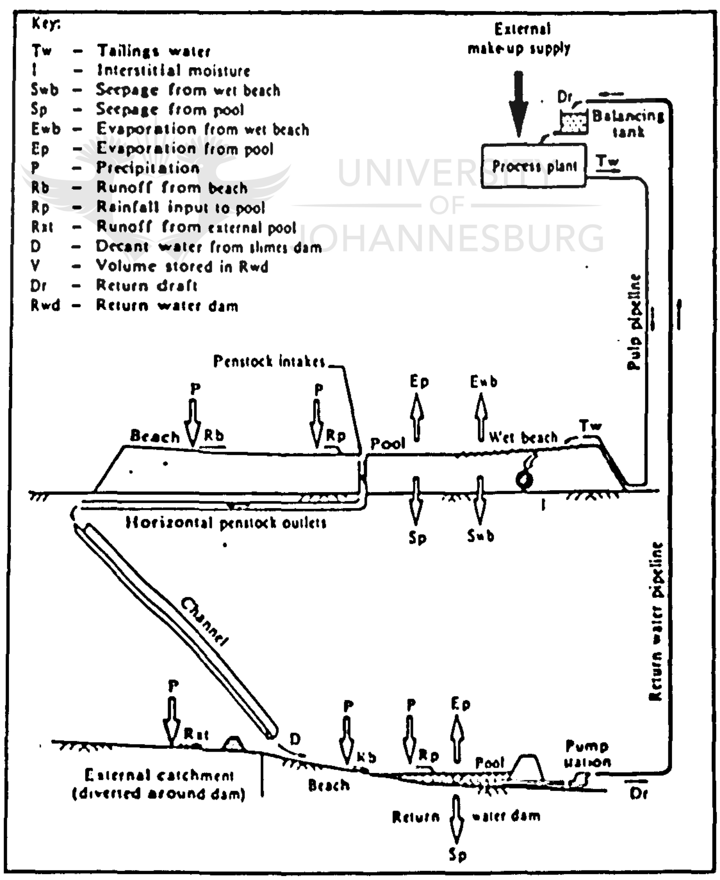


Figure 1: A typical tailings system network (Stanley, 1987).

The water balance at one of the largest mines in the south eastern part of North West Province, Vaal Reefs Exploration and Mining Company Ltd, required more information regarding the water loss on the slimes dams. Evaporation from the surface of the slimes dams was studied in more detail.

1.1 PROBLEM FORMULATION

The water loss on the slimes dams at Vaal Reefs Exploration and Mining Company Ltd needed to be quantified. However, the textural characteristics of the slime on the slimes dam has a large influence on the movement and retention of water in the slimes dam. The fineness and horizontal layering of the slimes dams combine to largely curtail the downward movement of water in the slimes dam (Du Plessis and Reynders - undated).

Thus, a large portion of the water loss on a slimes dam can be ascribed to evaporation.

The study was undertaken to achieve the following objectives:

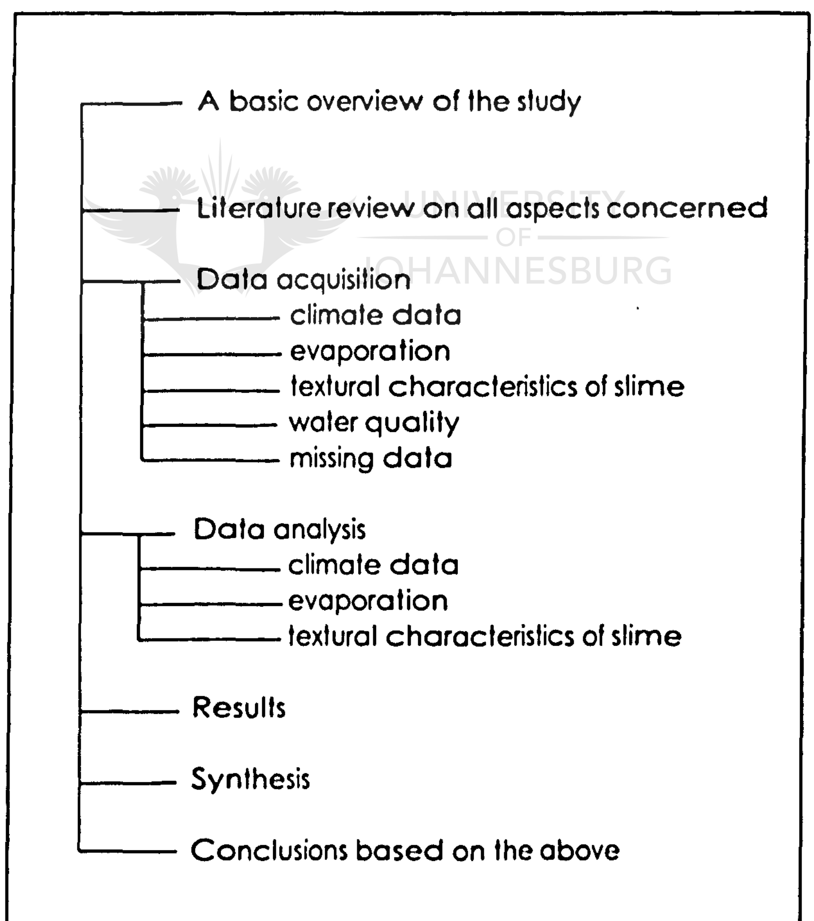
(1) Quantify the evaporation from the surface of the slimes dams;

(2) Identify the climatic variables influencing the evaporation on the slimes dam. Provide management options on the optimum time of the year for conserving water in the reticulation system or to dispose of low quality water efficiently.

The information will help improve the existing water management of the tailings systems by the conservation of water, efficient disposal of water when necessary, and in effect, the reduction of water pollution.

1.2 RESEARCH METHODOLOGY

The following flow diagram gives the procedure along which the research was undertaken:



Evaporation from the surface area of water on the slimes dam is also affected by a number of climatological factors such as :

- Radiation
- Wind flow
- Air temperature and vapour pressure
- Atmospheric pressure (Hounam, 1973)

Taking the above climatological factors into account, evaporation on the slimes dams will be quantified in accordance with the Highveld seasons. The Highveld experiences warm temperatures and summer rainfall. The rainfall can have various effects on the evaporation, thus the study was undertaken over one full rainfall year (July 1994 to July 1995). The Highveld seasons are classified as follows:

Winter : June, July, August, September
Spring : October, November
Summer : December, January, February, March
Autumn: April, May

The evaporation for each slimes dam will be determined by applying linear regression analysis between fresh water evaporation measurements recorded in Potchefstroom and actual evaporation from on the slimes dams. Cogho *et al* (1992) found from correlations and the cumulative evaporation from various stations in the northern Orange Free State that evaporation is fairly uniform over the area. Therefore, the evaporation recorded in Potchefstroom can be regarded as an accurate representation of evaporation in the area.

The regression line can serve as a predictive model for future forecasting of evaporation on the slimes dams. The actual evaporation from the slimes dams will be correlated with the climatological factors that influence evaporation on each of the slimes dams. The actual evaporation will provide the volumes of water evaporated from the surface area of the slimes dams.

2. LITERATURE REVIEW

2.1 WATER IN THE GOLD MINING INDUSTRY

As is the case with most other industries, gold mining operations would not be possible without an adequate supply of water of the right quality. The gold mining industry uses water for a wide variety of purposes in its underground and surface operations. Water is used underground in drilling operations, for dust suppression, environmental cooling, condenser circuits on refrigeration plants and recently as an energy source in hydropower and as a transport medium for backfill. In addition, potable water is supplied underground for drinking purposes. Many gold mines also produce considerable amounts of water through underground fissures (Pulles, 1992).

Considerable quantities of water are required for the surface operations on a gold mine. Water is required to transport the ore after it has been crushed and milled. The addition of water to the milled ore enables such operations as gravity concentration, thickening and cyanidation, followed by filtration or carbon-in-pulp recovery processes, to be performed. Finally, the water enables the transport of waste material to the slimes dams (Pulles, 1992).

Potable water is also supplied for domestic purposes at the hostels, residential areas and surface plants.

The water reticulation systems and actual volumes of water circulated, consumed and discharged, vary tremendously from mine to mine.

In order to obtain an understanding of the importance of water in gold mining a water balance has been produced for the whole gold mining industry, which in turn enables the estimation of water usage patterns on the "average" gold mine. A number of attempts have been made to quantify water usage patterns in the gold mining industry and the presented here was developed by Chamber of Mines Research Organisation (COMRO). The water balance developed by COMRO is summarized in Figure 2 (Pulles, 1992).

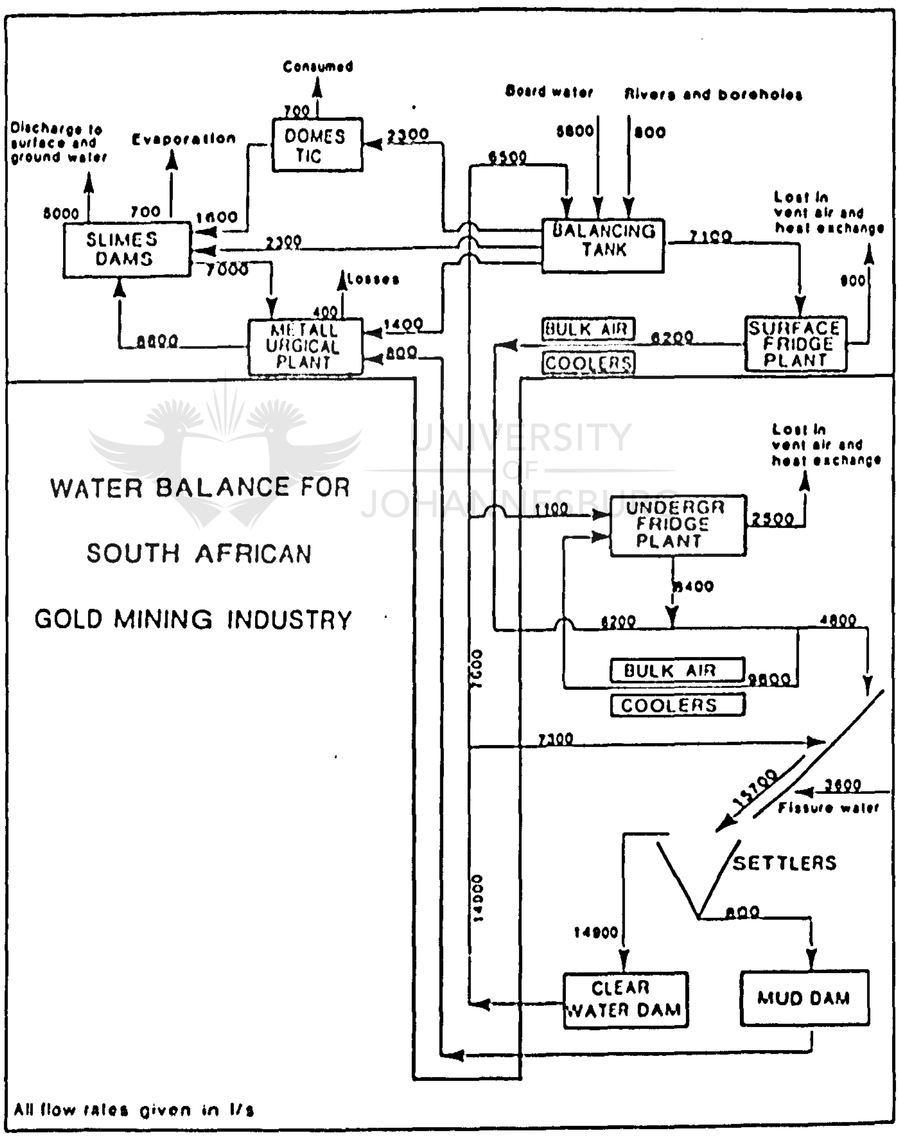


Figure 2: Water balance for the South African gold mining industry (Pulles, 1992).

The gold mining industry consumes and circulates an estimated 73 800 litres per second (l/s) of water. Approximately 63 600 l/s (86 percent) of this water is circulated in closed loops, and consumes the remaining 14 percent of the water. The bulk of the circulated water, 34 700 l/s is used as condenser water for the refridgeration plants, while 9 800 l/s of water is circulated to bulk air coolers to cool the air underground. A further 12 100 l/s of water is circulated for mining purposes, of which 4 800 l/s is chilled water, which performs a supplementary cooling function in the stopes. Taken together, a full 78 percent of the water in circulation is associated with mine cooling in one way or another. Finally, about 7 000 l/s of water is circulated between the reduction plant and the slimes dams for metallurgical purposes (Pulles, 1992).

2.2 TAILINGS SYSTEMS ON GOLD MINES

The gold mining operation produces a mixture of gold bearing ore and crushed development waste rock which after primary separation of the barren waste is forwarded to the reduction plants to expedite the removal of the gold and uranium. The waste product formed in this latter process is silt sized rock flour commonly known as reduction plant tailings or slimes (Verkerk, 1987).

The South African gold mines produce two types of tailings: A coarse tailings rock - which is an untreated waste rock and fine tailings - sand and slime - which is the residual material after metallurgical treatment of the milled ore (Gowan, 1987).

The disposal and impounding of the treated slime product is an important operation which has to be carried out in conjunction with the metallurgical treatment of the ore. The general method of building slimes dams in the Witwatersrand and surrounding areas differs from practice overseas because of the comparatively flat topography of the ground and low rainfall (Moir - undated).

Tailings waste disposal techniques in the South African mining industry have evolved over the years to the stage where they can be said to be extremely effective and suited to the conditions of application.

One of the features to be found in the mining industry is the number of different disposal techniques being used. Each technique has its own characteristic and best application, depending on a variety of factors such as topography, tailings material properties and availability of supervision and labour (Gowan and Williamson, 1987).

A typical tailings system will consist of tailings impoundments, return water dams and evaporation dams. Figure 3 is a diagrammatic representation of the water balance for a tailings system.

Other components of a residue disposal system include toe walls, an under drainage system, a decant system, stormwater diversion systems, return water systems and delivery system (Stanley, 1987).

Figure 4 is an aerial photograph of the construction phase the Mispah slimes dam at Vaal Reefs mine complex. The under drainage pipes and return water systems can be seen.

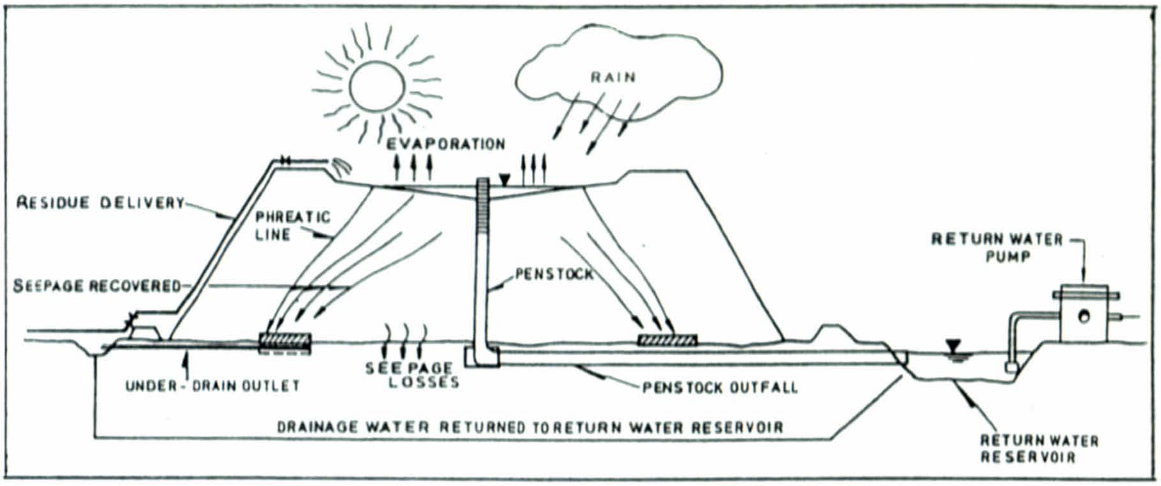


Figure 3 : Diagrammatic representation of the water balance for a typical tailings system (Handbook of Guidelines for Environmental Protection, 1983).

Figure 4: Aerial photograph of the construction phase of Mispah slimes dam.

Slurry water is pumped to the tailings dam. The solids settle out and clear water is decanted to a return facility. Other water inflows to the tailings dam are precipitation and surface runoff from an external catchment. Losses in the tailings dam include evaporation, evapotranspiration, seepage and interstitial water (Middleton and Stern, 1987).

A number of possible methods for hydraulically placing gold tailings exist, namely: (a) the paddock system, (b) the cyclone system, (c) the spigot system, and (d) open-end discharge behind a pre-formed wall. Vaal Reefs currently uses the paddock system. The choice of disposal methods for a particular project will be determined by a number of factors:

- cost, both capital and operating;
- previous mine experience with one or more of the methods and hence mine preferences;
- site topography
- climatic conditions as these effect drying characteristics and freeboard requirements;
- pulp density.

(Stanley, 1987).

(a) <u>Paddock system</u>

The paddock system for dam operation has been developed empirically over the past 100 years and seems particularly suited to the semi-arid and temperate climatic conditions in which most of the gold mines in South Africa are located. Figure 5 illustrates the paddock system method on slimes dams.

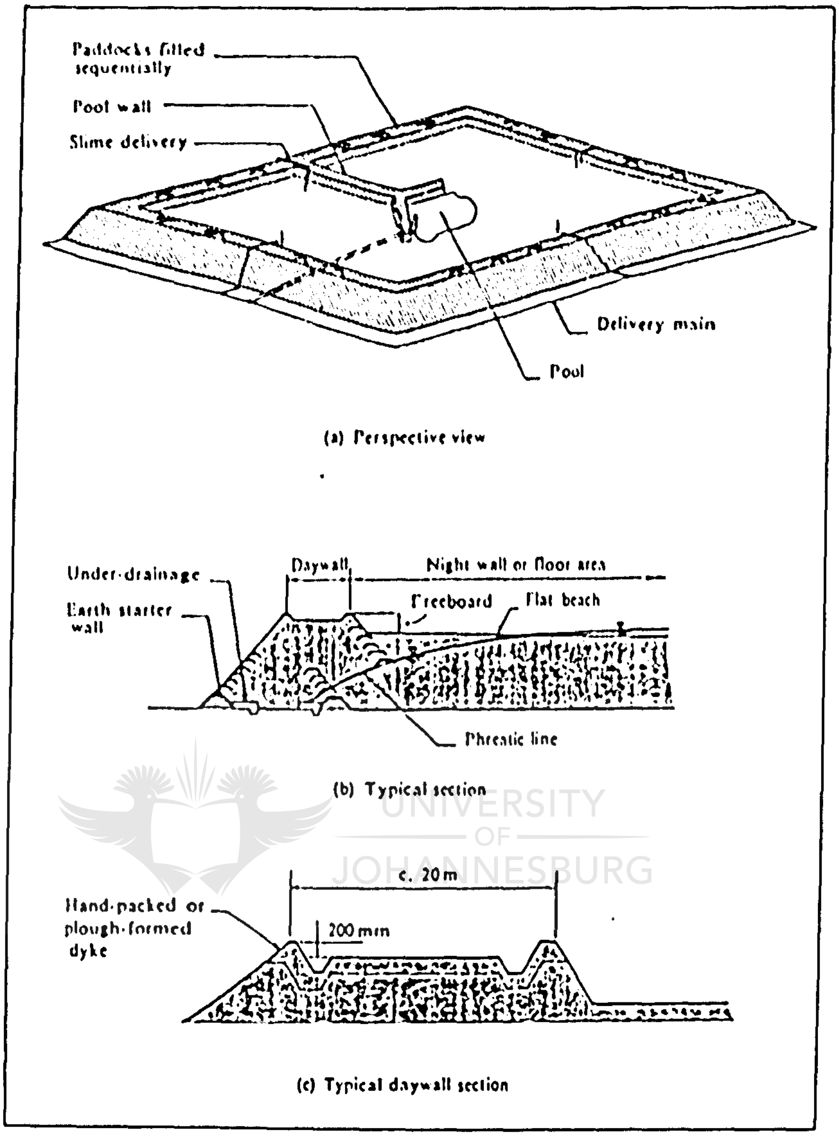


Figure 5: Paddock system of tailings dam construction (Stanley, 1987).

Deposition in this wall area is carried out only during the daylight owing to the large degree of control required on pulp depths. Uncontrolled deposition could easily result in over-topping.

During the night, the tailings are discharged directly into the interior of the dam behind the walls formed during the day. Excess water is drawn off the dam by means of penstock decants or by barge and pump.

On the goldfields of South Africa evaporation generally exceeds rainfall (Cogho, 1992).Provided that rates of rise are low enough, therefore the surface, with the exception of the pool area, becomes desiccated and large shrinkage cracks develop. These cracks are filled and re-filled by successive lifts of tailings. This desiccation is a fundamental requirement of paddocked dam construction. Drying results in densification, which gives the gold tailings the required strength. In addition the cracks tend to become filled with coarser material, which improves vertical drainage (Stanley, 1987).

(b) Cyclone system

Increased rates of rise can be tolerated by the gold tailings (up to 7 m/ year and more) by making use of a hydrocyclone to split the incoming slimes into two components:

- cyclone underflow which contains the coarser particles and significantly reduced water content;
- the cyclone overflow which contains the finer particles and most of the water.

The cyclone underflow generally has improved shear strength properties due to the lower water content, is relatively more free-draining than paddocked tailings, and will form a cone on discharge. The cyclone overflow material is wet and of lower permeability due to the increased proportion of fines (Stanley, 1987).

The Cyclone system is conventionally best suited to tailings with a wide particle grading, to awkward sites where high rates of rise may apply and to situations where manual labour or mechanisation may not be suitable (Gowan and Williamson, 1987).

(c) Spigot system

The Spigot system is based on the need to ensure adequate drying and drainage of the tailings in the outer wall area by maximising the effects of natural evaporation and drainage. The system involves the use of a pipeline with multiple outlets referred to as a spigoted pipe. Regulated delivery in limited (200 mm maximum) layer thickness using a spigoted pipe is carried out. The spigoting encourages runoff of supernatant water directly to the pool concurrent with deposition. By depositing in thin layers, with a drying period between successive layers, the drainage of each newly deposited layer and evaporation effects are enhanced (Stanley, 1987).

Spigot deposition is generally used when the tailings has a wide grading and especially where it has a fairly high percentage of fines (Gowan and Williamson, 1987).

(d) Open-end discharge behind pre-formed walls

There are some topographical situations which dictate that they should best be deposited behind a pre-formed earth or rockfill wall. This method may often be more capital intensive than the methods described above where the tailings itself is used to form the outer impoundement. However there are situations where this system is necessary for successful tailings disposal (Gowan and Williamson, 1987).

3. STUDY AREA

Vaal Reefs Exploration and Company Mining Limited is situated in the south eastern part of the North West Province. Figure 6 is a map of surface layout of Vaal Reefs Mine complex adopted from van Niekerk (1994). The Vaal Reefs Mine Complex surrounds the town of Orkney, and is 18 kilometres south of Klerksdorp and 60 kilometres away west south west of Potchefstroom.

Three slimes dams were selected, namely; East slimes dam, West slimes dam and Mispah slimes dam. Three Class A evaporation pans were installed on the penstock pipes. The evaporation pans required regular filling with slimes dam water, it was therefore imperative that the most regularly pumped slimes dams be used. Accessibility to the slimes dam was essential for the data collection, therefore the three used most consistently and with easy access were chosen. These are East slimes dam, Mispah slimes dam and West slimes dam. Table 1 shows the top surface area in hectares of the slimes dams used.

Table 1: Surface area of slimes dams used at Vaal Reefs.

SLIMES DAM	SURFACE AREA IN HECTARES
East Slimes Dam	102.1062 ha
Mispah Slimes Dam	129.1514 ha
West Slimes Dam "Grasdam"	38.5275 ha

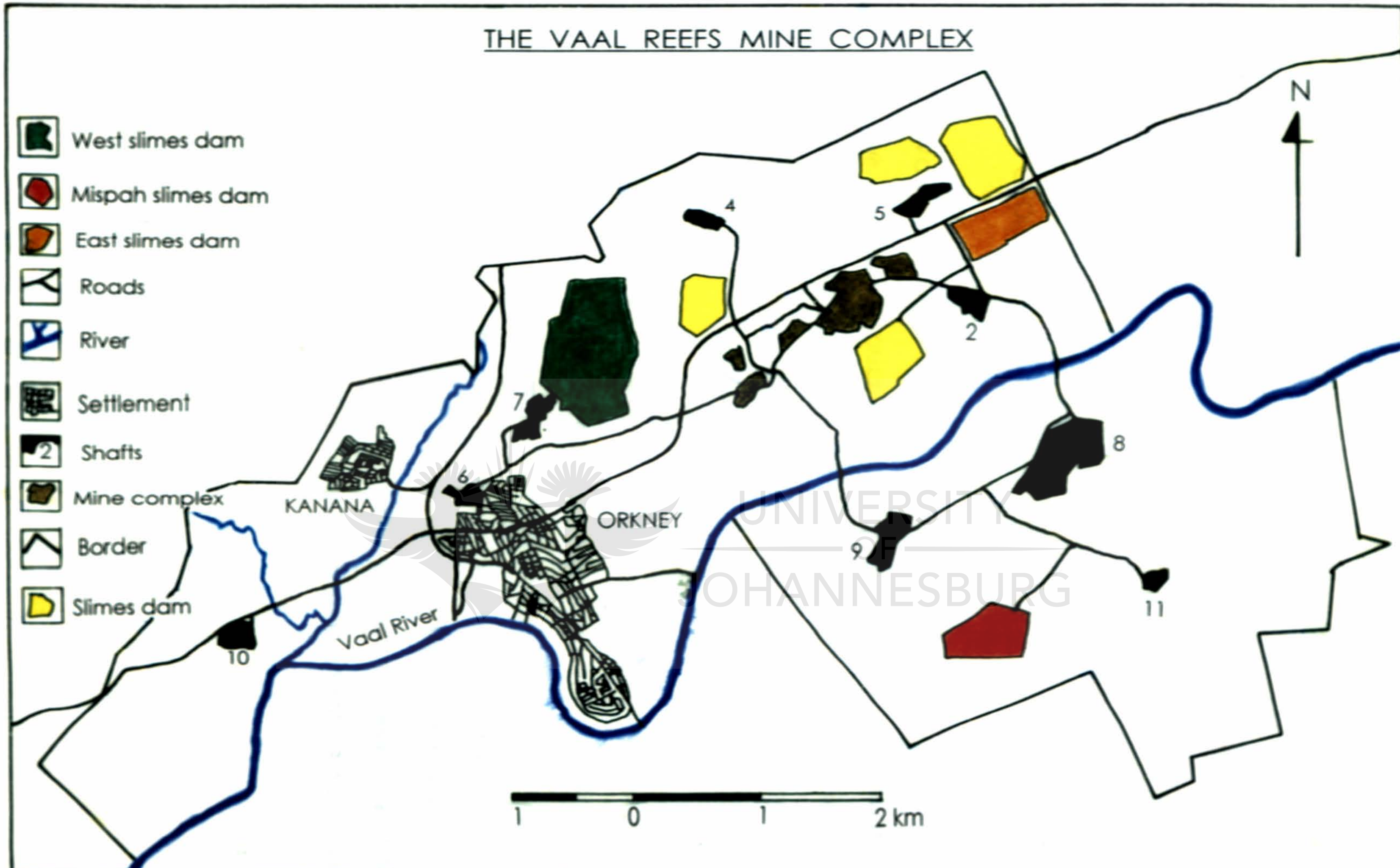


Figure 6 : Surface layout of the Vaal Reefs Mine Complex (van Niekerk, 1994).

3.1 PHYSICAL ASPECTS OF THE STUDY AREA

The surrounding area of the mine is a gently undulating plain, with rocky outcrops which slopes down to the Vaal River from the North and South boundaries. The average altitude is 1 300 metres and the general slope over approximately 10 kilometres is about 0,5 metres per hundred metres.

3.1.1 GEOLOGY

The Vaal Reefs Lease area is successively underlain by sediments and lavas of the Dominion Group, the largely sedimentary succession of the West Rand and Central Rand Groups, the dominantly volcanic sequences of the Ventersdorp and the largely sedimentary rocks of the Transvaal and Karoo sequences.

A generalised stratigraphic column for the Central Rand, Ventersdorp, Transvaal and Karoo sequences as they occur in the south eastern part of the lease area near No. 11 Shaft is shown in Figure 7. Because of their depth, the sediments and lavas of the Dominion Group have not been intersected in the Lease area, while only the upper portions of the West Rand Group have been exposed in development near major faults and in exploratory boreholes (Vaal Reefs Exploration and Mining Ltd, 1993).

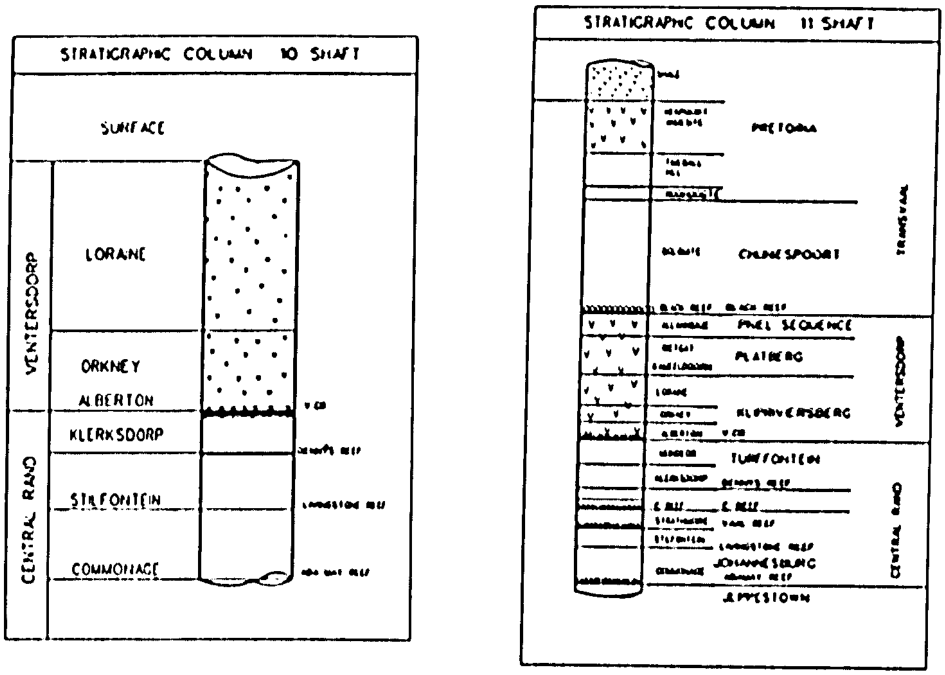


Figure 7: Stratigraphic comparison between 10 Shaft and 11 Shaft at Vaal Reefs Complex (Vaal Reefs Exploration and Mining Ltd, 1993).

3.1.2 SOIL TYPES

A representative soil sample of the area shows various soil types, namely:

Class A

This soil is found mostly in the southern and south-east lease area and consists mainly of the Hutton, Avalon, Clovelly and Glencoe soil types. The texture of the soil is mainly sandy with low clay content.

Class B

These soils are mainly of alluvial origin with a very high loamy (clay) texture content. They have a dark to black colour and manifest a varying degree of structural development.

The dominant soil form is the Oakleaf form. These soils are deeper than 150cm and do not show any signs of dampness and are normally situated in the low lying areas (below the 50 year floodline). In some areas the alluvial soils are lime containing and therefore the diagnostic horizon is neocarbonate or Augrabies-form soils.

A large variety of soils occur in the dry vlei areas. These vary from rock outcrops, Mispah, Hutton, Westleigh-form soils to soils with high clay contents.

Class C

This is the Mispah soil type with shallow Hutton and other shallow soils type. These soils consist of an orthic A-horizon on solid rock (dolomite) and are only suitable for grazing and domestic use such as housing or recreation.

Class D

This shallow type of soil is adjacent to the Class C and is usually found in very rocky areas.

Class E

This soil covers a wide spectrum of soil types such as Hutton, Mispah and Litosols which is known for its drainage capabilities and as a high potential grazing land. The major portion of the infrastructure of Vaal Reefs is situated on this type of ground.

3.1.3 NATURAL VEGETATION

The main veld type in the area is a combination of:

a. Transitional *Cymbopogon-Themeda* veld and

b. Dry *Cymbopogon-Themeda* veld

(Vaal Reefs Exploration & Mining Ltd, 1993).

According to Acocks (1988) the transitional *Cymbopogon-Themeda* veld type occupies areas receiving 400 - 600 mm of rain per annum. It extends from the western edge of the *Cymbopogon-Themeda* Veld to the small escarpment that runs down the middle of the Orange Free State, in an irregular belt, deeply indented from the west by the drier valleys of tributaries of the Vaal River, and from the east by wetter and sandier ridges.

The Dry *Cymbopogon-Themeda* Veld type lies to the west and south of the Transitional *Cymbopogon-Themeda* Veld, at a lower elevation, and is drier (Acocks, 1988).

Meadows (1985) provides a map, Figure 8, of South Africa showing the various vegetation types in South Africa. The Transitional and Dry areas are clearly depicted.

The transitional *Cymbopogon-Themeda* Veld areas at the mine, is strongly dominated by *Themeda triandra*, but the presence of such species as *Arista congesta*, *Panicum coloratum* and *Erasgrostis chloromelas* are also be present (Acocks, 1988). However, it was observed that very little of the natural vegetation and soil cover exists in close proximity to the slimes dams. The Dry *Cymbopogon-Themeda* Veld areas at the mine various species such as *Cymbopogon plurinodis*, *Gravia flava*, *Diospyros lyceoides*, *Aristida congesta* and *Eragrostis lehmaniana* can be found (Vaal Reefs Exploration & Mining Ltd, 1993).

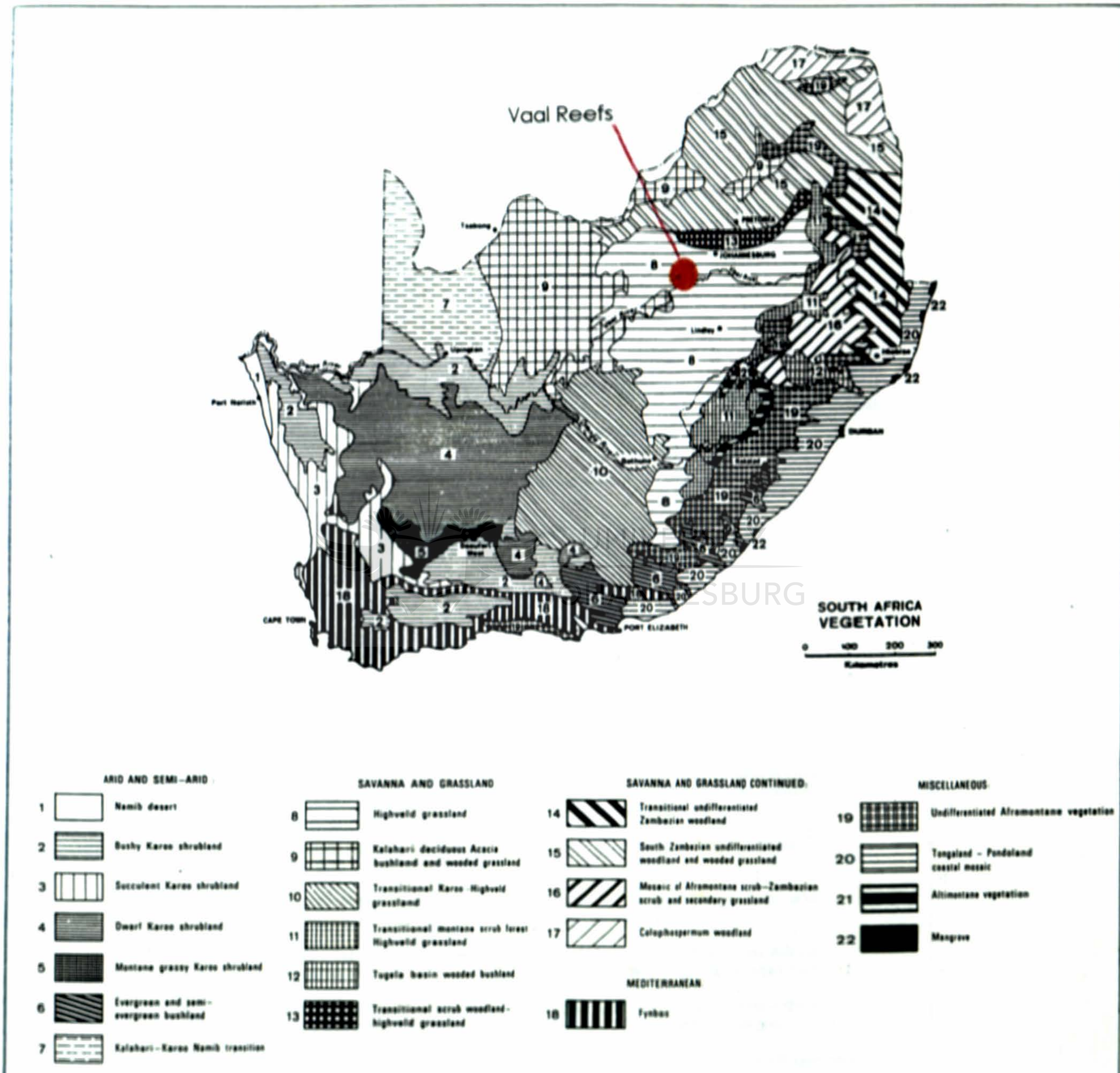


Figure 8: The vegetation of South Africa (Meadows, 1985).

3.1.4 CLIMATE

Schulze (1966) classifies the study area as the Highveld climate. Figure 9 shows the climatic regions of South Africa. The Highveld climate basically experiences temperate to warm climate with summer rain.

REGION, AREA and CLIMATE

A	Southern Cape Coastal Belt : Rain during all seasons	NT	Northern Transvaal : Warm, Steppe, summer rain
B	Botswana : Warm, Steppe, summer rain	SE	South-eastern coastal region : Temperate to warm, mainly summer rain
D	Drakensberg region : Temperate to warm with summer rain	Sn	Northern Steppe : Semi-arid climate
E	East Coast : Warm to hot and humid subtropical climate	Ss	Southern Steppe : Semi-arid climate
H	Highveld : Temperate to warm with summer rain	SWAn	Northern South West Africa : Warm, Steppe, summer rain
K	Little and Great Karoo : Mainly semi-arid climate	SWAs	Southern South West Africa : Desert and poor Steppe
L	Lowveld : Warm, Steppe	W	Namaqualand and North-western Cape : Desert climate
M	South-western Cape : Mediterranean climate		

Figure 9: Climatic regions of South Africa (Schulze, 1966).

3.1.4.1 RAINFALL

The Vaal Reefs mine falls within a summer rainfall area with an average annual precipitation of about 650mm. The rainfall is almost exclusively due to showers and thunderstorms and falls mainly in summer, from October to April with the maximum falls in January (Vaal Reefs Exploration & Mining Ltd, 1993).

3.1.4.2 TEMPERATURE

The temperature ranges from a summer mean of approximately 22 degrees Celsius to a winter mean of approximately six degrees Celsius (Vaal Reefs Exploration & Mining Ltd, 1993). Figure 10 depicts the wet and dry bulb temperatures of the area.

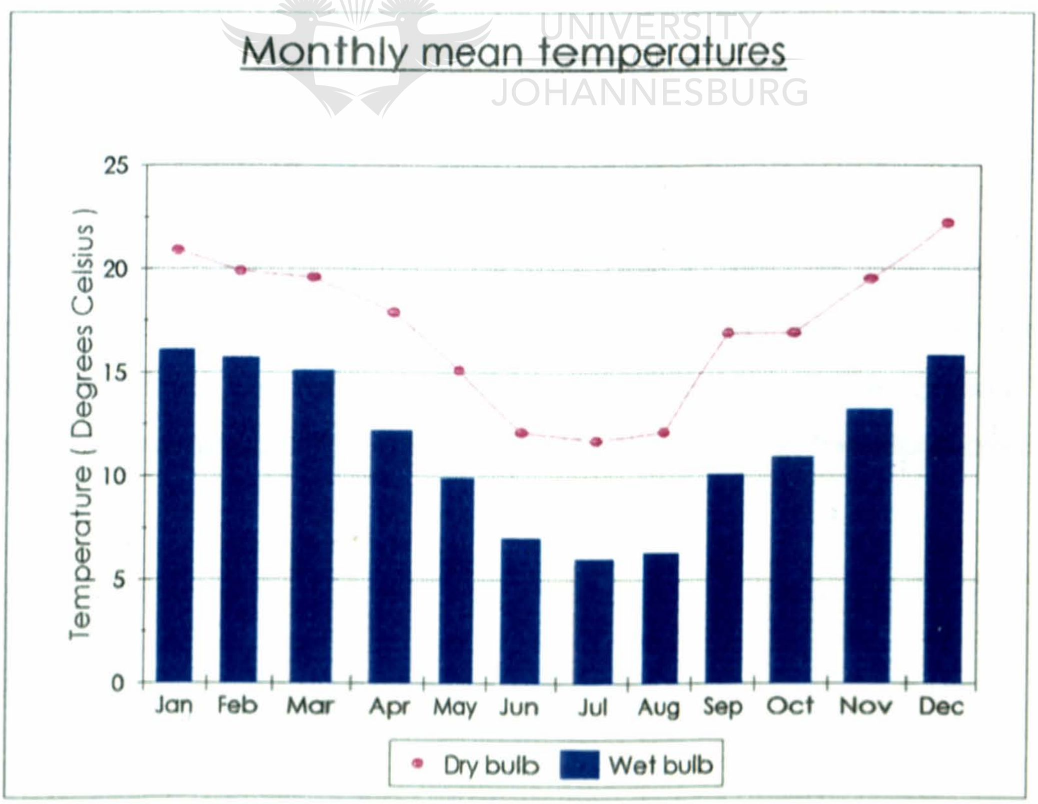


Figure 10: Average wet and dry bulb temperatures.

3.1.4.3 WIND

The primary wind is a northerly wind with a velocity of approximately 3.71 metres per second. The wind velocity increases during September, October and November (Vaal Reefs Exploration & Mining Ltd, 1993).

3.2 HUMAN ASPECTS

3.2.1 SETTLEMENTS AND POPULATION

Table 2 contains information regarding settlements in the area and the population numbers of each settlement as provided by the Development Bank of South Africa (1992a).

3.2.2 ECONOMIC ACTIVITIES

The main economic activities in the study area is predominantly mining, but many other economic activities are being practised. The large settlement and population size require various types of services. Table 3 shows the major economic activities and sources of employment in the study area.

Table 2 : Population density and location on the study area and surrounding areas (Development Bank of South Africa, 1992).

	WHITE	COLOURED	ASIAN	BLACK	TOTAL
Klerksdorp	43 590	949	89	7 268	51 896
Manzilpark		39	1 258	253	1 550
Alabama		6 847		287	7 134
Jouberton		482		108 462	108 944
TOTAL KLERKSDORP	43 590	8 317	1 347	116 270	169 524
Stilfontein	14 569	98	3	1 536	16 206
Khuma		134		32 000	32 134
TOTAL STILFONTEIN	14 569	232	3	33 536	48 340
Orkney	12 439	174		8 168	20 781
Kanana				45 312	45 312
TOTAL ORKNEY	12 439	174		53 480	66 093
Hartebeesfontein	1 266			201	1 467
Tigane				6 793	6 793
TOTAL HARTEBEES-FONTEIN	1 266			6 994	8 260
Vaal Reefs	1 062	13		27 297	28 372
Hartebeesfontein Mine				20 317	20 317
Buffelsfontein Mine	328			15 276	15 604
TOTAL URBAN	73 254	8 736	1 350	27 170	356 510
TOTAL RURAL	2 558	455	28	38 695	41 736
TOTAL KLERKSDORP MAGISTERIAL DISTRICTS	75 812	9 191	1 378	311 865	398 246

Table 3 : Economic activities and sources of employment

(Development Bank of South Africa, June 1992)

	1980 (%)	1990 (%)
Agriculture	3,9	3,6
Mining	62,5	56,4
Manufacturing	4,1	4,1
Energy	0,4	0,5
Construction	2,5	2,9
Commerce	7,7	9,4
Transport	2,9	2,4
Finance	1,4	2,4
Services	14,6	18,4

4. STATISTICAL TECHNIQUES APPLIED

A common tool for portraying the relationship or association between two variables is a two-dimensional graph called a scattergram or scatterplot. With one variable plotted on each axis, the pattern of points in a scattergram helps to provide an understanding of the nature of a particular relationship (McGrew and Monroe, 1993).

Statistical measures of the strength and direction of a relationship between two variables is termed a correlation coefficient. A correlation coefficient of the value of -1.0 indicates a perfect inverse relationship or a perfect negative correlation between two variables. A value of 1.0 indicates a perfect direct relationship or perfect positive correlation. A complete absence of relationship, or no correlation, is indicated by a coefficient of 0.0 (Ebdon, 1985).

Like correlation, linear regression attempts to determine how one variable relates to another. Correlation determines the degree of association between variables. In linear regression, however, one variable serves as the dependent variable and the other as the independent variable.

Linear regression describes this pattern of points more objectively by placing a line through the scatter of points. This line, called the " best fitting " or " least-squares " line of regression, summarises the overall trend in the data and represents the form of the relationship between the independent and dependent variables.

Although an infinite number of lines could be drawn to summarise the points in a scattergram, the least-squares regression line is unique.

As the name implies, the line minimises the sum of squared vertical distances between each data point and the line. No other line can be generated where the sum of the squared distances between the points and the line (measured vertically) is a smaller value than that calculated for the least-squares line. This line represents the best estimate of the relationship between the independent and dependent variables. It also serves as a predictive model by generating estimates of the dependent variable using both the values of the independent variable and knowledge of the relationship which connects the two variables.

In a linear regression with independent variable (X) and dependent variable (Y), the least-squares regression line is denoted by the following equation:

$$Y = a + bX$$

In addition to the two variables, the equation contains two constants (a and b), which are calculated from the actual set of data. These values uniquely define the equation and establish the position of the best fitting line on the scattergram (McGrew and Monroe, 1993).

The constant a, called the Y-intercept, represents the expected value of Y where the regression line crosses the Y axis. The other constant in the regression equation, b, represents the slopes of the line. This value, also called the regression coefficient, shows the absolute change of the line in the Y (vertical) direction associated with an increase of 1 in the X (horizontal) direction. The slope reveals how responsive the dependent variable is to a unit increase in the independent variable.

The regression line does not pass through all of the observed points. These deviations are known as residuals from the regression. Clearly then these residuals are small; the regression line is a good fit. This is the basis of one for calculating the extent to which the regression accounts for the variation in the observed values of the dependent variable.

To find out how much of this variation is accounted for by the regression, the variance of the predicted values of the dependent variable can also be calculated. The ratio between these two variances provides a measure of the goodness of fit of a regression. This ratio is known as the coefficient of determination, which has the symbol r^2.

Converting this ratio to a percentage, it can be said that a certain percentage of the variable of the dependent variable is accounted for by the regression.

5. DATA ACQUISITION

5.1 SPECIFIC CLIMATIC DATA FOR STUDY PERIOD

The closest weather station to Vaal Reefs is at Potchefstroom. The relatively flat topography of the area allows for some of the climatic data to be constant over the area. Cogho *et al* (1992) showed that the cumulative evaporation from various stations in the northern Orange Free State, including many other climatic variables, are fairly uniform over the area. Rainfall is mainly in the form of thunderstorms, giving it a very variable and site specific nature. Bearing this in mind, standard rain gauges were set up on the penstocks alongside the Class A evaporation pans.

The following climatic data were obtained from the Weather Bureau, Department of Environment Affairs and Tourism, Pretoria for one rainfall year of July 1994 to July 1995.

- Wind speed at 8h00 and 14h00
- Relative humidity at 08h00 and 14h00
- Maximum and minimum temperatures
- Atmospheric pressure at 08h00 and 14h00
- Hourly global solar and diffuse radiation

Wind speed is recorded in metres per second at a level of 2m above the ground. The wind data used were recorded at 08h00 and 14h00. The physical structure of the slimes dam, in other words the height, and the resultant wind flow across the surface will require a detailed and site specific study.

It is not possible to maintain the same conditions of wind speed and turbulence over both lake or water surface and evaporation pan because of the different surface characteristics. The evaporation pan will induce local mechanical turbulence which can be increased by other objects in its neighbourhood. This study therefore concentrates on climate on the macro scale and the resultant evaporation (Hounam, 1973).

Relative humidity is the amount of water vapour present in a specific volume of air expressed as a percentage of the total amount of water vapour that the same volume of air at the same temperature can contain when the air is saturated. Relative humidity is expressed as a percentage (van Rensburg, 1985). Humidity is complicated as it is a factor of atmospheric pressure and temperature (McIntosh and Thom, 1969). The degree of equality between temperature and humidity over the surface of the water and over the pan depends primarily on the influence of the surface water on the air flowing over the pan (Hounam, 1973).

Maximum and minimum temperatures are expressed in degrees Celcius. The temperature influences evaporation by providing large temperature differences resulting in humidity and pressure fluctuations. Atmospheric pressure is expressed in millibars (mb) or Hecto Pascals (HPa).

Solar radiation and diffuse radiation is important to heat transfer in the atmosphere and affects temperature directly. A cloud cover presents a barrier to the transmission of solar radiation through the atmosphere. Reflection occurs from the cloud top and absorption takes place within the cloud. This is termed diffuse radiation.

Radiation and diffuse radiation are expressed in megajoules (Preston-Whyte and Tyson, 1989). The hourly radiation and diffuse radiation data were totalled to get a daily sum.

The above climatic data were recorded every day at 08h00 and 14h00.

All the climate data were averaged to provide the average weather variables per two and three day observations on the slimes dams. The data were entered into a computerized statistics programme for analysis, namely STATGRAPHICS as available on the Rand Afrikaans University network.

5.2 EVAPORATION

Evaporation can be measured using various techniques. The most common is that of the lysimeter, evaporation pans, either Class A or Symons tank, and the more complicated neutron probes. The installation of the Class A evaporation pan and the measurement of water loss is relatively easy compared to using a lysimeter. On the other hand, absorption of heat by the pan and the water can raise the temperature above that of the natural surfaces, causing increased evaporation. For these and other reasons, the measured evaporation from a pan is slightly greater than the evaporation from a lake or the large water surface area, and neither one gives directly the evapotranspiration from an area with a dense vegetation cover (Longley, 1970). Due to the nature and the manner in which slimes dams function, it was best to set up the Class A pans on the penstock pipes. This provided easy access to the pans and water for regular filling of the pans. Figure 11 shows the levelling of the penstock pipe using wooden beams in the preparation of a level base for the Class A pan. Figure 12 shows the Class A pan set up on the penstock pipe on East Slimes dam.

Figure 11 : Preparing the penstock pipe for a level base for the Class A pan.

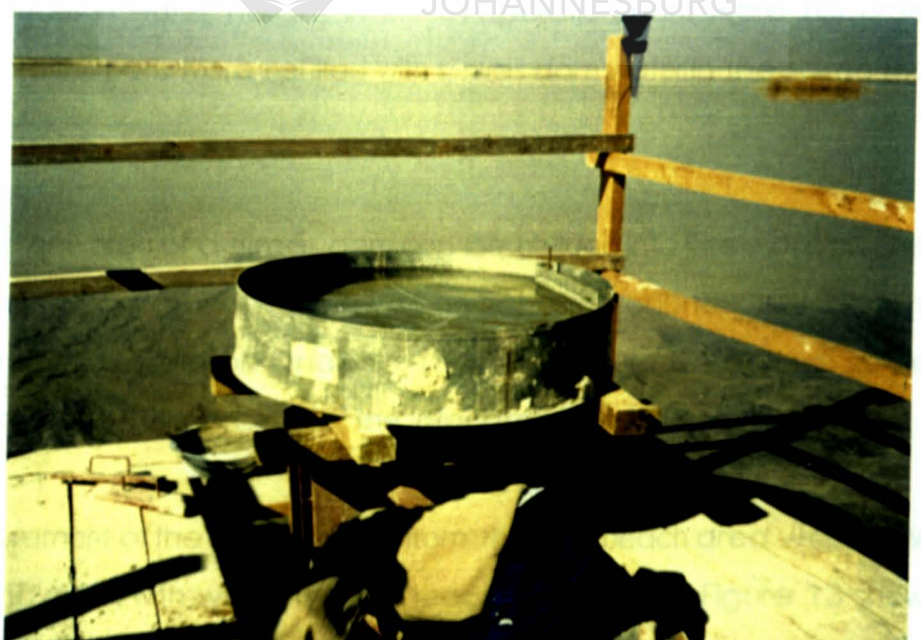


Figure 12 : The Class A pan set up on the penstock pipe on East slimes dam.

The standard Class A evaporation pan is approved and regularly used by the Weather Bureau. The pan is a circular tank of 1,18 metres in diameter and is 25 centimetres deep. The height of the water surface is measured along a rule adjusted at an angle in the water (Weather Bureau, 1960). Appendix 1 shows the plans for the Class A evaporation pan.

The Class A pans were hired from AGROMET in Potchefstroom, part of the Institute for Soil, Water and Climate which is part of the Agricultural Research Council.

The Class A pans were set up on top of the penstock pipes and carefully calibrated to ensure the accuracy of the data. Water from the pool area on the slimes dam was added, using standard 5 litre buckets, to the evaporation pans. The height of the water in the pan was noted. Readings were taken on Mondays, Wednesdays and Fridays by Amos Mtila. The differences in water height in the evaporation pans were recorded. The evaporation pans were refilled with slimes dam water in the same maner as above.

The surface area of a slimes dam can be divided into three areas. These are briefly the pool of water, the wet beach area and the dry beach area. According to Middleton and Stern (1987), these areas make up 25 percent, 50 percent and 25 percent of the total area respectively.

Measurement of the evaporation from the wet beach area was carried out by filling a dish with wet slime and recording the mass. Figure 13 shows how the dish, filled with slime to a marked level, is being weighed using the standard tubular spring scale. The mass was measured with a conventional 10 kilogram tubular spring scale. A study by van Zyl (1987) provided information on the textural and behavioural characteristics of the wet beach area.

In order to calculate the water balance and exact loss of water on the surface area of the slimes dams, evapotranspiration should be taken into account if plants are in abundance.

Figure 13 : Weighing the slimes in the dish.

Transpiration denotes water losses to the atmosphere from vegetation, whereas evaporation refers to water losses from the soil and water surfaces. In combination, these are termed evapotranspiration. The presence of vegetation can create both positive and negative changes in water loss on a slimes dam. Shade caused by the vegetation can result in water conservation, whereas transpiration can provide a parallel path and enhance loss of water (Kadlec *et al*, 1990).

Numerous methods have been developed for evapotranspiration estimation. Most of these are based on the dependence of free-water evaporation on a number of climatological parameters, mainly net radiation flux, temperature, wind speed, and relative humidity of the air. Different techniques have been developed partly in response to the availability of data for evapotranspiration estimation (Shih and Cheng, 1991).

In fact, Thornthwaite and Mather (1955) defines potential evapotranspiration as the water loss from a large homogeneous, vegetation covered area which never suffers from a lack of water. Potential evapotranspiration is primarily a function of climatic condition (energy from the sun) and is not a function of type of vegetation, type of soil, soil moisture content, or land management practices.

Phragmites australis (Common Reed) grows on some slimes dams, and was in abundance on parts of West slimes dam. Vegetation can affect evaporation by inhibiting full sunlight on the surface of the water and disrupting the wind flow over the surface of the water. However, the vegetation transpires a lot of the water in the pool and wet beach areas. The evaporation pan on West slimes dam was set up amongst the *Phragmites* which surrounded the penstock area on the slimes dam. As a result, the evaporation pan was often in the shade from the *Phragmites* and protected from the wind. The actual evaporation from the pan can be seen as representing a very densely vegetated slimes dam.

5.3 TEXTURAL CHARACTERISTICS OF SLIME

Data concerning the particle size and shape were provided by Otto and Harmse (1994). Samples of approximately 100 grams in mass were collected at selected sites at slimes dams at Vaal Reefs. These were dried at a constant temperature of 40 degrees Celsius for 48 hours. The low temperature ensured that no textural characteristics of clay particles were altered.

Hausenbuiller (1985) points out that a unique relationship between permeability and/or infiltration and soil strength occurs. Both Marsh and Dozier (1981) and Pitty (1978) point out that particle size plays an important role in controlling the infiltration of dump materials. A decrease in particle size will mean an increase in surface area of the material and thus an increase in capillary and adhesion forces, which lends itself to a greater moisture retaining capacity.

Pores are also less likely to be inter-connective, in a fine graded material such as clay, causing the decrease in infiltration rates of the material (van Rooyen, 1992).

5.4 WATER QUALITY

Water quality data were received from Otto and Harmse (1993). The information was extracted and loaded into a graphics programme for analysis. Figure 14 shows the difference in pH of the water depending on the process used in the metallurgical plants. The water samples at West slimes dam were collected in the return water trenches alongside the slimes dam. The return water trenches usually collect seepage water from the slimes dams. Because of the fineness of the slimes dams particles, their surface area and consequently potential pollution capacity are great (du Plessis, undated). This implies that the pH of the water decreases considerably as the water leaches through the slimes dams. Thus, the pH of the water indicated in Figure 14 is lower than the slimes dam surface water.

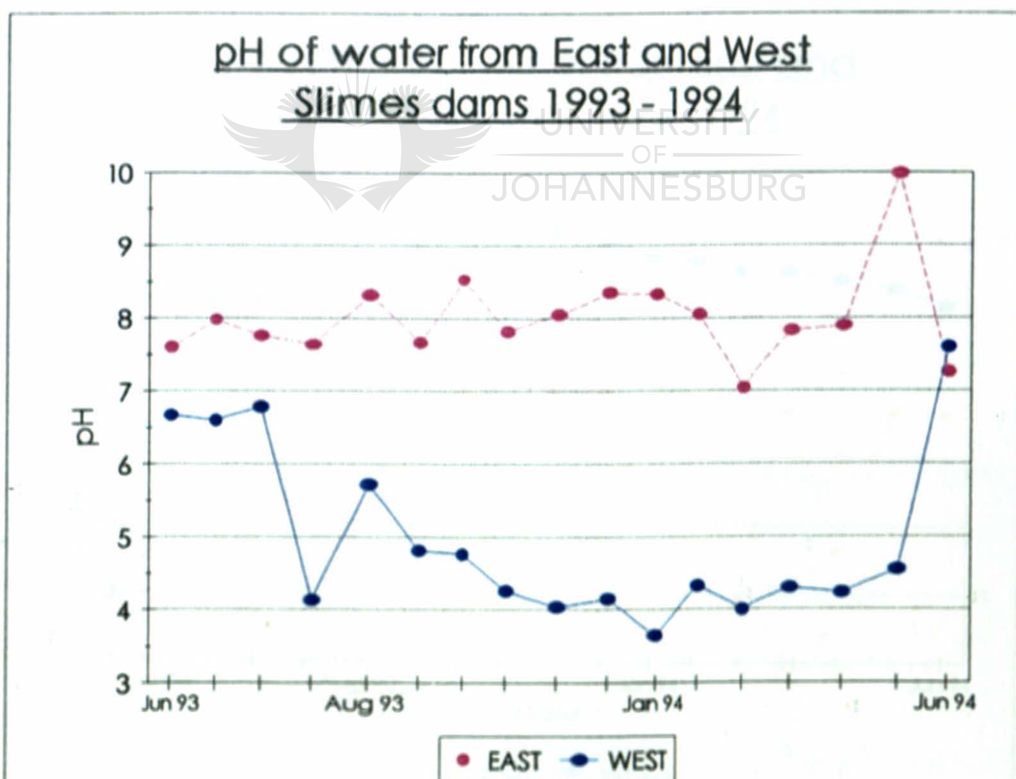


Figure 14 : The pH of water on East and West slimes dams.

Figure 15 is a line diagram depicting the conductivity of water from East and West slimes dams. An approximate correlation between the electrical conductance and the total dissolved solids (TDS) exists. In fact, TDS is usually measured using a conductivity meter and the conductivity in micro siemens/cm is converted to TDS in mg/l using the relationship 1 μs/cm = 0.7 mg/l of dissolved solids at 20ºC. The conductivity of the water can be closely related to the pH and alkalinity of water with a high pH (Tedder - undated).

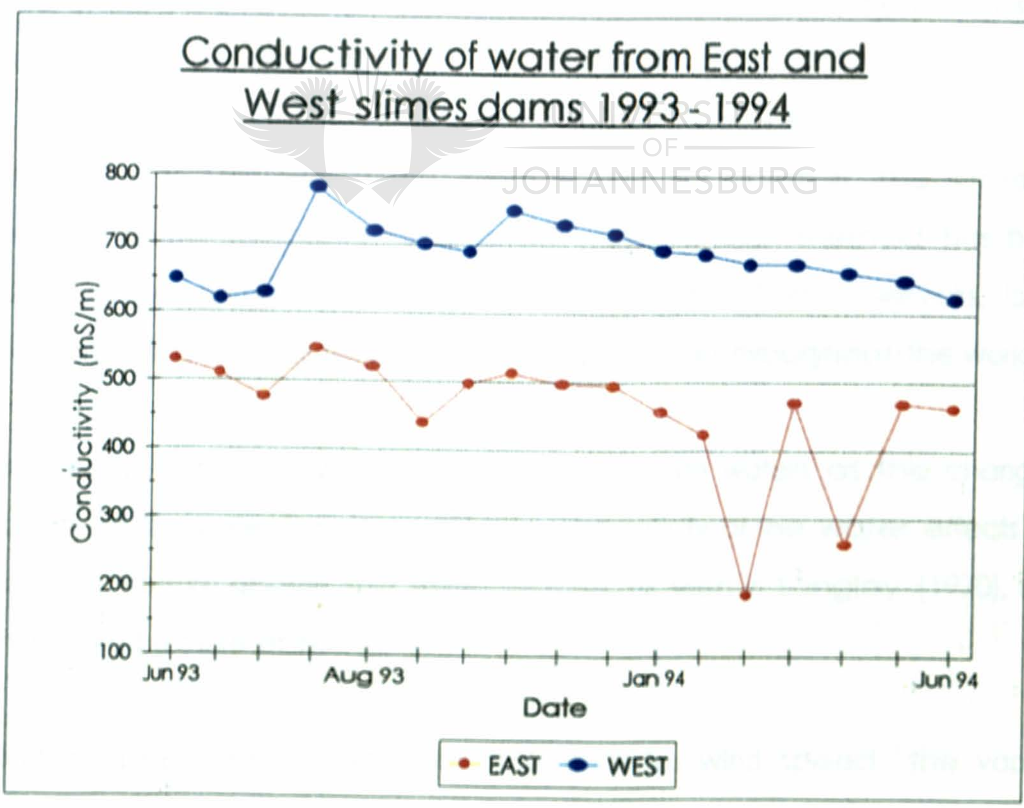


Figure 15 : The conductivity of the water from the slimes dam return water.

5.5 MISSING DATA

Evaporation could unfortunately not always be recorded as scheduled due to public holidays, transport problems and mainly due to penstocks and platforms being rebuilt. Theories exist where evaporation can be estimated by various methods using climatological data.

Hanson (1973) provided a formula to predict Class A pan evaporation using radiation, temperature and two constants. However, this method is not suitable within the mining industry where high and variable values of salinity of the water are encountered.

Two of the more developed methods to estimate evaporation are those of Penman and Dalton.

According to Monteith (1973), Penman uses net radiation, the saturation deficit, temperature and wind speed. The Penman method has been successfully applied to estimate the evaporation from reservoirs, lakes, catchments and crops in a wide variety of climates throughout the world.

However, Penman is not suitable for mine waste waters as the changing salinity of the water is not considered. The salinity of the water effects the vapour pressure above the water. Dalton, as seen in Longley (1970), can therefore be more applicable.

Dalton developed an equation that includes wind speed, the vapour pressure above the water, and the vapour pressure of the air. Vapour pressure These variables will provide for an accurate estimation of evaporation. However, the formula that was developed could be used readily with standard metereological data. This results in a generalized formula that cannot be applied to a specific site as such. Penman's equation is seen to have wider applications (Longley, 1970).

Mine waste waters however change salinity when the slime is pumped. Precipitation also acts as a dilution factor to polluted water (Longley, 1970). To overccome some of these complicating factors, a simple linear regression between two evaporation measurements at the same site was decided upon. The regression line would be more applicable to the sites than any of the above equations.

Simple linear regression was applied to the available data in comparison to "fresh" water evaporation measurements taken in Potchefstroom. A summary of the results of the regression analysis on each slimes dam is tabled below. Table 4 shows the predicted regression line for the winter months of the year. Table 5 shows the regression line for spring, Table 6 the regression line for summer and finally Table 7, the regression line for autumn.

Figure 16 is the regression line of the winter months for East slimes dam. The strong relationship can be observed.

Table 4 : Results of the linear regression analysis and analysis of variance for the winter months.

	EAST	MISPAH	WEST
Intercept on y-axis	0.359	-2.037	5.498
Slope of line	1.153	1.387	0.884
Correlation Coefficient	0.924	0.687	0.61
R Squared	85.39%	47.17%	37.25%

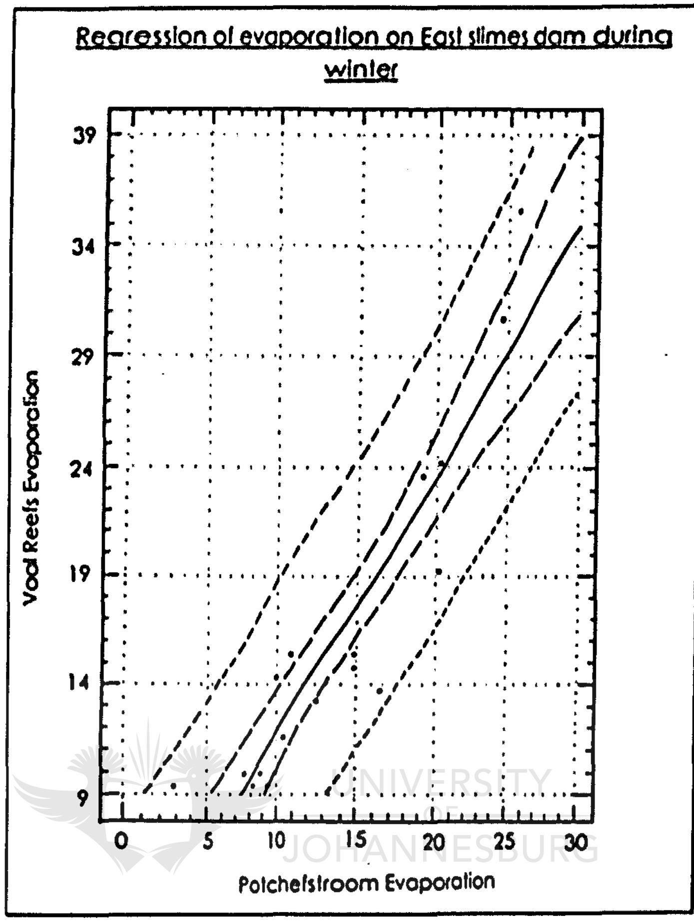


Figure 16 : Regression line of winter months for East slimes dam.

Table 5 : Results of the linear regression analysis and analysis of variance during spring.

	EAST	MISPAH	WEST
Intercept on y-axis	13.391	14.845	-1.069
Slope of line	0.6884	0.499	0.632
Correlation Coefficient	0.5317	0.495	0.675
R Squared	28.27%	24.56%	45.52%

Figure 17 is the regression line for Vaal Reefs evaporation and Potchefstroom evaporation on West slimes dam for spring. As can be seen from Figure 17, the relationship is far weaker than observed in Figure 16. The residuals are widely distributed, indicating the lack of correlation. The regression lines for East slimes dam and Mispah slimes dam are weaker than the regression line indicated in Figure 17, West slimes dam.

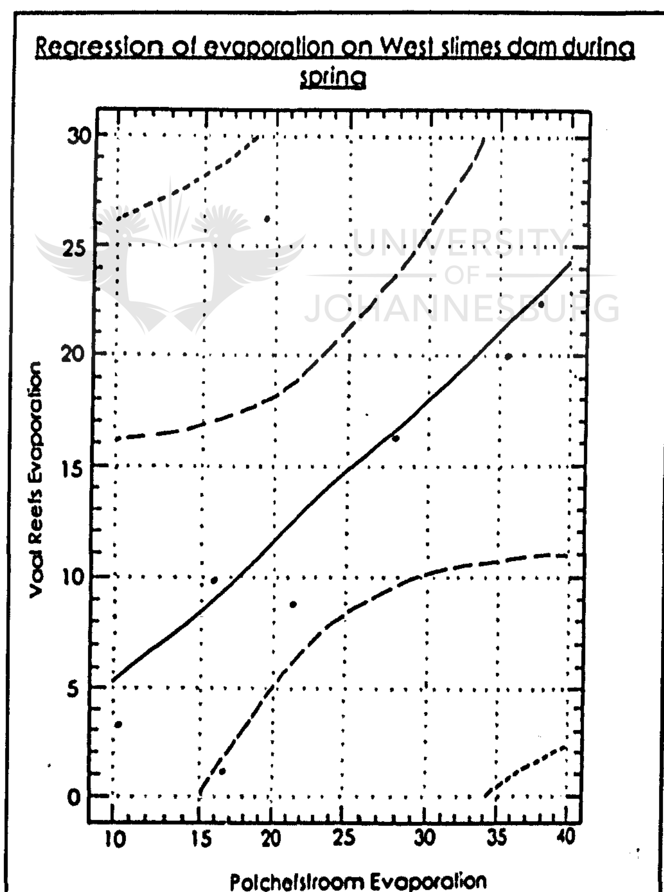


Figure 17: Regression line for West slimes dam in spring.

Table 6 : Results of the linear regression analysis and analysis of variance during summer.

	EAST	MISPAH	WEST
Intercept on y-axis	3.1646	1.949	8.403
Slope of line	0.6882	1.072	0.494
Correlation Coefficient	0.7077	0.6236	0.421
R Squared	49.99%	38.89%	17.71%

Figure 18 is a regression line of evaporation at Vaal Reefs East slimes dam and Potchefstroom. The regression shows the low residual values and a stronger relationship than in spring.

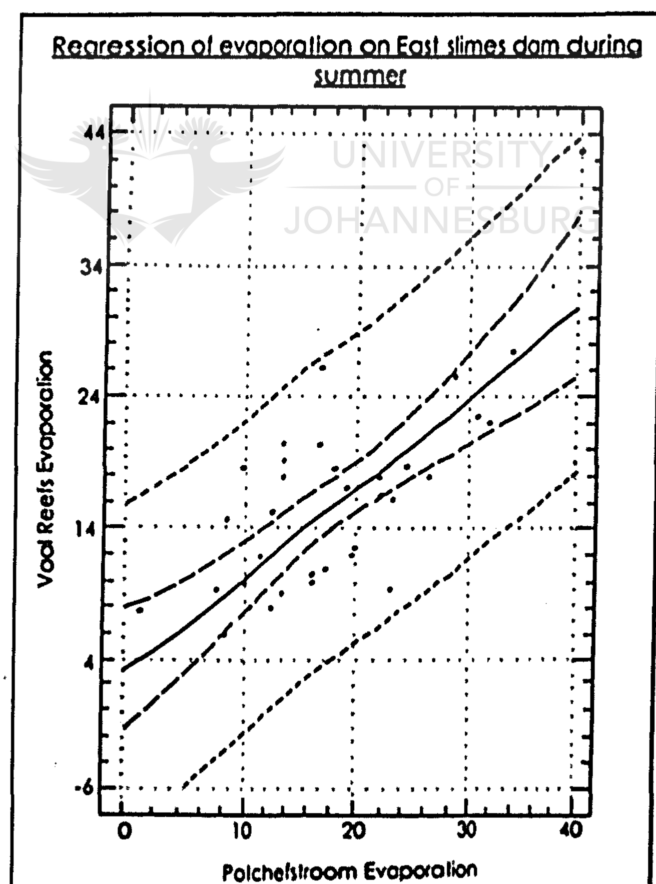


Figure 18 : Regression line for East slimes dam during summer.

Table 7: Results of the linear regression analysis and analysis of variance for the autumn months.

	EAST	MISPAH	WEST
Intercept on y-axis	3.4658	4.596	5.284
Slope of line	1.3635	0.877	0.604
Correlation Coefficient	0.7853	0.809	0.607
R Squared	61.67%	65.4%	36.79%

Figure 19 is the regression lines for the autumn months on Mispah slimes dam. The strong positive relationship can be seen with low residual values. The relationship is weaker than can be observed in Figure 16, the winter months and Figure 18, the summer months. However, the relationship is stronger than indicated in Figure 17, the spring months.

The observed values of fresh water evaporation at Potchefstroom provided an indication of the linear relationship between the values observed at Potchefstroom and those measured at Vaal Reefs. The data that are missing were calculated using the straight line equation, $Y = a + bX$.

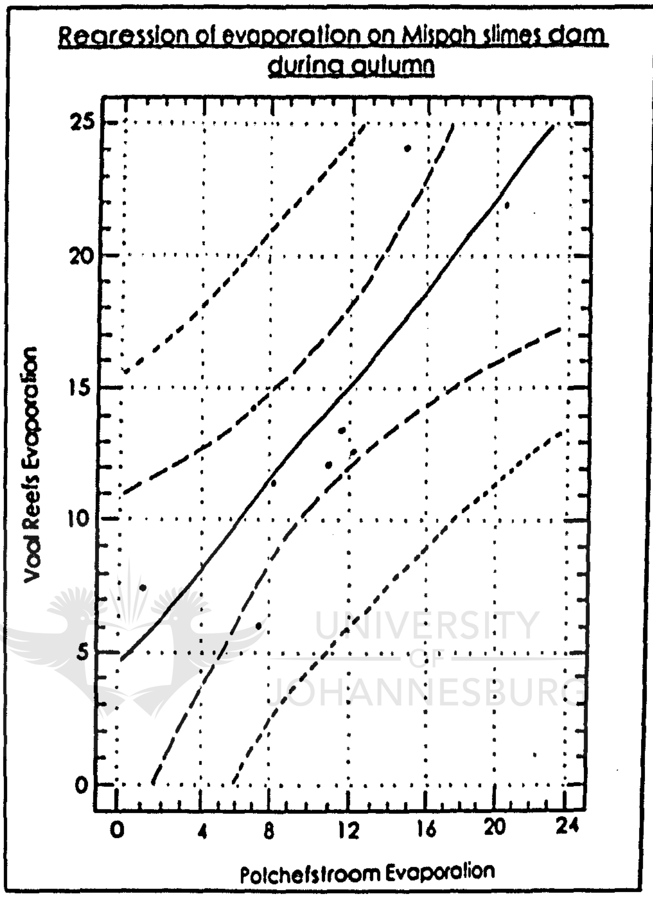


Figure 19 : Regression analysis of autumn months on Misaph slimes dam.

6. DATA ANALYSIS

6.1 WEATHER DATA

Data collected from the Weather Bureau in Pretoria were averaged out over the days of observation. In other words, if the Class A pan was set on the Monday morning and the next reading was taken on Wednesday afternoon, the data would be averaged for the same time period. The data averaged are wind speed in the morning, wind speed in the afternoon, humidity in the morning, humidity in the afternoon, maximum and minimum temperature, atmospheric pressure in the morning and the afternoon. Hourly radiation and diffuse radiation was totalled for the day and then averaged out for the same period. Each climatic variable was correlated with the evaporation measured on the slimes dams. The strength and nature of the relationship between evaporation and each climatic variable for each slimes dam was studied. Appendix 2 shows the data for each slimes dam's evaporation and climatic variables affecting it.

The variance between two sets of data will be studied for each set, namely climatic data and evaporation data. However, the variance, within each set of data needs to be studied. This entails a frequency distribution showing the general width of the distribution and the height. In order to specify the overall characteristics of any frequency distribution, it is usual to consider two main features of the distribution, its central tendency and variance (King, 1969).

A frequency distribution will reveal any extremely high or low observations, in the set of data, that could effect the results of a regression analysis and analysis of variance (Ebdon, 1985).

A measure of central tendency is the median, which is the middle value in a ranking of the complete distribution of values. The median is less sensitive to any exceptionally large or small values in the group (King, 1969). Variance is not often used as a descriptive measure of dispersion. Instead the square root of the variance is taken. This measure is known as the root mean square deviation, or simply the standard deviation.

Standard deviation and other measures of dispersion are concerned with the spread of values in a frequency distribution. In a sense they measure the 'width' of the distribution. However, measures of dispersion do not provide any information about the other characteristics of the shape of a frequency distribution (Ebdon, 1985).

The skewness measures the degree of symmetry in a frequency distribution by determining the extent to which the values are evenly or unevenly distributed on either side of the mean. Kurtosis measures the flatness or peakedness of a data set. If a frequency distribution is symmetric, with an equal number of values on either side of the mean, the distribution has little or no skewness. If a value in a distribution is greater than the mean, its cubed deviation will be positive. However, if a value is less than the mean, it will produce a negative cubed deviation. In a symmetric distribution, these positive and negative cubed deviations will counterbalance each other, and the sum will be zero. In a distribution having a tail to the left, large negative cubed deviations will cause the sum of all deviations to be negative. The resultant distribution is said to be negatively skewed. On the other hand, in a distribution with a tail to the right, large positive cubed deviations will dominate the sum, and a positively skewed distribution will result (McGrew and Monroe, 1993).

The Highveld season are classified as the following:

Winter = June, July, August, September

Spring = October, November

Summer = December, January, February, March

Autumn = April, May

Table 8 shows the median, standard deviation, skewness and kurtosis of the winter data.

Table 8 : Summary statistics for weather data in winter.

WINTER						
Variable	Sample size	Average	Median	Std. Deviation	Skewness	Kurtosis
Evaporation	47	16.83 ℓ	15.33 ℓ	7.21ℓ	0.81	0.24
Windspeed (am)	47	2.55 ms^{-1}	2.5 ms^{-1}	2.08 ms^{-1}	0.79	0.56
Wind speed (pm)	47	4.87 ms^{-1}	5 ms^{-1}	3.31 ms^{-1}	0.8	1.56
Humidity (am)	47	62.10 %	62 %	15.23 %	0.2	-0.8
Humidity (pm)	47	27.06 %	21.5 %	21.22 %	2.74	7.35
Max temp	47	22.36 °C	21.9 °C	4.35 °C	0.39	0.58
Min temp	47	2.75 °C	2.15 °C	4.36 °C	0.68	0.12
Atmospheric pressure (am)	47	27.08 mb	8.73 mb	125.64mb	6.86	46.99
Atmospheric pressure (pm)	47	8.73 mb	8.71mb	0.14mb	6.3	41.91
Radiation	47	17.43 MJ	17.04 MJ	3.23 MJ	-0.18	0.24
Diffuse radiation	47	3.05 MJ	3.11 MJ	0.9 MJ	0.32	-0.92

The skewness of the distribution graph of atmospheric pressure in the morning and the afternoon shows a positively skewed distribution. With this is an extremely high kurtosis of 46.99 for atmospheric pressure in the morning and 41.9 in the afternoon. Wind speed (am) appears to be even except for one or two unusually high frequencies, indicated by the kurtosis of 1.56. The standard deviation is low with the value of 3.31 metres per second. Humidity is evenly distributed with the low values of skewness of 0.2 and the kurtosis of -0.8. Minimum temperature has the most even height distribution, in other words kurtosis. This indicates that minimum temperature does not vary very much in winter. In fact, the standard deviation is a mere 4.36 degrees Celsius. The descriptive statistics for each season are summarised in Table 9, Table 10 and Table 11.

Table 9 : Summary statistics for weather data in spring.

SPRING						
Variable	Sample size	Average	Median	Std. Dev-iation	Skewness	Kurtosis
Evaporation	26	26.98 ℓ	26.25 ℓ	9.83 ℓ	-0.67	0.78
Windspeed (am)	26	5.83 ms^{-1}	6 ms^{-1}	2.31 ms^{-1}	0.19	2.71
Wind speed (pm)	26	5.93 ms^{-1}	6.4 ms^{-1}	1.88 ms^{-1}	-1.29	2.69
Humidity (am)	26	60.16%	58.75%	11.54%	0.2	0.13
Humidity (pm)	26	29.69%	30%	12.69%	0.93	1.27
Max temp	26	28.35°C	29.4°C	3.58°C	-0.54	-0.33
Min temp	26	11.83°C	11.95°C	3.36°C	-0.39	-0.61
Atmospheric pressure (am)	26	41.75 mb	8.69 mb	168.58 mb	5.09	26
Atmospheric pressure (pm)	26	8.67 mb	8.67 mb	0.02 mb	0.52	2.44
Radiation	26	23.16 MJ	23.96 MJ	4.69 MJ	-0.41	-0.57
Diffuse radiation	26	5.44 MJ	4.64 MJ	1.77 MJ	0.89	0.14

The skewness and kurtosis of the spring months is very similar to those of winter, except for some small changes in wind speed. The atmospheric pressure in the morning has a positive skewness of 5.09 and a kurtosis of 26. This is much lower than the results for winter, indicating a more even distribution. The humidity (am) has the same skewness of 0.2 but a lower kurtosis of 0.13.

Table 10 is the summary statistics for summer. The skewness shows little deviation from the mean. The skewness and kurtosis is smaller for summer than for spring in most of the variables. This indicates that the weather in summer is more stable and does not change that quickly.

Table 10 : Summary statistics for weather data in summer.

SUMMER						
Variable	Sample size	Average	Median	Std. Deviation	Skewness	Kurtosis
Evaporation	52	18.07 ℓ	18.14 ℓ	8.13 ℓ	0.96	1.56
Windspeed (am)	52	4.03 ms^{-1}	4 ms^{-1}	1.8 ms^{-1}	-0.04	-0.86
Wind speed (pm)	52	5.05 ms^{-1}	5 ms^{-1}	2.03 ms^{-1}	0.46	-0.07
Humidity (am)	52	69.97 %	73.5 %	11.27 %	-0.33	-0.8
Humidity (pm)	52	39.3 %	39.85 %	15.54 %	0.83	1.32
Max temp	52	29.58 °C	29.75 °C	3.33 °C	-0.57	-0.25
Min temp	52	15.29 °C	15.2 °C	1.79 °C	0.05	1.14
Atmospheric pressure (am)	52	8.69 mb	8.69 mb	0.01 mb	4.33E-3	-0.48
Atmospheric pressure (pm)	52	8.67 mb	8.67 mb	0.02 mb	-0.31	-0.54
Radiation	52	22.35 MJ	22.77 MJ	6.14 MJ	-0.43	0.3
Diffuse radiation	52	6.33 MJ	6.27 MJ	2.05 MJ	0.23	-0.56

Table 10 shows the alarming skewness of 4.33E-3 for atmospheric pressure in the morning. The kurtosis, however, is very low at -0.48 in comparison to the winter and spring results. This indicates a drastic change in the atmospheric pressure in summer. Atmospheric pressure in the afternoon however shows an even distribution of skewness as well as kurtosis; this shows how the atmospheric pressures change into a pattern for the summer months. The kurtosis of diffuse radiation has increased slightly. This is due to the increased cloud cover in the summer months and the irregular thunderstorms. Table 11is the summary statistics of the data for autumn.

Table 11 : Summary statistics for weather data in autumn.

AUTUMN						
Variable	Sample size	Average	Median	Std. Deviation	Skewness	Kurtosis
Evaporation	24	18.57 ℓ	18.13 ℓ	7.29 ℓ	0.34	-0.72
Windspeed (am)	24	2.59 ms^{-1}	2.3 ms^{-1}	1.81 ms^{-1}	0.43	-0.25
Wind speed (pm)	24	4.03 ms^{-1}	4.15 ms^{-1}	2.68 ms^{-1}	0.81	2.14
Humidity (am)	24	84.04 %	85.15 %	7.85 %	-0.25	-0.99
Humidity (pm)	24	41.98 %	39.25 %	14.88 %	0.61	0.48
Max temp	24	22.83 °C	22.95 °C	3.31 °C	-0.35	-0.56
Min temp	24	7.72 °C	8.62 °C	3.62 °C	-0.24	1.36
Atmospheric pressure (am)	24	8.71 mb	8.71 mb	0.04 mb	-0.18	-0.68
Atmospheric pressure (pm)	24	8.7 mb	8.7 mb	0.04 mb	-0.56	-0.49
Radiation	24	16.17 MJ	17.15 MJ	4.55 MJ	-1.31	1.37
Diffuse radiation	24	3.85 MJ	3.41MJ	1.56 MJ	1.09	1.1

As can be seen in the table 11, the autumn data begins to change in comparison to summer and winter. The skewness and kurtosis of the data for autumn shows a very even distribution. The atmospheric pressure in the morning has a skewness of only -0.18 and a kurtosis of -0.68.

The evaporation during all the seasons was evenly distributed. The most uneven distribution can be seen in summer (Table 10) where the skewness of 0.96 is higher than in winter, spring and autumn. The kurtosis is highest in summer, showing how the thundershower activity and increased temperature, radiation and humidity effect evaporation.

The standard deviation of evaporation remains relatively constant between 8.13 litres in summer, 9.83 litres in spring, 7.21 litres in winter and 7.29 litres in autumn.

6.2 EVAPORATION

The data collected from the Class A evaporation pans were collected as height in millimetres. The data were multiplied by the area of the Class A pan to obtain volumes. These readings were then divided by one thousand to obtain litres. Evaporation was analysed in relation to each climatic variable in a regression analysis and an analysis of variance.

Fresh slimes was put into a dish with a volume of 0.02826 m^3 . The dish, filled at the same height, holds approximately 7 litres of water. The slime, filled to the same height in the dish, has an average weight of 9,000 kilograms. Simply put, the slimes has a specific mass of 1,286. An average figure is used due to the ratio of sediment to water in the slimes not being consistent.

The density of the slimes varies as the drying and building requirements on the slimes dams change.

6.3 TEXTURAL CHARACTERISTICS OF THE SLIME

The dried sediments mass for each sample was determined to an accuracy of one milligram, before being sieved for 15 minutes. An Endecott-mechanical sieve was used with a sieve stack consisting of sieves of a 0,5 phi increment. The purpose of using phi is that it changes an arithmetic series of grain sizes to a logarithmic series so that linear statistical measures can be applied to the distribution curve (Tucker, 1991). Phi is a factor of the grain size in millimetres on a logarithmic basis which enables the data to be applied to linear statistical tests:

$$\text{Phi} = \frac{-\log d}{\log d_2}$$

d = diameter of particle in millimetres

Sieves ranging from -5,0 phi (32 mm) to a =4,75 phi (0,0156mm) in size were used. The mass of particles in each sieve was determined to one thousandth of a gram (Otto and Harmse, 1993).

These values were then used in a Turbo Pascal software program to calculate the following parameters : average grain size, median size, degree of sorting, skewness and kurtosis. The parameters were calculated by means of the standard Folk & Ward formulae (Folk & Ward, 1956).

7. RESULTS

7.1 EVAPORATION

The erratic weight differences of the slimes in the dish during the winter and the summer months are depicted in Figure 20 and Figure 21.

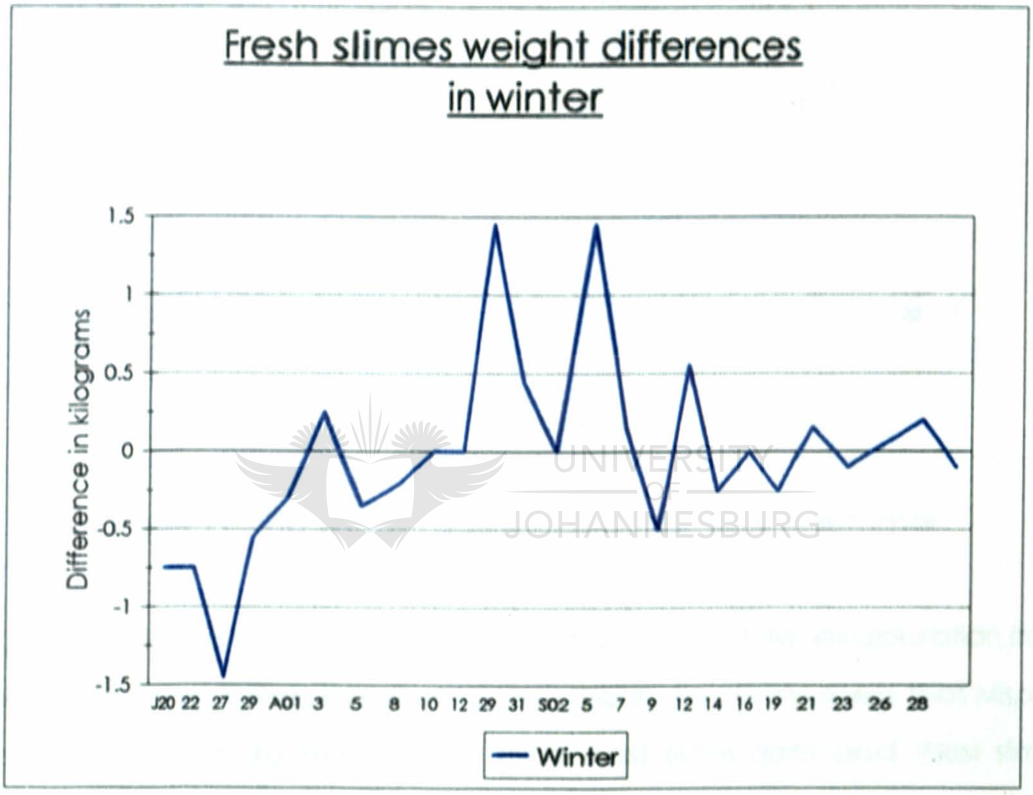


Figure 20 : The weight differences of the fresh slime in winter.

Although the weight loss of the slimes is depicted as erratic, it does show that a trend exists during winter and summer. It is also clear from the graph that evaporation is generally higher during summer. This can be attributed to the increase in temperature and radiation.

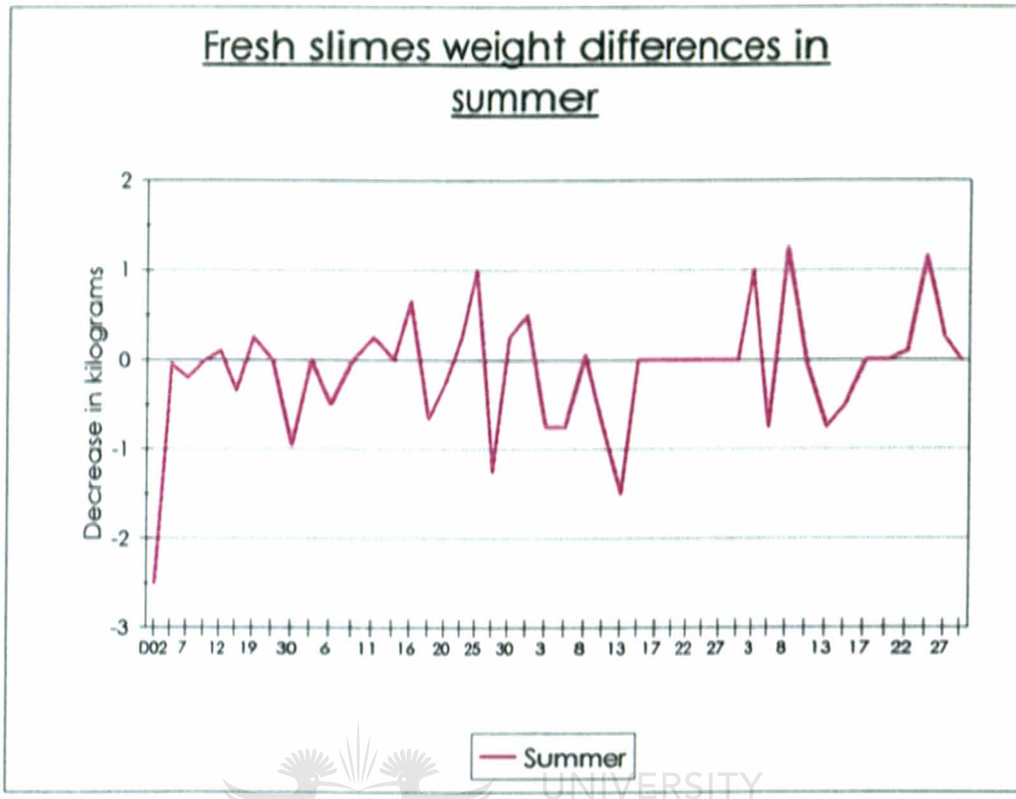


Figure 21 : The weight differences of fresh slime in summer.

Figure 22 shows a three dimensional depiction of the total evaporation from the Class A pans in litres on slimes dams. It can be clearly seen that Mispah slimes dam has more evaporation than East slimes dam and West slimes dam. There can be numerous reasons for this, entailing weather variations and water quality differences.

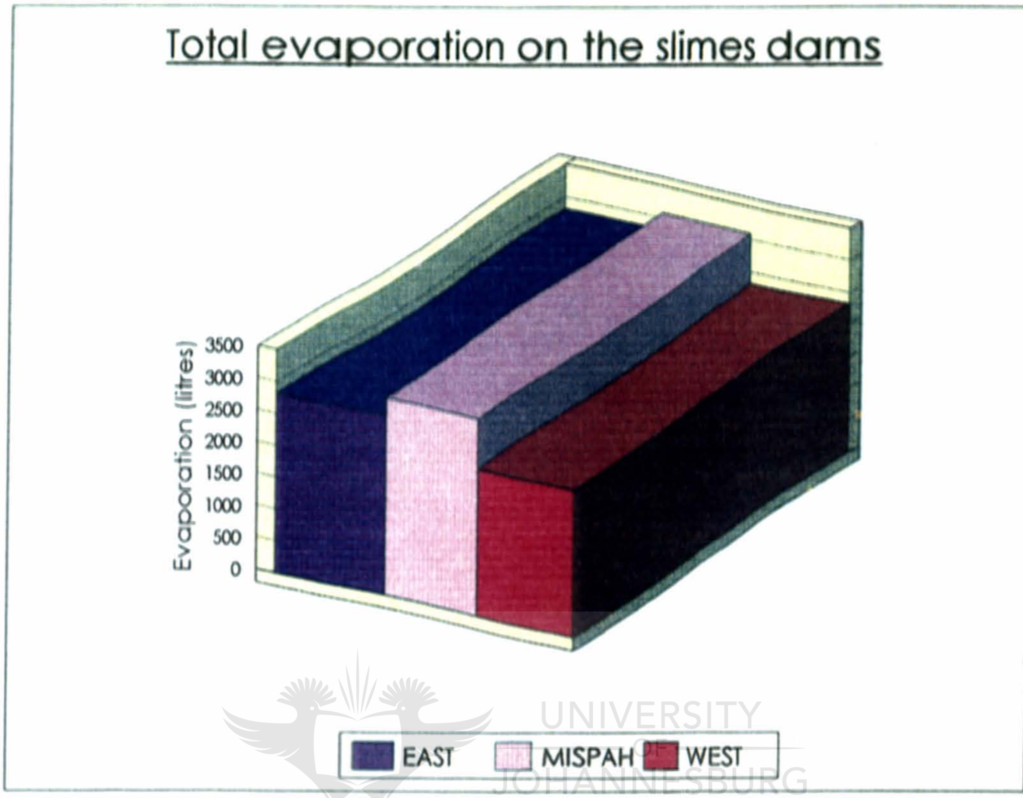


Figure 22 : Three dimensional bar graph on the total evaporation on the slimes dams.

These differences can be seen to be seasonal variations due to various climatic factors. The seasonal variation of the evaporation between each of the slimes dam is illustrated by the bar graph in Figure 23. Figure 23 already shows the continual influence that plant cover on West slimes dam has on the evaporation from the surface area. The evaporation on West slimes dam, as measured by the evaporation pan, is less in comparison to East slimes dam and Mispah slimes dam. The evaporation pan on West slimes dam is set up amonst the plants growing on the slimes dam. The three slimes dams experience the same weather conditions. East slimes dam and

West slimes are very similar in physical height, but as Figure 22 indicates, East slimes has a recorded higher actual evaporation. The assumption can be made that the plant cover is having an effect on the evaporation by prohibiting direct sunlight to the evaporation pan. It must not be assumed that the plant cover is the only reason for the decreased evaporation on West slimes dam, the water qualitymay have a large influence too.

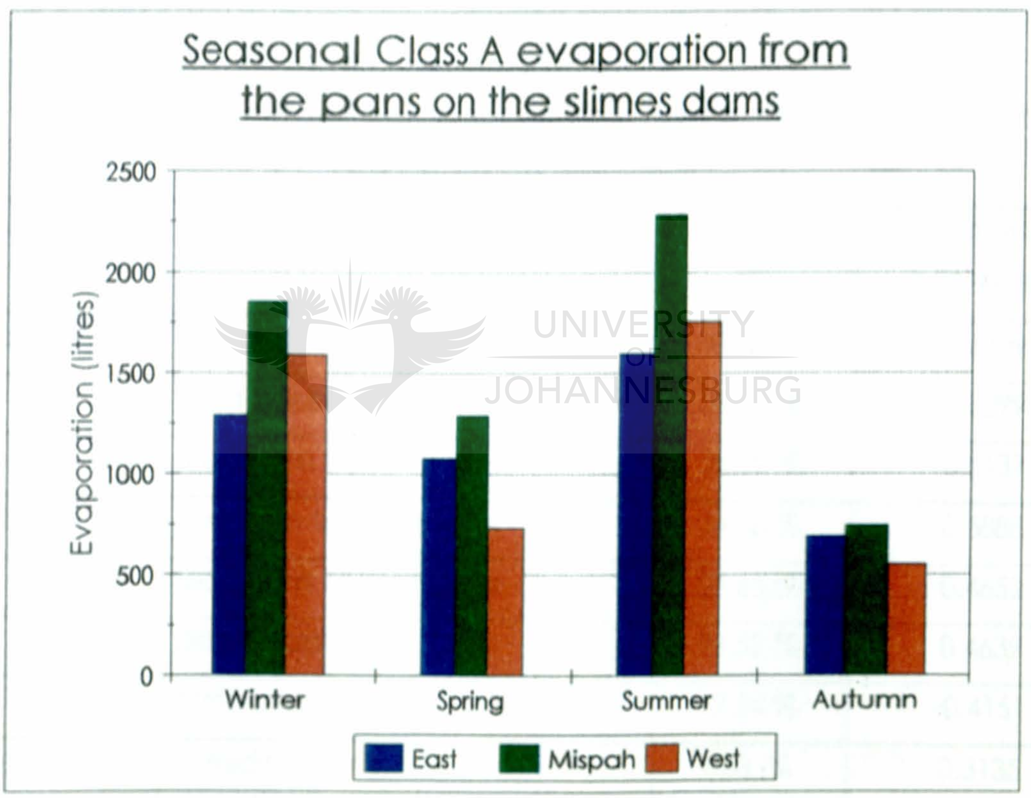


Figure 23 : Seasonal evaporation from the pans on the slimes dams.

The results of the regression analysis and analysis of variance for each climatic factor on each slimes dam per season is discussed below. The detailed results are in Appendix 3.

7.1.1 WINTER

Table 10 is a summary of the results from the regression analysis and analysis of variance. Temperature has an important influence on the evaporation in the winter months on East slimes dam and Mispah slimes dams.

Table 12 : Results of the regression analysis and the analysis of variance during the winter months.

SLIMES DAM	VARIABLE	R^2 (%)	CORRELATION COEFFICIENT
East	Minimum temperature	41.06 %	0.6409
	Wind speed (am)	39.68 %	0.6299
	Maximum temperature	26.39 %	0.5137
Mispah	Minimum temperature	34.68 %	0.5888
	Maximum temperature	21.65 %	0.4652
	Diffuse radiation	21.52 %	0.4639
	Atmospheric pressure (am)	17.24 %	-0.4151
West	Humidity (pm)	9.83 %	0.3135
	Atmospheric pressure (am)	8.21 %	-0.2865
	Wind speed (am)	7.97 %	0.2822
	Minimum temperature	6.14 %	0.2478

Both East and Mispah slimes dams evaporation rate is strongly influenced by temperature differences, hence the good correlation coefficients of the maximum and minimum temperatures. The regression analysis and analysis of variance clearly show that minimum temperature accounts for 41.06 % of the total climatic variables that influences evaporation on East slimes dam and 34.68 % on Mispah slimes dam. However, temperature, both maximum and minimum temperature, accounts for 67.45 % of the total variation in evaporation on East slimes dam. Figure 24 is an area graph clearly showing the strong relationship between evaporation and minimum temperature on East slimes dam.

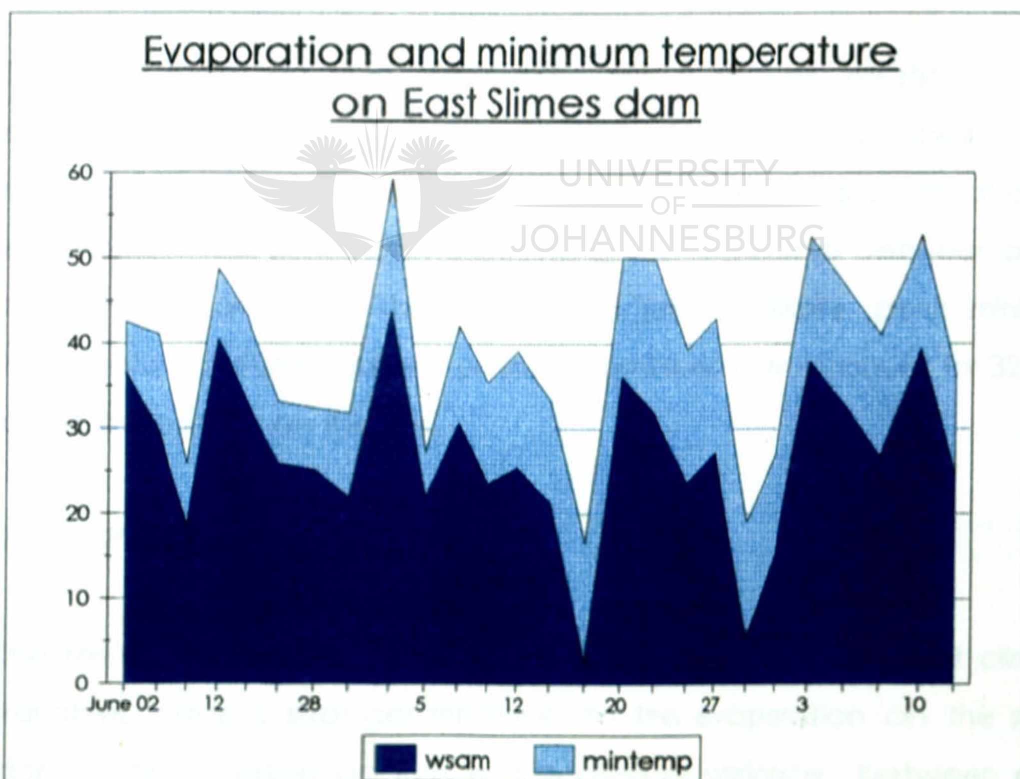


Figure 24 : Evaporation and minimum temperature on East slimes dam.

The combined temperature on Mispah slimes dam accounts for 56.33 % of the total variation. East slimes dam's surface area has an elevation of approximately 34.6 metres above the surrounding area with an average rate of rise of 1.0 metres per year (Vaal Reefs Exploration and Mining Company Limited, 1993). This elevation allows the wind flow to be undisturbed and play a large role in control of the temperature. Mispah slimes dam, with an initial surface area of 140 hectares and proposed rate of rise of 2,8 metres per year, is still close to ground level. The day walls and side walls are approximately three metres higher than the water surface of the slimes dam. The wind flow is therefore slightly more disturbed than on East slimes dam.

The wind speed on East slimes dam has a stronger relationship with evaporation than it does on Mispah slimes dam. The wind speed in the morning accounts for 39.68 % of the total climatic variables affecting evaporation. West slimes dam shows no strong relationship between any of the climatic variables. The wind speed (am); humidity (pm); minimum temperature and atmospheric pressure combined only account for 32.15 % of the evaporation on this site.

7.1.2 SPRING

The results, depicted in Table 13, for spring show very different climatic variables having a stronger influence on the evaporation on the slimes dams. The regression analysis and analysis of variance between each climatic variable and evaporation from the Class A pans show interesting relationships.

The increase in humidity and inconstant atmospheric pressure associated with the spring months has a profound effect on the evaporation. The strong relationship is clearly shown in Table 13 by East and Mispah slimes dams where humidity accounts for 37.28 % and 28.58 % of the total respectively. The negative correlation coefficients indicate the inverse relationship between humidity and evaporation. This simply means that as humidity decreases, so evaporation increases.

West slimes dam is influenced by humidity (pm) and the increased radiation. Humidity, both morning and afternoon, radiation and maximum temperature account for 52.07 % of the total. The increase in diffuse radiation is effected by the increase in humidity.

Table 13 : Summary of results of regression analysis and analysis of variance during the spring months.

SLIMES DAM	VARIABLE	R^2 (%)	CORRELATION COEFFICIENT
East	Humidity (am)	37.28 %	0.6106
	Atmospheric pressure (am)	25.74 %	0.5074
	Atmospheric pressure (pm)	14.43 %	0.3799
Mispah	Humidity (am)	28.58 %	-0.5346
	Radiation	13.4 %	0.3661
	Diffuse radiation	11.01 %	-0.3317
West	Humidity (pm)	17.39 %	-0.4171
	Radiation	15.37 %	0.3919
	Humidity (am)	10.06 %	-0.3255
	Maximum temperature	9.25 %	0.3042

7.1.3 SUMMER

Summer with the increased temperature, radiation and increased variation in humidity influence evaporation to large extent on East and Mispah slimes dams. The rainfall, ie. summer rainfall mainly in the form of thunderstorms, settles in. The associated humidity (pm) and maximum temperature variations account for 75.65 % of the evaporation on Mispah slimes dam. Wind speed has no effect on the evaporation in summer due to the increased radiation and temperature. Table 14 is the summary of the results of the regression analysis and analysis of variance. As can be clearly seen in Table 14, humidity, temperature and radiation have a marked effect on evaporation on all three slimes dams.

Table 14 : Summary of results of regression analysis and analysis of variance during the summer months.

SLIMES DAM	VARIABLE	R^2 (%)	CORRELATION COEFFICIENT
East	Humidity (am)	30.96 %	-0.5564
	Radiation	25.03 %	-0.5003
	Humidity (pm)	17.48 %	-0.4181
Mispah	Maximum temperature	40.73 %	0.6382
	Radiation	37.04 %	0.6086
	Humidity (pm)	34.92 %	-0.5909
West	Radiation	20.8 %	0.4561
	Humidity (pm)	19.45 %	-0.4409
	Humidity (am)	14.13 %	-0.3759

The relationship between each climatic variable is closely related to the other resulting in the summer months evaporation being attributed to three variables which are pronounced in summer, namely humidity, radiation and maximum temperature.

7.1.4 AUTUMN

Table 15 is summary of the results of the regression analysis and analysis of variance.

Table 15 : Summary of results of regression analysis and analysis of variance during the autumn months.

SLIMES DAM	VARIABLE	R^2 (%)	CORRELATION COEFFICIENT
East	Wind speed (am)	32.4 %	-0.5692
	Wind speed (pm)	23.25 %	-0.4822
	Atmospheric pressure (am)	22.56 %	-0.4749
Mispah	Wind speed (am)	27.13 %	-0.5208
	Atmospheric pressure (am)	17.2 %	-0.4147
	Atmospheric pressure (pm)	12.56 %	-0.3544
	Wind speed (pm)	10.62 %	-0.3258
West	Wind speed (pm)	27.4 %	-0.5206
	Wind speed (am)	22.12 %	-0.4704
	Atmospheric pressure (am)	12.4 %	-0.3521
	Atmospheric pressure (pm)	12.25 %	-0.35

The autumn months, marked by cooler, dryer conditions and increased atmospheric pressure differences, influence the evaporation to a large extent. Table 15 shows the strong relationships between atmospheric pressure in the morning and afternoon and wind speed on the three slimes dams.

Wind speed in the morning and afternoon account for 55.65 % on East slimes dam and 49.23 % on West slimes dam. Figure 25 is a combination graph showing the inverse relationship between wind speed and evaporation in autumn. The wind decreases the temperature, thereby decreasing the evaporation.

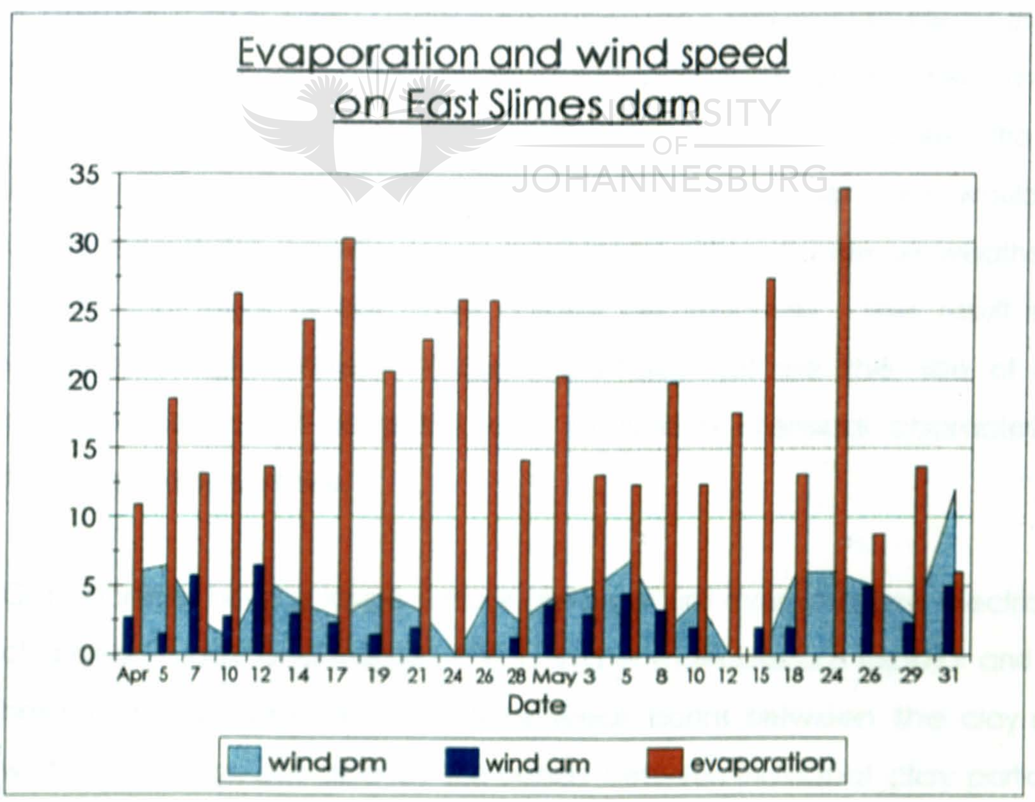


Figure 25 : Combination graph showing evaporation and wind speed on East slimes dam.

7.2 TEXTURAL CHARACTERISTICS

The parameters determined through textural analysis of the sediments of the slimes dams are good indicators of the permeability and water retention capabilities of the slimes dams themselves.

The median Phi-value for a number of samples taken at Vaal Reefs by Van Niekerk (1994) was 3,209 phi with a standard deviation of 0,2 phi. This indicates that the average size of the particles can be classified as a fine soil. There is no significant size difference between the surface and one metre deep samples.

A phenomenon noticed under the microscope is that most particles smaller than 0,0625 mm are quartz grains. Under natural conditions there are no weathering processes that break quartz down to these small sizes (Otto and Harmse, 1993). Furthermore, any such fine quartz particles would be dispersed with the erosion forces associated with such intense weathering agents that might occur under natural circumstances. The result is an abnormally high amount of quartz particles that are the size of clay particles, but do not have the same physical or chemical characteristics that clay particles have.

Clay particles have a large surface area per unit mass and are electrically charged (Fuggle and Rabie , 1994). Water molecules are bipolar and are held in a clay substrate not only by weak bonds between the clay and water molecules, but also by the bonds between individual clay particles. The flat shape of clay particles, and their electric ion charge, causes a low porosity. The spherical character of the quartz particles causes larger inter particle areas which leads to greater porosity (Wild, 1993).

The texture of the different sediments investigated thus relates to porosity and water retention capabilities. This basically means that the slimes dam sediment has the capability of absorbing larger amounts of water than would be expected when looking at the physical characteristics (permeability and porosity). The sediment does not have the water retention capabilities of natural soil and therefore their water holding capacity is more dependent on evaporation and gravity than is natural soil (Otto and Harmse, 1994).

Figure 26 clearly indicates soil-moisture characteristics curves for coarse and fine tailings materials (Van Zyl, 1987).

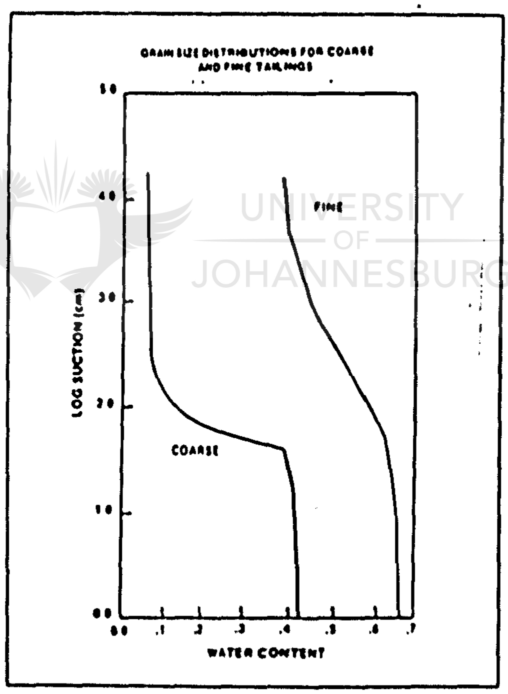


Figure 26 : Soil-moisture characteristic curves of slimes material (Van Zyl, 1987).

Slurry deposition of tailings is not a continuous process, but occurs in cycles on different parts of a tailings pond. This results in layers of saturated tailings deposited over previously deposited layers. A management strategy is usually designed to allow sufficient time between deposition of layers so that drainage and evaporation can occur from the deposited material.

The flow of water above the water table in tailings ponds occurs under unsaturated conditions. Flow is essentially vertical in the flat beach portions. Between subsequent depositions, water may drain downward to a water table or evaporate upward. Water movement in the deposited layer depends on the material characteristics, the occurrence of evaporation, and the moisture profiles of the previously deposited tailings.

Evaporation in the coarse tailings affects primarily the upper 25 to 30 cm. Water contents at elevations below 2.75 metres are essentially unaffected by evaporation. Evaporation causes upward flux in only the upper 25 to 30 cm of the profile.

A water table deeper than three metres would have little effect on the downward movement of water in coarser tailings. Water would move downward regardless of the depth. The steady upward flux of water from the water table in the fine tailings undergoing evaporation depends greatly on the depth to the water table. The deeper the water table, the lower the flux.

In fine tailings, evaporation effects are large, drying the upper portion of the profile significantly, and causing a steady upward flux from the water table three metres below the surface in less than 60 days. Approximately the upper 100 cm of the profile is affected by evaporation. Evaporation is therefore, more important for the dewatering of fine tailings than for coarse tailings. The increased reduction in water content caused by evaporation in the coarse profile over and above that caused by drainage only is not significant. It is expected that further reduction in the moisture content over a greater depth can be obtained for the fine tailings if the water table is deeper than three metres from the surface.

It can be concluded that in coarser tailings enough time must be allowed for the tailings to drain to minimise resaturation of previous layers. Evaporation helps slightly to prevent resaturation, and does so in the first few days after deposition of the new layer. Since the amount of time the coarser tailings require to drain is more than a few days, drainage is the most important factor in selecting optimum times between depositions (Van Zyl, 1987).

8. SYNTHESIS

The overall evaporation on the slimes dams can be calculated by the height of water evaporated from the pan (in millimetres) and multiplying it by the area of the slimes dam. This is only applicable to the pool area of the slimes dam. The evaporation in kilolitres per slimes dam has been tabled in Table 16.

Table 16 : The total evaporation in kilolitres for each slimes dam.

	EAST	MISPAH	WEST
June	26 533.81 kℓ	47 600.1 kℓ	138 881.27 kℓ
July	38 126.61 kℓ	57 860.4 kℓ	17 162.87 kℓ
August	51 694.29 kℓ	69 636.53 kℓ	19 985.22 kℓ
September	68 185.83 kℓ	98 712.69 kℓ	19 053.53 kℓ
October	87 967.27 kℓ	101 057.31 kℓ	17 430 kℓ
November	75 642.34 kℓ	83 354.88 kℓ	14 809.44 kℓ
December	59 605.25 kℓ	102 643.98 kℓ	20 745.36 kℓ
January	61 256.26 kℓ	84 273.41 kℓ	20 995.22 kℓ
February	47 275.88 kℓ	84 355.99 kℓ	20 836.86 kℓ
March	36 979.46 kℓ	65 681.65 kℓ	14 639.64 kℓ
April	57 579.3 kℓ	62 449.33 kℓ	13 395.63 kℓ
May	43 350.23 kℓ	47 490.98 kℓ	10 918 kℓ

The area of the slimes dams was taken from Table 1. The pool area, according to Middleton and Stern (1987), makes up 25 % of the total area on the slimes dam surface. These above figures are graphically presented in Figure 27, Figure 28 and Figure 29.

Figure 27 shows the evaporation on East slimes dam for the period July 1994 to July 1995. The results show definite trends in the spring and summer months. Figure 28 shows the similar trends for Mispah slimes dam as it does for East slimes dam. The weather has a strong influence on the evaporation during the warmer months.

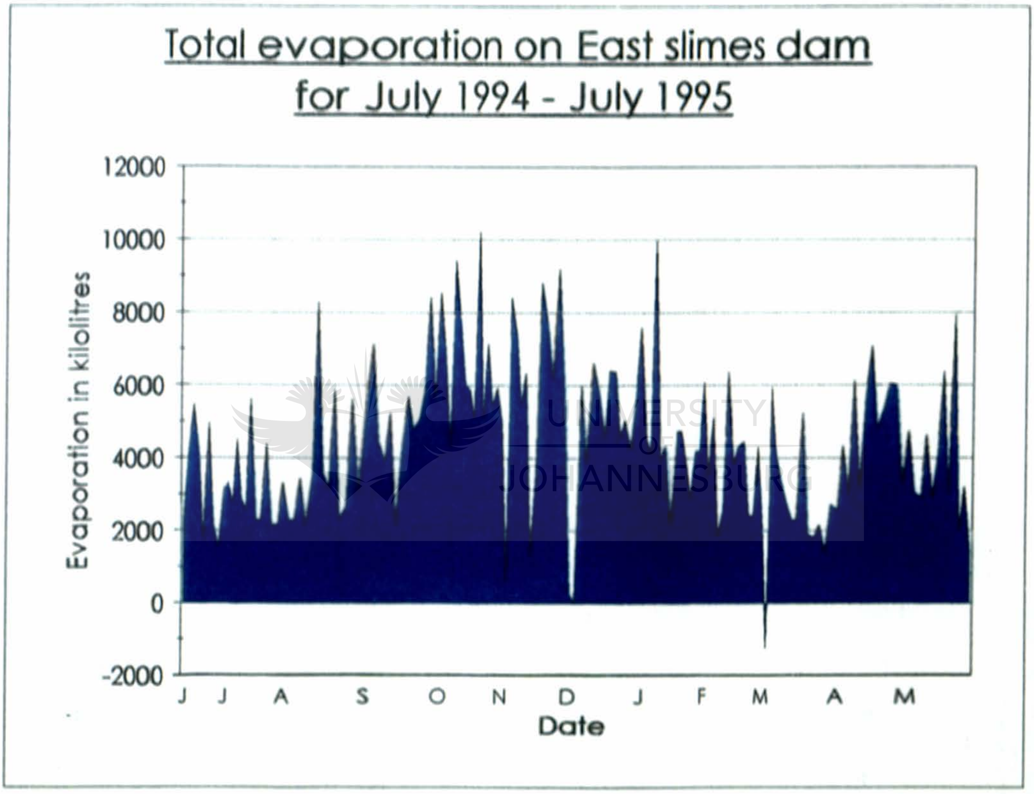


Figure 27 : Total evaporation for East slimes dam for the period July 1994 to July 1995.

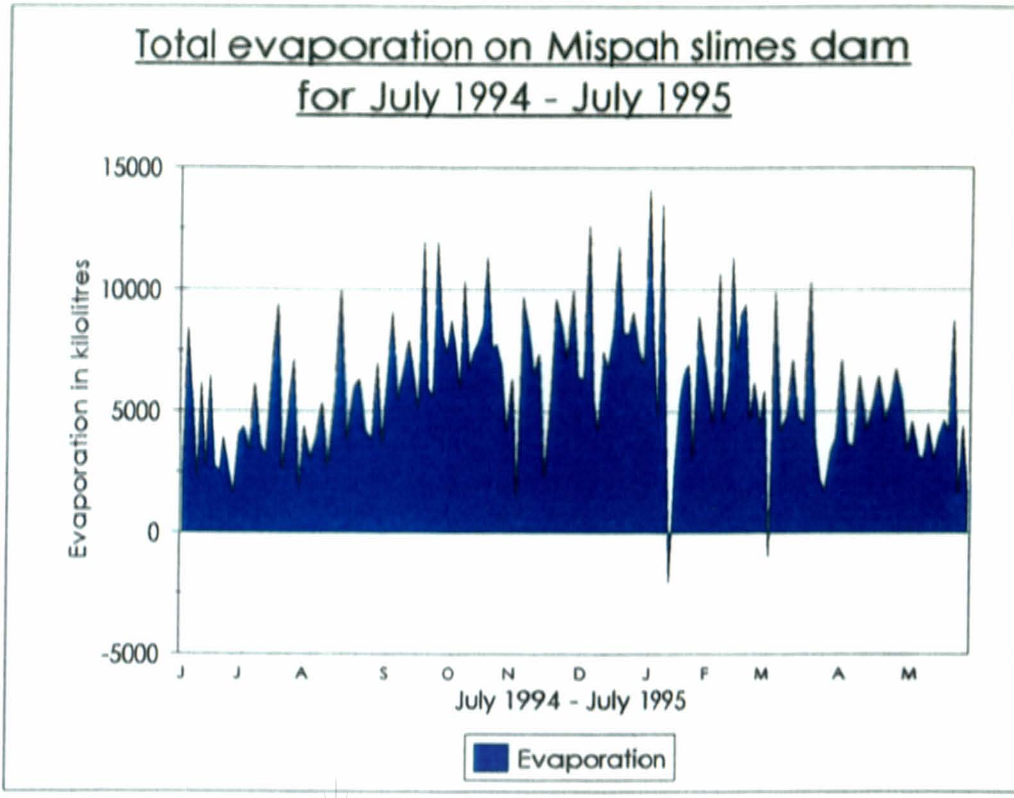


Figure 28 : Total evaporation on Mispah slimes dam for the period July 1994 to July 1995.

Figure 29 shows the evaporation for West slimes dam. The trend that can be seen in the Figure 29 differs considerably from both East and Mispah slimes dam. It must be remembered that the Class A pan was set up amongst the *Phragmites* in the penstock area. The pan was thus effected by the shade produced by the *Phragmites* as well as the disturbed wind flow over the surface of the slimes dam. However, this does not imply that the water loss on West slimes dam is less. The *Phragmites* , as a common wetland plant, absorbs phenomenal quantities of water.

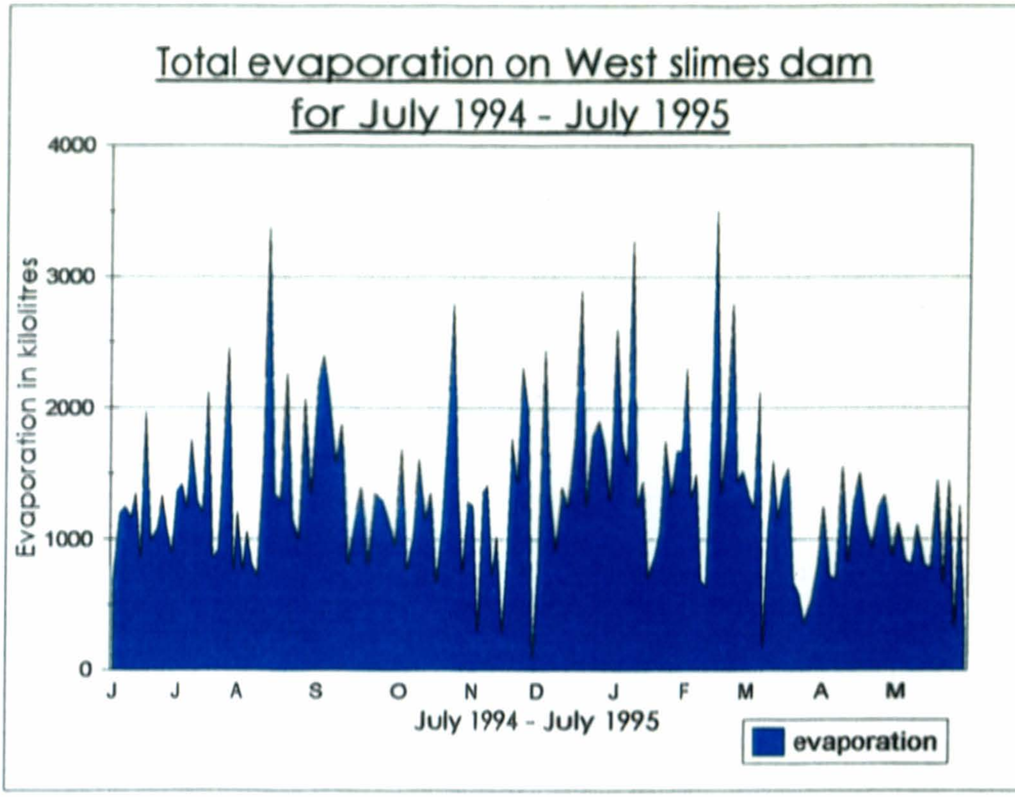


Figure 29 : Total evaporation on West slimes dam for the period of July 1994 to July 1995.

Figure 30 depicts monthly evaporation data. The general trend can be observed where East and Mispah evaporation increases dramatically at the onset of spring. However, the trend for West slimes dam can be seen as radically different. The growth of these plants start in the early spring season and continues through summer and autumn. During winter, shoots die gradually as the temperature falls. The maximum shoot height and leaf number are attained during summer shortly before flowering (Patten, 1990).

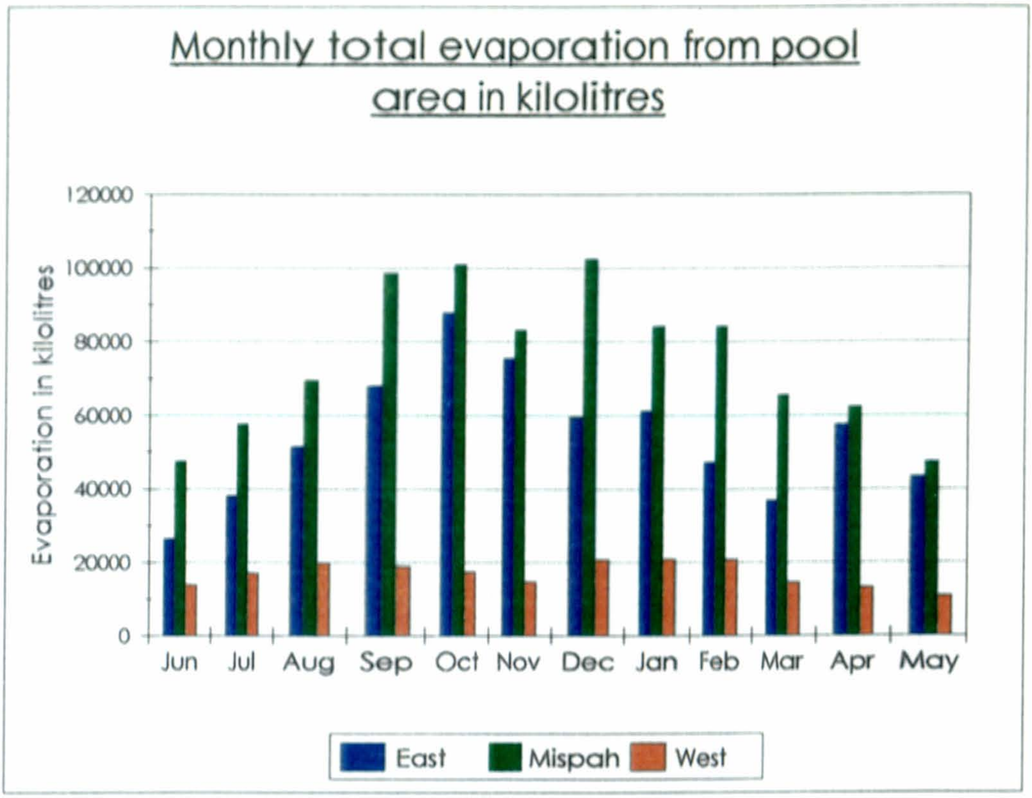


Figure 30 : Monthly total evaporation for the three slimes dams.

Returning to the Highveld seasons, Table 17 contains the totals for each season and a grand total for each slimes dam. The evaporation is expressed in kilolitres per slimes dam.

Table 17 : Seasonal totals and a grand total evaporation for each slimes dam.

SEASON	MONTHS	EAST	MISPAH	WEST
Winter	Jun, Jul, Aug, Sep	300 895.26 kℓ	547 619.39 kℓ	140 165.8 kℓ
Spring	Oct, Nov	251 576.88 kℓ	380 824.39 kℓ	64 479.54 kℓ
Summer	Dec, Jan, Feb, Mar	373 254.24 kℓ	673 910.07 kℓ	154 434.2 kℓ
Autumn	Apr, May	161 508.82 kℓ	219 880.61 kℓ	48 627.55 kℓ
TOTAL		1 087 235.2 kℓ	822 234.5 kℓ	407 707.09 kℓ

Figure 31 is a bar graph of the data in Table 17. The graph shows how Mispah slimes dam, with the largest surface area, evaporates more water than the other slimes dams. The factor of surface area is important to remember when studying West slimes dam.

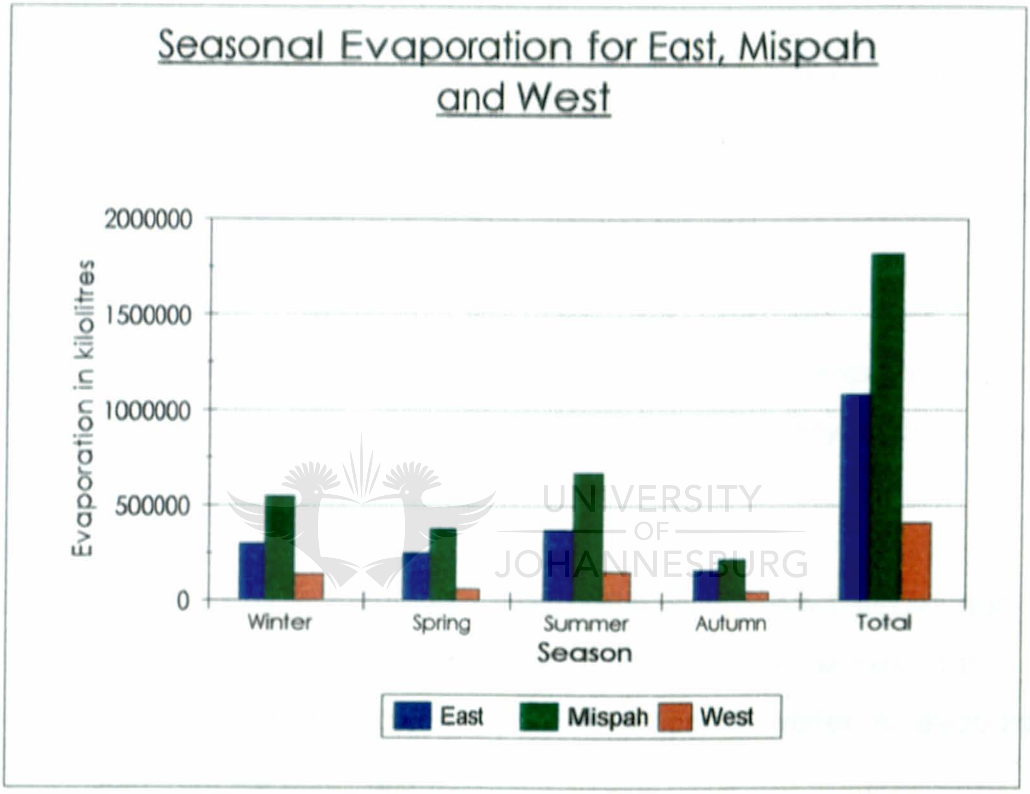


Figure 31 : Seasonal evaporation of the slimes dams and a total for the year.

According to Funke (1990), it has been estimated that only 40 percent of the water in a slimes dam is available for evaporation and downward seepage, while roughly 25 percent is retained within the slimes and 30 percent of the water is returned to the plant.

9. CONCLUSION

From the information gained in this study, certain aspects (in conjunction with the study's objectives) have come to light, namely:

Objective 1:

- The total evaporation for East slimes dam was 1 087 235.2 kilolitres for the full rainfall year. This indicates that approximately 2 978 kilolitres of water is evaporated per day over the entire pool surface area.

- The total evaporation for the rainfall year for Mispah slimes dam was 822 234.5 kilolitres. In other words, approximately 2 253 kilolitres of water is evaporated from the pool area per day.

- The total evaporation for the rainfall year for West slimes dam was 407 707.1 kilolitres from the pool area on the slimes dam. This indicates that approximately 1117 kilolitres of water is evaporated daily from the pool area.

To simplify the evaporation figures above, Table 18 shows the average daily evaporation lost per month from the evaporation pans. The height in millimetres per square metre per month is presented in Figure 32. Mispah slimes dam and East slimes dam can be regarded as more accurate representations of the evaporation from the pool areas on slimes dams.

Table 18 : Average daily evaporation in millimetres per square metre

MONTH	EAST	MISPAH	WEST
Jun	3.16	4.49	4.39
Jul	4.4	5.28	5.25
Aug	5.96	6.35	6.11
Sep	8.13	9.31	6.02
Oct	10.15	9.22	5.33
Nov	9.02	8.42	4.68
Dec	6.88	9.37	6.35
Jan	7.07	7.69	6.42
Feb	6.04	8.52	7.05
Mar	4.27	5.99	4.48
Apr	6.87	5.89	4.23
May	5.34	4.33	3.34

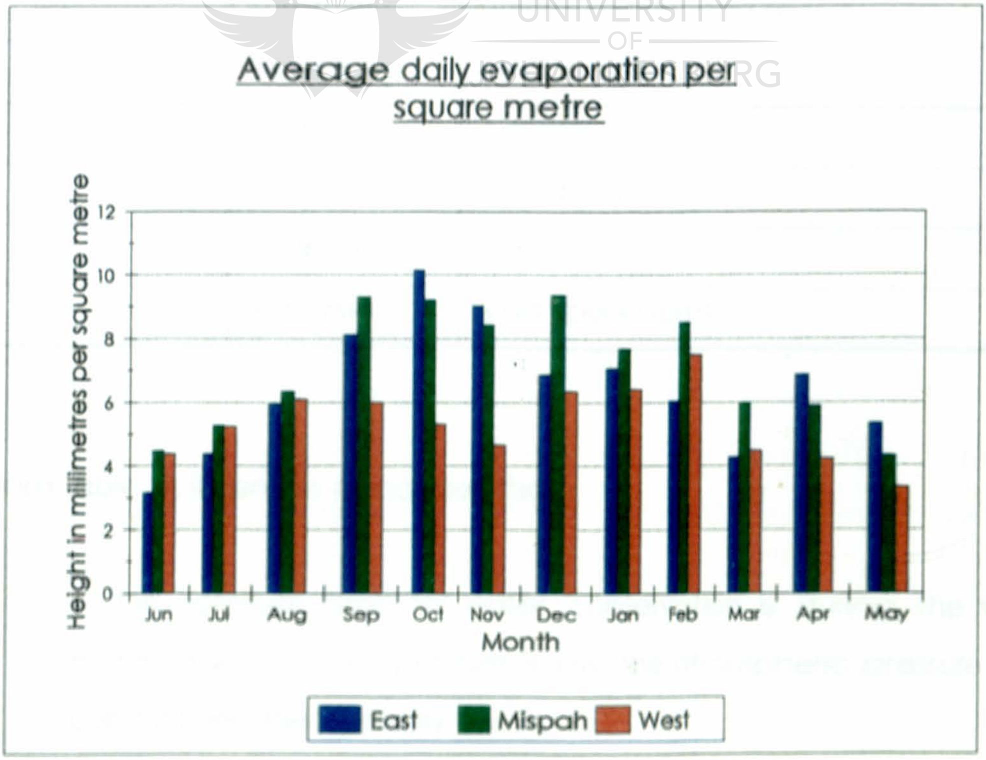


Figure 32 : Average daily evaporation per square metre

Objective 2:

These are average daily figures for the year, and these are in turn influenced by the climatic variables per season as indicated in Table 19.

Table 19 : Summary of the most important factors influencing evaporation on the slimes dams.

SLIMES DAM	SEASON	VARIABLE
EAST :	Winter	Minimum temperature
	Spring	Humidity (am)
	Summer	Humidity (am)
	Autumn	Wind speed (am)
MISPAH :	Winter	Minimum temperature
	Spring	Humidity (am)
	Summer	Maximum temperature
	Autumn	Wind speed (am)
WEST :	Winter	Humidity (pm)
	Spring	Humidity (pm)
	Summer	Humidity (pm)
	Autu mn	Wind speed (pm)

From Table 19, it can be concluded that:

- the optimum time for water conservation is during the winter months when the temperature is low, the atmospheric pressure more constant and the humidity low.

- the water quality within the reticulation systems may deteriorate to such an extent that treatment may not be a viable option in terms of excessive cost, then the best time to dispose of these waters would be in the hot, dry spring and summer months. Although the rainfall does add water in to the system, it acts as a diluting factor. This allows the high saline water to be evaporated far quicker.

Some deficiencies found in the study are as follows:

- The continual pH and conductivity variation in the slimes dam water effects the vapour pressure to a large extent which has a direct effect on the evaporation. The evaporation will therefore be generalised for the slimes dam. The water quality of one slimes dam to another will result in a generalised model. A site specific study is suggested with detailed data for the specific area, resulting in an accurate and exact prediction model for that specific site.

- The ratios of the pool area, wet beach area and dry beach area as proposed by Middleton and Stern (1987) provide too large a generalisation for the accurate calculation of the evaporation from the surface area of the slimes dam. It was observed that the water quantity varied to a large extent during the rest periods and pumping periods on the slimes dams. The ratios do however provide a good division of the slimes dams surface area during the regularly pumping periods.

Some problems experienced in the study are those of transportation and data missing due to the public holidays.

The simplest and most common means of estimating the evaporation is on the basis of data obtained from pan and tank evaporimeters. For future monitoring and improved water resource management, a Class A evaporation pan can be set up in close proximity to the offices at the mine. The daily data collected can be applied to the regression lines in Table 4, Table 5, Table 6 and Table 7 to provide a predicted evaporation quantity for the slimes dams in the south eastern part of the North West Province.

10. REFERENCES

Acocks, J.P.H. 1988 : Veld Types of South Africa. Botanical Research Institute.

Cogho, V.E.; L.J. van Niekerk; H.P.J. Pretorius and F.D.I. Hodgson. 1992 : The Development of Techniques for the Evaluation and Effective Management of Surface and Ground-Water Contamination in the Orange Free State Goldfields. Water Research Commission Report No. 224/1/92. (17 - 22).

Development Bank of South Africa. 1992a : South African Population Projections. Pretoria.

Development Bank of South Africa. June 1992b : Economic and Social Memorandum Region J. Pretoria.

Du Plessis, H.M. and A.G. Reynders - undated. Potential Impact of Gold Mines on the Surface Water Environment. Water Research Commission. Pretoria.

Ebdon, D. 1985 : Statistics in Geography. Blackwell : Oxford. (90 - 91).

Folk, R.L. and W.C. Ward. 1957 : *Brazos.River Bar : A Study in the Significance of Grain Size Parameters.* Journal of Sedimentary Potrology, vol 27, no. 1. (3 - 26).

Fuggle, R.F and M.A. Rabie (ed.) 1994 : Environmental Management in South Africa. uta & Co Ltd. Cape Town.

Funke, J.W. 1990 : The Water Requirements and Pollution Potential of South African Gold and Uranium Mines. Water Research Commission Report KV9/90, May 1990.

Gowan, M.J. 1987 : *Civil Engineering Aspects of Tailings Disposal in the Orange Free State*. Proceedings of the International Conference on Mining and Industrial Waste Management. Johannesburg. (101 - 105).

Gowan, M.J. and J.R.G. Williamson. 1987 : A Review of Tailings Deposition Techniques in South Africa and Appropriate Selection of Application. Proceedings of the International Conference on Mining and Industrial Waste Management. Johannesburg. (81 - 87).

Handbook of Guidelines for Environmental Protection. 1983 : The Design, Operation and Closure of Metalliferous and Coal Residue Deposits, Volume 1 / 1983. Chamber of Mines of South Africa. Johannesburg.

Hanson, G.L. 1989 : *Predictions of Class A Evaporation Pans in South West Idaho*. Journal of Irrigation and Drainage Engineering Vol. 115 April 1989. (166 - 171).

Hausenbuiller, R.L. 1985 : Soil Science : Principles and Practices .Wm. C. Brown Publishers : Iowa. (211 - 213).

Hounam, C.E. 1973 : Comparison between Pan and LakeEvaporation. World Meteorolgical Organization. Technical Note No. 126. (1 - 51).

Kadlec, R.H., R.B. Williams and R.D. Scheffe. 1990 : *Wetland Evapotranspiration in Temperate and Arid Climates*. The Ecology and Management of Wetlands : Volume 1. (146 - 159).

King, L.J. 1969 : Statistical Analysis in Geography. Prentice-Hall Inc. London.

Longley, R.W. 1970 : Elements of Meteorology. John Wiley & Sons : New York. (96 - 99).

Marsh, W.M. and J. Dozier. 1981 : Landscape : An Introduction to Physical Geography. Addison - Wesley : London.

McGrew, J.C. and C.B. Monroe. 1993 : An Introduction to Statistical Problem Solving in Geography. Wm. C. Brown : Oxford. (244 - 285).

McIntosh, D.H and A.S. Thom. 1969 : Essentials of Meteorology. Wykeham Publications : London. (19 - 21).

Meadows, M.E. 1985 : Biogeography and Ecosystems of South Africa. Juta & Co. Cape Town.

Middleton, B. J. and J. Stern. 1987: *Water balances of tailings impoundments using computer based techniques.* Proceedings of the International Conference on Mining and Industrial Waste Management. Johannesburg. (289 - 296).

Moir, A.T.- undated: *Slime Residue Disposal dams.* Gold Metallurgy on the Witwatersrand.

Monteith, J.L. 1973 : Principles of Environmental Physics. Edward Arnold : London. (178 - 180).

Otto, D. and J.T.Harmse. 1993 : The Establishment of Sources of Water Pollution in the Gold Mining Industry on the Witwatersrand and Management Guidelines for the Limitations thereof - with special refernce to the influence of seepage and subsurface drainage on a secondary drainage basin in the Vaal River System. Final Report, Case Study II. Department of Geography and Environmental Management : Rand Afrikaans University : Johannesburg.

Otto, D. and J.T. Harmse. 1994 : The Establishment of Guidelines and Procedures to Assess and Ameliorate the Impact of Mining Operations on the Surface Water Environment - with specific reference to discard dump seepage and grounwater aspects. Final Report. Case Study III. Rand Afrikaans University. (1 - 17)

Patten, B.C. (Ed.) 1990 : Wetlands and Shallow Continental Water Bodies : Volume 1 : Natural and Human Relationships. The Hague : SPB Academic Publishing. (150 - 151).

Pitty, A.F. 1978 : Geography and Soil Properties. Methuan : London.

Preston-Whyte, R.A. and P.D. Tyson. 1989 : The Atmosphere and Weather of Southern Africa. Oxford University Press : Cape Town. (83).

Pulles, W. 1992 : *Water Pollution : Its Management and Control in the South African Gold Mining Industry.* Journal of the Mine Ventilation Society of South Africa, February 1992 . (18 - 36).

Schulze, B.R. 1966: Climate of South Africa, General Survey. WB40. Department of Transport, Pretoria.

Shih, Sun F. and Ke S. Cheng. 1991 : *Evapotranspiration Estimation for Data Short Environments.* Journal of Irrigation and Drainage Engineering, vol 117, no.1 Jan/Feb 1991. ASCE.

Stanley, G.C. (Ed.) 1987 : The Extractive Metallurgy of Gold in South Africa vol II. South African Institute of Mining and Metallurgy. Johannesburg. (655 - 705).

Tedder, H.A. - undated. *Water Management in Mining.* Environmental Engineering in SA Mines. Anikem. (893 - 910).

Thom, H.C.S. 1966 : Some Methods of Climatological Analysis. World Meteorological Organisation Technical Note No. 81. WMO : Geneva: Switzerland. (37 - 51).

Thornthwaite, C.W. and J.R. Mather. 1955 : *The Water Balance.* Publications in Climatology. Laboratory of Climatology, Vol 8, No.1. (104).

Tucker, M.E. 1991 : Sedimentary Petrology : An Introduction to the Origin of Sedimentary Rocks (2nd Edition) Blackwell: London.

Vaal Reefs Exploration and Mining Company Ltd. 1993 : Environmental Management Programme Report, November 1993.

van Niekerk, H.S. 1994 : "Tekstuuranalise van die slikhope en die omliggende grond in die Vaal Reefs Mynkompleks". Department of Geology, Rand Afrikaans University.

van Rensburg, P. 1985 : Weather Forecasting. Perskor : Johannesburg. (15 - 17).

van Rooyen, K.C. 1992 : An Integrated Method of Coal Discard and Slurry Disposal to Reduce the Environmental Impact from Coal Residue. Masters Thesis. Department of Geography : Rand Afrikaans University.

van Zyl, 1987 : *Seepage and Drainage Analysis of Tailings Impoundments - Is it really that simple ?* Proceedings of the International Conference on Mining and Industrial Waste Management : Johannesburg. (211 - 219)

Verkerk, C.G. 1987 : *The Hydraulic Transportation of Gold Mine Waste Materials.* Proceedings of the International Conference on Mining and Industrial Waste Management : Johannesburg. (139 - 145)

Wagner, J. 1987 : *Waste Water Management - Current Practices and Constraints.* Proceedings of the International Conference on Mining and Industrial Waste Management. Johannesburg. (275 - 282).

Wagner, J.C. and A.M. van Niekerk. 1987 : *Quality and Treatment of Effluent Originating from Mine and Municipal Solid Waste Sites.* Proceedings of the International Conference on Mining and Industrial Waste Management : Johannesburg. (283 - 288).

Wates, J.A. and R.J. Kelley. 1985 : *Water Management on a Gold Mine.* Colloquium : Treatment and Reuse of Water in the Mining and Metallurgical Industry. COMRO, May 1985.

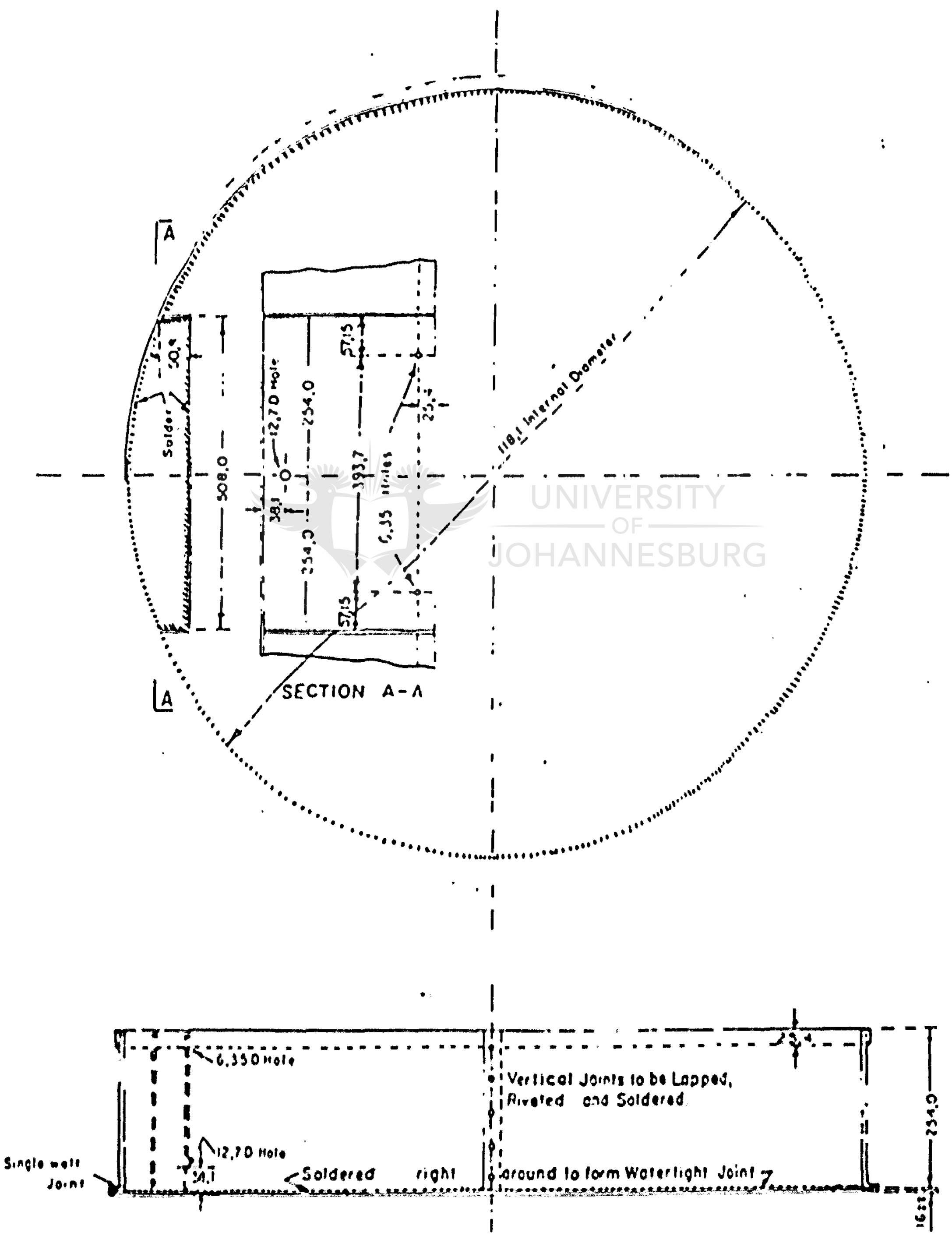
Weather Bureau. 1960 : Technical Manual. Department of Environment Affairs : Pretoria.

Webber Wentzel. 1992 : Environmental Law Brief: Water Under the Bridge? Johannesburg.Attorneys Notaries & Conveyancers - Patent Attorneys & Trade Mark Agents.

Wild, A. 1993 : Soils and the Environment: An Introduction. Cambridge University Press: London.

APPENDIX 1

CLASS A EVAPORATION TANK



All 16gg. Galvanised Sheet Iron

EAST SLIMES DAM

Date	Potch evap	Vlrfs evap	wsam	wspm	hudam	hudpm	maxtemp	mintemp	apam	appm	radiation	diffuse
June 02	6.56	9.85	1.5	5	82	32	20.3	2.2	872.4	870.5	13.56	3.77
3	3.28	18.06	2.7	2	91	33	19.4	1.3	874.2	874.5	12.61	3.8
7	17.52	23.5	3	6.5	77	29	17.1	-0.7	872.5	870.7	14.75	3.31
12	19.16	17.52	0	16	68.3	41	18.4	-0.8	873.5	872.1	15.84	1.7
14	10.4	---	12	8	70.5	40.5	20.8	0.5	874.8	870.9	15.35	2.17
16	9.31	---	10	9	60	19.5	19.9	5	867.8	864.9	15.09	2.14
19	8.76	---	10	12	80	46	15.9	-0.6	872.4	871.6	13.12	2.85
21	6.57	---	4	8	74	28	18.9	2.9	877.1	874.3	14.56	2.15
23	7.66	7.66	0	11	83	25	19	1.5	874.7	872.3	14.65	2.1
26	10.95	21.35	3.3	7	61.7	15.5	21.3	-1.2	873.7	871.6	15.04	1.99
28	7.66	9.19	2	0	48.5	21.5	21.9	-0.9	876.3	874.1	14.66	2.45
30	5.47	6.67	0	11	77.5	18	21.9	-1.6	871.1	868.1	15.31	2.22
M.Total	113.3	113.8										
July 03	11.5	13.62	3.5	5.5	74	38.5	20.6	3.5	873.8	871.3	14.48	2.67
5	12.04	14.24	0	5	92.5	25.5	20.6	3.6	873.2	871.2	13.4	3.28
7	9.85	11.72	2	4.5	65	15.5	19.5	2.15	873.2	871.4	15.54	2.12
10	16.42	19.29	3.3	2.7	79	18.3	21	1.7	873.4	870.8	15.57	2.14
12	10.4	12.35	1	4	63	14	22.3	-1.9	872.6	870.2	15.66	1.85
14	9.3	11.09	1.75	6.5	67.5	24.5	20.8	-2.15	873.3	871.5	13.41	3.83
18	21.9	24.09	0.8	4.2	57.4	16	20	-3.5	874.9	873.9	15.34	2.24
20	8.21	9.85	0	5.5	70.5	19	19.8	-0.8	875.1	872.8	15.86	2.08
22	8.76	9.85	2	4	64	21.5	19.4	-1.3	874.9	872.1	15.67	2.42
25	15.99	18.8	3.5	2.8	49	13.7	21.9	-0.6	869	866.3	15.69	2.11
27	2.74	9.31	3	9	91	57.5	10.5	-0.6	867.2	867.7	7.9	4.99
29	8.21	9.31	0	1	82.5	33.5	17.6	-4.3	878.5	877.2	16.56	2.08
M.Total	135.32	163.5										
Aug 1	9.85	14.23	0	3.3	82.6	28.7	17.5	-1.4	880.3	878.5	17.04	1.89
3	7.66	9.85	2	3.5	65.5	16.5	19	-2.9	875.9	874	17.12	1.89
5	8.76	9.85	3.5	5.5	54	20.5	20.1	0.5	875.9	874.2	16.31	3.28
8	14.78	14.78	0	4.5	72.6	24	19.6	2.8	873.5	871.1	14.92	4.3
10	9.31	9.31	0.08	3.3	55.5	17	19.5	0	870.8	869	17.66	2.49
12	14.78	15.33	2.5	7	45.5	12	21.9	-1.6	871.7	870.1	18.02	2.53
15	25.73	35.58	7.8	9.3	61.3	26.3	23.2	8.5	866.1	866.4	16.8	4.25
17	10.95	15.33	2.5	7.5	62	22	19.9	0.2	870	868.6	18.42	3.11
19	16.42	13.69	3.3	5.8	67	23	23.5	5.4	871.1	868.2	17.04	4.24

East slimes dam

22	19.71	25.18	5.5	8.7	59.6	30.3	19.7	5.1	870	868.6	18.49	3.29
24	9.85	9.85	2.5	0.8	73	28.5	17.7	1.8	878.4	875.7	20.17	1.88
26	10.4	11.5	0	1.5	56.5	22.5	22.4	2.5	877.4	875.3	19.16	3.14
29	20.26	24.09	0	1.5	44.6	10	25.8	3.5	877.6	874.2	19.66	3.33
31	12.59	13.14	1.5	0	63.6	100	22.4	7.2	875.9	871	19.84	3.43
M.Total	191.05	221.7										
Sep 2	19.16	23.54	2.3	0	54.5	100	22.4	6.8	873	869.9	20.35	3.07
5	24.64	30.66	4.5	0	49	100	27.5	7.8	871.6	868.8	21.32	2.57
7	20.26	19.16	5.3	6.3	40.5	12	27.4	6.4	874.5	872.6	21.57	2.79
9	14.23	16.77	2.5	5	35.5	19.5	26.9	7.3	873.4	872.4	20.5	3.47
12	19.16	22.46	5.3	6.7	63	21.3	22.7	5.5	879.5	876.6	20.66	3.54
14	20.8	'9.31	4.5	3.7	41	11.5	27.4	5.2	869.5	865.8	21.8	3.49
16	18.07	18.61	2	0	73.5	13	24.5	3.5	872	868.7	18.32	4.26
19	20.8	24.35	2.5	2.3	43	9.3	27.9	8.5	870.2	866.7	22.81	3.77
21	17.52	20.56	5.5	7	47	13	28.9	6.3	872.3	869.7	23.95	2.93
23	18.61	21.82	5	3	55.5	18.5	31	10.9	872.5	869.2	21.91	4.31
26	21.35	24.98	1.7	7	50.3	19	32	11.1	870.1	967.4	22.05	4.51
28	21.35	36.13	8.5	6.5	48	19	32.1	15.4	870.4	866.3	21.63	3.72
30	18.07	24.09	5	6	40.5	22	24.7	7.5	865.4	861.7	20.03	4.88
	254.02	292.4										
Total	1133.4	1291										
Oct 03	33.39	36.68	3.7	3.7	52.3	15	25.6	5.9	868.5	865.1	22.75	3.81
5	9.64	29.97	5.5	7	40	30	24.3	11.1	870	867.9	14.31	5.15
7	16.42	18.61	0	8	65	34.5	20.8	7.2	876.9	873.8	19.11	5.93
10	30.66	40.51	6	4.7	50.3	24.3	24.9	8.2	870.1	867.6	23.86	4.15
12	22.45	33.21	8	9	55	19	29.8	10	866.6	865.6	24.94	4.44
14	12.04	25.92	7	5	63.5	14	27.1	7.3	870.2	867	24.05	4.62
17	26.28	25.18	6.3	6.7	69	52.7	20.8	7.2	875	873.6	25.37	4.38
19	20.8	21.9	3	0	51.5	15	30.1	9.9	870.1	866	30.38	2.68
21	25.18	43.8	6.8	6.3	36.5	14	31.5	15.5	865.2	862.2	28.51	3.96
24	29.89	21.9	6.5	4	60	37.3	26.9	5.3	870.8	868.6	24.64	4.37
26	22.45	30.66	3.5	6.5	57.5	11.5	32	11.4	869.6	866.3	30.64	3.56
28	15.33	23.49	3	3	56.5	23.5	31.8	11.9	868.4	865.1	28.41	4.66
31	24.85	25.45	6	6.5	75	30.3	27.2	13.7	869.5	866.2	16.72	6.42
	289.38	377.3										
Nov 02	14.23	21.35	12.5	5.9	68	26	26.9	12	873.4	867.6	25.54	5.61
4	11.5	2.53	5.9	6.4	63	35	29.7	14	868.3	865.9	25.87	4.54
7	30.66	36.13	5.9	6.4	63	35	29.7	14	868.3	865.9	25.87	4.54
9	14.01	31.71	8	8	50	33	34	18.1	868.3	866.5	27.97	3.76

11	14.78	23.56	8.25	7.5	73.5	30	31.1	15.7	868.4	866.6	20.7	7.05
14	20.04	27.19	3.3	4.3	73.7	50.7	29.1	15.7	870.2	867.6	16.23	7.07
16	18.07	5.47	5	6.4	78	35	23.9	13.6	869.6	865.9	18.08	7.45
18	15.88	15.33	5	6.4	86.5	35	27.8	11.8	870.7	865.9	13.91	8.49
21	35.58	37.88	6.3	6.4	61.7	35	31	14.6	867.7	865.9	23.21	5.76
23	27.92	32.61	7	7.75	52.5	22	33.5	14	865.6	859.9	22.95	8.88
25	19.16	26.58	6.3	4.5	57.5	27.5	30.6	14.4	864.4	866.2	20.35	9.69
28	37.77	39.39	5.7	6.7	50.7	21.7	31.7	13.3	866.8	864.3	27.08	4.25
30	16.42	24.69	7	7	54	65	25.3	11.9	869.6	870.1	20.74	6.19
M.Total	276.02	324.4										
Total	854.78	1079										
Dec 02	21.35	1.153	6	3.5	64	32.5	28.1	11.7	869.1	867.7	31.11	6.51
5	38.98	0.116	5.7	6.7	61.3	27	33.2	15.7	869.1	867.7	31.11	6.51
7	14.45	25.73	6.5	10	57	43	29.7	15.3	870.5	869.7	23.84	10.42
9	14.23	16.73	5.5	7.5	74.5	41.5	29.8	14.7	871.1	866.1	20.19	9.47
12	24.09	28.42	4	4	54.7	41	25.4	14.2	869.4	869	16.25	9.87
14	19.71	24.64	6	9	47.5	12	32.8	12.5	871.7	864.9	34.16	9.45
16	24.09	19.74	7.5	7	42.5	21	34.2	15	867.2	866.3	30.16	10.78
19	35.36	27.5	4.3	5	59.3	28	33.6	15.8	868.4	865.3	30.58	11.08
21	22.99	27.37	2.5	1.5	60	18	34.3	14	867.1	867.2	32.56	10.26
23	24.09	19.74	5	3.33	78	43	29.7	16.5	869.4	867	23.81	7.83
26	26.82	21.62	4.2	2.5	64	31	32.1	15	865.3	863.4	28.41	7.85
28	21.9	18.24	5	5.4	60	25	28.5	15.1	868.2	864.9	19.62	9.92
30	18.61	24.64	5	6.3	65.5	26.5	29.8	17	866.8	864.2	23.78	6.91
M.Total	306.67	255.6										
Jan 02	42.7	32.55	2.3	4.3	56	31	31.9	14.7	866.2	865	31.75	2.41
4	23.54	19.36	7.5	6	67.5	12.5	33.1	14.6	869.7	868.6	30.43	4.14
6	21.35	17.86	5	4.5	57	19	32.9	15	871	868.6	28.4	4.21
9	39.96	42.7	4	6	58.3	37.6	34.6	18.8	868	863.9	28.23	3.91
11	19.16	17.06	7	9.25	68	54.5	26	12.5	866.9	864.9	15.64	8.45
13	9.52	18.57	3	9.5	75.5	57	25.8	10.3	867.6	866.4	15.98	8.79
16	22.99	9.41	3.25	6.3	77	73	24.7	14.8	868.6	867.1	17.48	7.72
18	13.57	20.26	6	3	83	46.5	28.8	16.3	865.9	863.9	22.98	6.52
20	16.97	20.26	2.5	6	73	45.5	27.8	18.05	868.2	867.1	19.33	8.97
23	22.99	16.26	5	3.33	78	43	29.7	16.5	869.4	867	23.81	7.83
25	19.71	12.4	3.25	3.25	74.5	41.5	30.5	16.2	869.1	867.1	25.24	5.21
27	26.28	18.03	3	6	62.5	24	33.7	16.6	866.5	864.5	28.54	4.45
30	21.79	18	2	6	59	29.6	34.2	20	867.5	866.8	28.33	5.55
M.Total	300.53	262.7										

East slimes dam

Feb 01	16.97	26.1	6	5.5	76.5	45	29	15.6	867.1	865	22.57	6.91
3	12.59	15.15	0.75	5	74	45.5	30.8	16.4	868.4	866.9	21.08	5.43
6	31.86	21.9	5.5	4.7	80.3	40	31.2	17.7	871.3	868.7	28.07	4.37
8	12.59	7.93	2	4	80.5	40	31.3	19.3	868.9	866.7	25.99	6.46
10	17.52	10.95	1.75	5.5	78.5	37.5	30	15.8	869.5	867.8	18.98	8.12
13	33.94	27.37	5.5	5.7	60	24.7	32.4	16	869.6	867.3	28.7	3.49
15	21.9	16.42	4.5	6.75	52.5	17.5	33.2	12.6	870.8	867.9	30.12	2.01
17	24.09	18.61	5.5	3.5	56	25	33.1	15.3	868.1	866.1	28.07	3.45
20	13.79	19.11	5.5	6.3	74.7	52.6	27.5	16.8	869.7	867.9	16.31	5.81
22	16.42	10.4	0.75	2	83.5	40	29.7	15	867.2	865.6	17.48	8.85
24	16.42	10.4	3.5	4	75.5	41.5	30	15.3	870.5	868.8	25.11	5.79
27	18.06	18.42	1.3	6	81.7	41	31.2	17.3	868.4	866.2	24.57	4.83
M.Total	236.15	202.8										
Mar 01	13.69	8.96	1	2.5	85	37	30.4	14.9	868.1	866.1	19.73	6.21
3	11.5	-5.37	4	5	84	57	25.1	16.5	869.9	868.5	19.18	7.84
6	28.47	25.44	3.3	4.7	81.3	39.7	28.5	14.7	872.2	869.5	22.29	6.44
8	13.69	17.86	6.5	3.5	69	38.5	28.9	16.3	869.9	867.7	25.8	4.86
10	8.21	14.59	3.5	1.25	76	57	27.7	14.1	870.2	868.4	21.1	4.97
13	19.7	12.04	3.7	6.2	72	38	27.4	13.6	871.6	869.4	23.36	5.67
15	9.85	9.85	2	3	86	48	28.8	14.3	869.4	867.5	20.77	5.76
17	16.42	9.85	2	3.5	82	38.5	28.8	13.3	872.3	869.8	18.95	6.33
20	30.66	22.45	1.7	4	62	28.3	32.5	13.9	870	867.6	24.27	3.33
22	10.62	8.21	4	4	60	27.5	32	14.8	868.4	867	21.11	3.71
24	0.98	7.72	3.75	3	75	87	22.5	14.2	868.1	867.2	12.81	4.96
27	7.34	9.26	1.3	3	90	80	21.4	14.2	867.5	866.4	6.33	4.13
29	8.21	6.02	3.75	7	84.5	52	25.7	15.3	870	868.7	14.75	6.53
31	11.5	11.72	5.25	8	80.5	60.5	22.9	15.3	870.1	867.9	7.56	5.59
M.Total	190.84	158.6										
Total	1877.5	1601										
April 3	14.78	10.95	2.7	6	86.3	41.7	23.8	8.2	873.2	871.7	18.88	6.28
5	12.04	18.61	1.5	6.5	89	36.5	25.1	10.4	871.5	869.5	20.39	4.64
7	10.9	13.14	5.75	2.5	81	37	26.2	12.2	873.2	870.9	18.92	6.35
10	20.47	26.28	2.8	1	77.3	32.7	27.6	11.7	871.1	868.8	19.62	3.78
12	6.89	13.69	6.5	5.5	77	39.5	22.1	11	875.6	875.1	20.67	3.15
14	15.33	24.37	3	3.75	80.5	59	23.1	9.05	871.6	869.7	20.78	3.5
17	19.71	30.34	2.3	2.7	75.3	26.7	26.7	9.03	869.2	867.4	21.59	2.34
19	12.59	20.63	1.5	4.5	87	70	24.3	10.75	871.7	870.3	14.33	4.85
21	8.98	22.99	2	3.25	72.4	27	27.9	12.75	866.7	863.7	19.29	3.33
24	20.8	25.89	0	0	80.3	39	24.8	12.6	864.9	862.8	12.7	5.77
26	16.42	25.85	0	4.5	69	16.5	26.5	5.05	865.3	862.8	18.83	3.05

East slimes dam

28	7.88	14.21	1.25	2.5	72.5	17.5	26.4	1.5	868.3	867.4	19.65	1.8
M.Total	166.79	247										
May 01	12.37	20.33	3.7	4.3	89	76.7	19.3	9.17	869.7	869.3	4.79	3.17
3	7.12	13.17	3	5	92.5	66	23.3	10.7	870.2	869.3	5.17	8.13
5	6.57	12.42	4.5	7	91	48	22.6	8.15	871.8	869.4	16.07	4.41
8	12.04	19.88	3.3	2	90.3	49	22.8	10.8	866.1	863.5	16.38	3.69
10	6.57	12.42	2	4	96	47	19.2	3.9	872.7	871.9	18.06	2.33
12	10.4	17.65	0	0	96.5	45	21.5	4.8	874.9	872.5	15.28	4.59
15	12.59	27.37	2	0	75.7	39	19.1	5.75	875.9	874.3	17.32	2.43
18	9.3	13.14	2	6	83.5	34.3	22.7	4.3	870.1	874	16.98	1.89
24	18.61	33.94	0	6	92.5	32	15.5	1.6	871.3	871.5	9.19	2.76
26	4.93	8.76	5	5	84	47	20	4.3	876.7	874.3	13.47	4.13
29	10.95	13.69	2.3	2.7	89	35	19.6	4.1	877.1	875.4	14.39	3.18
31	6.57	6.02	5	12	89.5	45.5	17.9	3.4	876.5	874.2	15.31	2.99
M.Total	118.02	198.8										
Total	451.6	692.7										

MISPAH SLIMES DAM

Date	Potch evap	Virfs evap	wsam	wspm	hudam	hudpm	maxtemp	mintemp	apam	appm	radiation	diffuse
June 02	6.56	8.76	1.5	5	82	32	20.3	2.2	872.4	870.5	13.56	3.77
3	3.28	28.47	2.7	2	91	33	19.4	1.3	874.2	874.5	12.61	3.8
7	17.52	19.16	3	6.5	77	29	17.1	-0.7	872.5	870.7	14.75	3.31
9	7.12	7.84	4.5	15	75.5	35	17.1	-1.9	877.5	874.7	14.46	3.24
12	12.04	20.8	0	16	68.3	41	18.4	-0.8	873.5	872.1	15.84	1.7
14	10.4	9.3	12	8	70.5	40.5	20.8	0.5	874.8	870.9	15.35	2.17
16	9.31	---	10	9	60	19.5	19.9	5	867.8	864.9	15.09	2.14
19	8.76	21.9	10	12	80	46	15.9	-0.6	872.4	871.6	13.12	2.85
21	6.57	9.3	4	8	74	28	18.9	2.9	877.1	874.3	14.56	2.15
23	7.66	8.59	0	11	83	25	19	1.5	874.7	872.3	14.65	2.1
26	10.95	13.14	3.3	7	61.7	15.5	21.3	-1.2	873.7	871.6	15.04	1.99
28	7.66	8.59	2	0	48.5	21.5	21.9	-0.9	876.3	874.1	14.66	2.45
30	5.47	5.55	0	11	77.5	18	21.9	-1.5	871.1	868.1	15.31	2.22
M. Total	113.3	161.4										
July 03	11.5	13.92	3.5	5.5	74	38.5	20.6	3.5	873.8	871.3	14.48	2.67
5	12.04	14.67	0	5	92.5	25.5	20.6	3.6	873.2	871.2	13.4	3.28
7	9.85	11.63	2	4.5	65	15.5	19.5	2.15	873.2	871.4	15.54	2.12
10	16.42	20.75	3.3	2.7	79	18.3	21	1.7	873.4	870.8	15.57	2.14
12	10.4	12.4	1	4	63	14	22.3	-1.9	872.6	870.2	15.66	1.85
14	9.3	10.87	1.75	6.5	67.5	24.5	20.8	-2.15	873.3	871.5	13.41	3.83
18	21.9	22.99	0.8	4.2	57.4	16	20	-3.5	874.9	873.9	15.34	2:24
20	8.21	31.75	0	5.5	70.5	19	19.8	-0.8	875.1	872.8	15.86	2.08
22	8.76	8.76	2	4	64	21.5	19.4	-1.3	874.9	872.1	15.67	2.42
25	15.99	17.79	3.5	2.8	49	13.7	21.9	-0.6	869	866.3	15.69	2.11
27	2.74	24.09	3	9	91	57.5	10.5	-0.6	867.2	867.7	7.9	4.99
29	8.21	6.57	0	1	82.5	33.5	17.6	-4.3	878.5	877.2	16.56	2.08
M.Total	135.32	196.19										
Aug 1	9.85	14.78	0	3.3	82.6	28.7	17.5	-1.4	880.3	878.5	17.04	1.89
3	7.66	10.4	2	3.5	65.5	16.5	19	-2.9	875.9	874	17.12	1.89
5	8.76	13.14	3.5	5.5	54	20.5	20.1	0.5	875.9	874.2	16.31	3.28
8	14.78	18.07	0	4.5	72.6	24	19.6	2.8	873.5	871.1	14.92	4.3
10	9.31	9.31	0.8	3.3	55.5	17	19.5	0	870.8	869	17.66	2.49
12	14.78	18.48	2.5	7	45.5	12	21.9	-1.6	871.7	870.1	18.02	2.53
15	25.73	33.67	7.8	9.3	61.3	26.3	23.2	8.5	866.1	866.4	16.8	4.25
17	10.95	13.16	2.5	7.5	62	22	19.9	0.2	870	868.6	18.42	3.11
19	16.42	20.26	3.3	5.8	67	23	23.5	5.4	871.1	868.2	17.04	4.24

East slimes dam

22	19.71	21.35	5.5	8.7	59.6	30.3	19.7	5.1	870	868.6	18.49	3.29
24	9.85	14.23	2.5	0.8	73	28.5	17.7	1.8	878.4	875.7	20.17	1.88
26	10.4	13.14	0	1.5	56.5	22.5	22.4	2.5	877.4	875.3	19.16	3.14
29	20.26	23.54	0	1.5	44.6	10	25.8	3.5	877.6	874.2	19.66	3.33
31	12.59	12.59	1.5	0	63.6	100	22.4	7.2	875.9	871	19.84	3.43
M.Total	191.05	236.12										
Sep 2	19.16	22.99	2.3	0	54.5	100	22.4	6.8	873	869.9	20.35	3.07
5	24.64	30.66	4.5	0	49	100	27.5	7.8	871.6	868.8	21.32	2.57
7	20.26	18.61	5.3	6.3	40.5	12	27.4	6.4	874.5	872.6	21.57	2.79
9	14.23	22.45	2.5	5	35.5	19.5	26.9	7.3	873.4	872.4	20.5	3.47
12	19.16	26.82	5.3	6.7	63	21.3	22.7	5.5	879.5	876.6	20.66	3.54
14	20.8	22.45	4.5	3.7	41	11.5	27.4	5.2	869.5	865.8	21.8	3.49
16	18.07	17.52	2	0	73.5	13	24.5	3.5	872	868.7	18.32	4.26
19	20.8	40.51	2.5	2.3	43	9.3	27.9	8.5	870.2	866.7	22.81	3.77
21	17.52	20.26	5.5	7	47	13	28.9	6.3	872.3	869.7	23.95	2.93
23	18.61	19.16	5	3	55.5	18.5	31	10.9	872.5	869.2	21.91	4.31
26	21.35	40.51	1.7	7	50.3	19	32	11.1	870.1	967.4	22.05	4.51
28	21.35	27.59	8.5	6.5	48	19	32.1	15.4	870.4	866.3	21.63	3.72
30	18.07	25.18	5	6	40.5	22	24.7	7.5	865.4	861.7	20.03	4.88
M.Total	254.02	334.71										
Total	1387.38	1856.8										
Oct 03	33.39	29.56	3.7	3.7	52.3	15	25.6	5.9	868.5	865.1	22.75	3.81
5	9.64	25.73	5.5	7	40	30	24.3	11.1	870	867.9	14.31	5.15
7	16.42	20.26	0	8	65	34.5	20.8	7.2	876.9	873.8	19.11	5.93
10	30.66	35.04	6	4.7	50.3	24.3	24.9	8.2	870.1	867.6	23.86	4.15
12	22.45	22.99	8	9	55	19	29.8	10	866.6	865.6	24.94	4.44
14	12.04	25.18	7	5	63.5	14	27.1	7.3	870.2	867	24.05	4.62
17	26.28	26.82	6.3	6.7	69	52.7	20.8	7.2	875	873.6	25.37	4.38
19	20.8	29.05	3	0	51.5	15	30.1	9.9	870.1	866	30.38	2.68
21	25.18	38.32	6.8	6.3	36.5	14	31.5	15.5	865.2	862.2	28.51	3.96
24	29.89	25.9	6.5	4	60	37.3	26.9	5.3	870.8	868.6	24.64	4.37
26	22.45	26.28	3.5	6.5	57.5	11.5	32	11.4	869.6	866.3	30.64	3.56
28	15.33	23.3	3	3	56.5	23.5	31.8	11.9	868.4	865.1	28.41	4.66
31	24.85	14.23	6	6.5	75	30.3	27.2	13.7	869.5	866.2	16.72	6.42
M.Total	289.38	342.66										
Nov 02	14.23	21.35	12.5	5.9	68	26	26.9	12	873.4	867.6	25.54	5.61
4	11.5	5.03	5.9	6.4	63	35	29.7	14	868.3	865.9	25.87	4.54
7	30.66	32.85	5.9	6.4	63	35	29.7	14	868.3	865.9	25.87	4.54
9	14.01	28.69	8	8	50	33	34	18.1	868.3	866.5	27.97	3.76

11	14.78	22.22	8.25	7.5	73.5	30	31.1	15.7	868.4	866.6	20.7	7.05
14	20.04	24.84	3.3	4.3	73.7	50.7	29.1	15.7	870.2	867.6	16.23	7.07
16	10.4	7.66	5	6.4	78	35	23.9	13.6	869.6	865.9	18.08	7.45
18	15.88	18.97	5	6.4	86.5	35	27.8	11.8	870.7	865.9	13.91	8.49
21	35.58	32.59	6.3	6.4	61.7	35	31	14.6	867.7	865.9	23.21	5.76
23	27.92	28.78	7	7.75	52.5	22	33.5	14	865.6	859.9	22.95	8.88
25	19.16	24.41	6.3	4.5	57.5	27.5	30.6	14.4	864.4	866.2	20.35	9.69
28	37.77	33.69	5.7	6.7	50.7	21.7	31.7	13.3	866.8	864.3	27.08	4.25
30	16.42	21.9	7	7	54	65	25.3	11.9	869.6	870.1	20.74	6.19
M.Total	268.35	302.98										
Total	1115.46	1291.3										
Dec 02	21.35	21.35	6	3.5	64	32.5	28.1	11.7	869.1	867.7	31.11	6.51
5	38.98	42.7	5.7	6.7	61.3	27	33.2	15.7	869.1	867.7	31.11	6.51
7	14.45	18.61	6.5	10	57	43	29.7	15.3	870.5	869.7	23.84	10.42
9	14.23	14.23	5.5	7.5	74.5	41.5	29.8	14.7	871.1	866.1	20.19	9.47
12	24.09	25.18	4	4	54.7	41	25.4	14.2	869.4	869	16.25	9.87
14	19.71	22.99	6	9	47.5	12	32.8	12.5	871.7	864.9	34.16	9.45
16	24.09	27.77	7.5	7	42.5	21	34.2	15	867.2	866.3	30.16	10.78
19	35.36	39.85	4.3	5	59.3	28	33.6	15.8	868.4	865.3	30.58	11.08
21	22.99	27.92	2.5	1.5	60	18	34.3	14	867.1	867.2	32.56	10.26
23	24.09	27.77	5	3.33	78	43	29.7	16.5	869.4	867	23.81	7.83
26	26.82	30.7	4.2	2.5	64	31	32.1	15	865.3	863.4	28.41	7.85
28	21.9	25.43	5	5.4	60	25	28.5	15.1	868.2	864.9	19.62	9.92
30	18.61	23.54	5	6.3	65.5	26.5	29.8	17	866.8	864.2	23.78	6.91
M.Total	306.67	348.04										
Jan 02	42.7	47.72	2.3	4.3	56	31	31.9	14.7	866.2	865	31.75	2.41
4	23.54	27.18	7.5	6	67.5	12.5	33.1	14.6	869.7	868.6	30.43	4.14
6	21.35	16.42	5	4.5	57	19	32.9	15	871	868.6	28.4	4.21
9	39.96	45.7	4	6	58.3	37.6	34.6	18.8	868	863.9	28.23	3.91
11	19.16	16.42	7	9.25	68	54.5	26	12.5	866.9	864.9	15.64	8.45
13	9.52	-6.96	3	9.5	75.5	57	25.8	10.3	867.6	866.4	15.98	8.79
16	22.99	8.99	3.25	6.3	77	73	24.7	14.8	868.6	867.1	17.48	7.72
18	13.57	18.61	6	3	83	46.5	28.8	16.3	865.9	863.9	22.98	6.52
20	16.97	22.44	2.5	6	73	45.5	27.8	18.05	868.2	867.1	19.33	8.97
23	22.99	23.4	5	3.33	78	43	29.7	16.5	869.4	867	23.81	7.83
25	19.71	10.4	3.25	3.25	74.5	41.5	30.5	16.2	869.1	867.1	25.24	5.21
27	26.28	30.12	3	6	62.5	24	33.7	16.6	866.5	864.5	28.54	4.45
30	21.79	25.31	2	6	59	29.6	34.2	20	867.5	866.8	28.33	5.55
M.Total	300.53	285.75										

Mispah slimes dam

Feb 01	16.97	20.14	6	5.5	76.5	45	29	15.6	867.1	865	22.57	6.91
3	12.59	15.44	0.75	5	74	45.5	30.8	16.4	868.4	866.9	21.08	5.43
6	31.86	36.1	5.5	4.7	80.3	40	31.2	17.7	871.3	868.7	28.07	4.37
8	12.59	15.44	2	4	80.5	40	31.3	19.3	868.9	866.7	25.99	6.46
10	17.52	20.73	1.75	5.5	78.5	37.5	30	15.8	869.5	867.8	18.98	8.12
13	33.94	38.33	5.5	5.7	60	24.7	32.4	16	869.6	867.3	28.7	3.49
15	21.9	25.43	4.5	6.75	52.5	17.5	33.2	12.6	870.8	867.9	30.12	2.01
17	24.09	30.66	5.5	3.5	56	25	33.1	15.3	868.1	866.1	28.07	3.45
20	13.79	31.75	5.5	6.3	74.7	52.6	27.5	16.8	869.7	867.9	16.31	5.81
22	16.42	15.88	0.75	2	83.5	40	29.7	15	867.2	865.6	17.48	8.85
24	16.42	20.8	3.5	4	75.5	41.5	30	15.3	870.5	868.8	25.11	5.79
27	18.06	15.33	1.3	6	81.7	41	31.2	17.3	868.4	866.2	24.57	4.83
M.Total	236.15	286.03										
Mar 01	13.69	19.7	1	2.5	85	37	30.4	14.9	868.1	866.1	19.73	6.21
3	11.5	-3.28	4	5	84	57	25.1	16.5	869.9	868.5	19.18	7.84
6	28.47	33.39	3.3	4.7	81.3	39.7	28.5	14.7	872.2	869.5	22.29	6.44
8	13.69	14.34	6.5	3.5	69	38.5	28.9	16.3	869.9	867.7	25.8	4.86
10	8.21	16.34	3.5	1.25	76	57	27.7	14.1	870.2	868.4	21.1	4.97
13	19.7	24.09	3.7	6.2	72	38	27.4	13.6	871.6	869.4	23.36	5.67
15	9.85	16.42	2	3	86	48	28.8	14.3	869.4	867.5	20.77	5.76
17	16.42	15.33	2	3.5	82	38.5	28.8	13.3	872.3	869.8	18.95	6.33
20	30.66	34.82	1.7	4	62	28.3	32.5	13.9	870	867.6	24.27	3.33
22	10.62	13.33	4	4	60	27.5	32	14.8	868.4	867	21.11	3.71
24	0.98	7.43	3.75	3	75	87	22.5	14.2	868.1	867.2	12.81	4.96
27	7.34	6.05	1.3	3	90	80	21.4	14.2	867.5	866.4	6.33	4.13
29	8.21	11.41	3.75	7	84.5	52	25.7	15.3	870	868.7	14.75	6.53
31	11.5	13.34	5.25	8	80.5	60.5	22.9	15.3	870.1	867.9	7.56	5.59
M.Total	190.84	222.71										
Total	2068.38	2285.1										
April 3	14.78	24.09	2.7	6	86.3	41.7	23.8	8.2	873.2	871.7	18.88	6.28
5	12.04	12.59	1.5	6.5	89	36.5	25.1	10.4	871.5	869.5	20.39	4.64
7	10.9	12.04	5.75	2.5	81	37	26.2	12.2	873.2	870.9	18.92	6.35
10	20.47	21.89	2.8	1	77.3	32.7	27.6	11.7	871.1	868.8	19.62	3.78
12	6.89	14.23	6.5	5.5	77	39.5	22.1	11	875.6	875.1	20.67	3.15
14	15.33	18.04	3	3.75	80.5	59	23.1	9.05	871.6	869.7	20.78	3.5
17	19.71	21.88	2.3	2.7	75.3	26.7	26.7	9.03	869.2	867.4	21.59	2.34
19	12.59	15.63	1.5	4.5	87	70	24.3	10.75	871.7	870.3	14.33	4.85
21	8.98	18.06	2	3.25	72.4	27	27.9	12.75	866.7	863.7	19.29	3.33
24	20.8	22.8	0	0	80.3	39	24.8	12.6	864.9	862.8	12.7	5.77
26	16.42	18.99	0	4.5	69	16.5	26.5	5.05	865.3	862.8	18.83	3.05

Mispah slimes dam

28	7.88	11.51	1.25	2.5	72.5	17.5	26.4	1.5	868.3	867.4	19.65	1.8
M.Total	166.79	211.75										
May 01	12.37	15.44	3.7	4.3	89	76.7	19.3	9.17	869.7	869.3	4.79	3.17
3	7.12	10.84	3	5	92.5	66	23.3	10.7	870.2	869.3	5.17	8.13
5	6.57	10.36	4.5	7	91	48	22.6	8.15	871.8	869.4	16.07	4.41
8	12.04	15.16	3.3	2	90.3	49	22.8	10.8	866.1	863.5	16.38	3.69
10	6.57	10.36	2	4	96	47	19.2	3.9	872.7	871.9	18.06	2.33
12	10.4	13.72	0	0	96.5	45	21.5	4.8	874.9	872.5	15.28	4.59
15	12.59	15.64	2	0	75.7	39	19.1	5.75	875.9	874.3	17.32	2.43
18	9.3	14.23	2	6	83.5	34.3	22.7	4.3	870.1	874	16.98	1.89
24	18.61	29.56	0	6	92.5	32	15.5	1.6	871.3	871.5	9.19	2.76
26	4.93	5.47	5	5	84	47	20	4.3	876.7	874.3	13.47	4.13
29	10.95	14.78	2.3	2.7	89	35	19.6	4.1	877.1	875.4	14.39	3.18
31	6.57	5.47	5	12	89.5	45.5	17.9	3.4	876.5	874.2	15.31	2.99
M.Total	118.02	161.03										
	569.62	745.56										

WEST SLIMES DAM

Date	Potch evap	Vlrfs evap	wsam	wspm	hudam	hudpm	maxtemp	mintemp	apam	appm	radiation	diffuse radiation
June 02	6.56	7.66	1.5	5	82	32	20.3	2.2	872.4	870.5	13.56	3.77
3	3.28	13.68	2.7	2	91	33	19.4	1.3	874.2	874.5	12.61	3.8
7	17.52	14.23	3	6.5	77	29	17.1	-0.7	872.5	870.7	14.75	3.31
9	7.12	13.27	4.5	15	75.5	35	17.1	-1.9	877.5	874.7	14.46	3.24
12	12.04	15.33	0	16	68.3	41	18.4	-0.8	873.5	872.1	15.84	1.7
14	10.4	9.85	12	8	70.5	40.5	20.8	0.5	874.8	870.9	15.35	2.17
16	9.31	---	10	9	60	19.5	19.9	5	867.8	864.9	15.09	2.14
19	8.76	22.4	10	12	80	46	15.9	-0.6	872.4	871.6	13.12	2.85
21	6.57	11.31	4	8	74	28	18.9	2.9	877.1	874.3	14.56	2.15
23	7.66	12.27	0	11	83	25	19	1.5	874.7	872.3	14.65	2.1
26	10.95	15.18	3.3	7	61.7	15.5	21.3	-1.2	873.7	871.6	15.04	1.99
28	7.66	12.27	2	0	48.5	21.5	21.9	-0.9	876.3	874.1	14.66	2.45
30	5.47	10.33	0	11	77.5	18	21.9	-1.6	871.1	868.1	15.31	2.22
M.Total	113.3	157.78										
July 03	11.5	15.66	3.5	5.5	74	38.5	20.6	3.5	873.8	871.3	14.48	2.67
5	12.04	16.14	0	5	95.5	25.5	20.6	3.6	873.2	871.2	13.4	3.28
7	9.85	14.21	2	4.5	65	15.5	19.5	2.15	873.2	871.4	15.54	2.12
10	16.42	20.01	3.3	2.7	79	18.3	21	1.7	873.4	870.8	15.57	2.14
12	10.4	14.69	1	4	63	14	22.3	-1.9	872.6	870.2	15.66	1.85
14	9.3	13.72	1.75	6.5	67.5	24.5	20.8	-2.15	873.3	871.5	13.41	3.83
18	21.9	24.09	0.8	4.2	57.4	16	20	-3.5	874.9	873.9	15.34	2.24
20	8.21	9.85	0	5.5	70.5	19	19.8	-0.8	875.1	872.8	15.86	2.08
22	8.76	10.4	2	4	64	21.5	19.4	-1.3	874.9	872.1	15.67	2.42
25	15.99	19.63	3.5	2.8	49	13.7	21.9	-0.6	869	866.3	15.69	2.11
27	2.74	27.92	3	9	91	57.5	10.5	-0.6	867.2	867.7	7.9	4.99
29	8.21	8.76	0	1	82.5	33.5	17.6	-4.3	878.5	877.2	16.56	2.08
M.Total	135.32	195.08										
Aug 1	9.85	13.69	0	3.3	82.6	28.7	17.5	-1.4	880.3	878.5	17.04	1.89
3	7.66	8.76	2	3.5	65.5	16.5	19	-2.9	875.9	874	17.12	1.89
5	8.76	12.04	3.5	5.5	54	20.5	20.1	0.5	875.9	874.2	16.31	3.28
8	14.78	9.31	0	4.5	72.6	24	19.6	2.8	873.5	871.1	14.92	4.3
10	9.31	8.21	0.8	3.3	55.5	17	19.5	0	870.8	869	17.66	2.49
12	14.78	17.52	2.5	7	45.5	12	21.9	-1.6	871.7	870.1	18.02	2.53
15	25.73	38.32	7.8	9.3	61.3	26.3	23.2	8.5	866.1	866.4	16.8	4.25
17	10.95	15.33	2.5	7.5	62	22	19.9	0.2	870	868.6	18.42	3.11

West slimes dam

19	16.42	14.78	3.3	5.8	67	23	23.5	5.4	871.1	868.2	17.04	4.24
22	19.71	25.73	5.5	8.7	59.6	30.3	19.7	5.1	870	868.6	18.49	3.29
24	9.85	13.14	2.5	0.8	73	28.5	17.7	1.8	878.4	875.7	20.17	1.88
26	10.4	11.5	0	1.5	56.5	22.5	22.4	2.5	877.4	875.3	19.16	3.14
29	20.28	23.5	0	1.5	44.6	10	25.8	3.5	877.6	874.2	19.66	3.33
31	12.59	15.33	1.5	0	63.6	100	22.4	7.2	875.9	871	19.84	3.43
M.Total	191.05	227.16										
Sep 2	19.16	25.18	2.3	0	54.5	100	22.4	6.8	873	869.9	20.35	3.07
5	24.64	27.28	4.5	0	49	100	27.5	7.8	871.6	868.8	21.32	2.57
7	20.26	23.41	5.3	6.3	40.5	12	27.4	6.4	874.5	872.6	21.57	2.79
9	14.23	18.08	2.5	5	35.5	19.5	26.9	7.3	873.4	872.4	20.5	3.47
12	19.16	21.35	5.3	6.7	63	21.3	22.7	5.5	879.5	876.6	20.66	3.54
14	20.8	9.31	4.5	3.7	41	11.5	27.4	5.2	869.5	865.8	21.8	3.49
16	18.07	12.57	2	0	73.5	13	24.5	3.5	872	868.7	18.32	4.26
19	20.8	15.88	2.5	2.3	43	9.3	27.9	8.5	870.2	866.7	22.81	3.77
21	17.52	9.31	5.5	7	47	13	28.9	6.3	872.3	869.7	23.95	2.93
23	18.61	15.33	5	3	55.5	18.5	31	10.9	872.5	869.2	21.91	4.31
26	21.35	14.78	1.7	7	50.3	19	32	11.1	870.1	967.4	22.05	4.51
28	21.35	13.14	8.5	6.5	48	19	32.1	15.4	870.4	866.3	21.63	3.72
30	18.07	10.95	5	6	40.5	22	24.7	7.5	865.4	861.7	20.03	4.88
M.Total	254.02	216.57										
Total	1387.4	1593.2										
Oct 03	33.39	19.16	3.7	3.7	52.3	15	25.6	5.9	868.5	865.1	22.75	3.81
5	9.64	8.76	5.5	7	40	30	24.3	11.1	870	867.9	14.31	5.15
7	16.42	11.5	0	8	65	34.5	20.8	7.2	876.9	873.8	19.11	5.93
10	30.66	18.31	6	4.7	50.3	24.3	24.9	8.2	870.1	867.6	23.86	4.15
12	22.45	13.12	8	9	55	19	29.8	10	866.6	865.6	24.94	4.44
14	12.04	15.33	7	5	63.5	14	27.1	7.3	870.2	867	24.05	4.62
17	26.28	7.66	6.3	6.7	69	52.7	20.8	7.2	875	873.6	25.37	4.38
19	20.8	12.59	3	0	51.5	15	30.1	9.9	870.1	866	30.38	2.68
21	25.18	20.8	6.8	6.3	36.5	14	31.5	15.5	865.2	862.2	28.51	3.96
24	29.89	31.75	6.5	4	60	37.3	26.9	5.3	870.8	868.6	24.64	4.37
26	22.45	15.88	3.5	6.5	57.5	11.5	32	11.4	869.6	866.3	30.64	3.56
28	15.33	8.62	3	3	56.5	23.5	31.8	11.9	868.4	865.1	28.41	4.66
31	24.85	14.64	6	6.5	75	30.3	27.2	13.7	869.5	866.2	16.72	6.42
M.Total	289.38	198.12										
Nov 02	14.23	14.23	12.5	5.9	68	26	26.9	12	873.4	867.6	25.54	5.61
4	11.5	3.38	5.9	6.4	63	35	29.7	14	868.3	865.9	25.87	4.54
7	30.66	15.49	5.9	6.4	63	35	29.7	14	868.3	865.9	25.87	4.54

West slimes dam

9	14.01	16.04	8	8	50	33	34	18.1	868.3	866.5	27.97	3.76
11	14.78	8.27	8.25	7.5	73.5	30	31.1	15.7	868.4	866.6	20.7	7.05
14	20.04	11.59	3.3	4.3	73.7	50.7	29.1	15.7	870.2	867.6	16.23	7.07
16	10.4	3.28	5	6.4	78	35	23.9	13.6	869.6	865.9	18.08	7.45
18	15.88	9.81	5	6.4	86.5	35	27.8	11.8	870.7	865.9	13.91	8.49
21	35.58	20.06	6.3	6.4	61.7	35	31	14.6	867.7	865.9	23.21	5.76
23	27.92	16.37	7	7.75	52.5	22	33.5	14	865.6	859.9	22.95	8.88
25	19.16	26.28	6.3	4.5	57.5	27.5	30.6	14.4	864.4	866.2	20.35	9.69
28	37.77	22.44	5.7	6.7	50.7	21.7	31.7	13.3	866.8	864.3	27.08	4.25
30	16.42	1.09	7	7	54	65	25.3	11.9	869.6	870.1	20.74	6.19
M.Total	268.35	168.33										
Total	1115.5	732.9										
Dec 02	21.35	8.76	6	3.5	64	32.5	28.1	11.7	869.1	867.7	31.11	6.51
5	38.98	27.66	5.7	6.7	61.3	27	33.2	15.7	869.1	867.7	31.11	6.51
7	14.45	15.54	6.5	10	57	43	29.7	15.3	870.5	869.7	23.84	10.42
9	14.23	10.4	5.5	7.5	74.5	41.5	29.8	14.7	871.1	866.1	20.19	9.47
12	24.09	15.88	4	4	54.7	41	25.4	14.2	869.4	869	16.25	9.87
14	19.71	14.23	6	9	47.5	12	32.8	12.5	871.7	864.9	34.16	9.45
16	24.09	20.3	7.5	7	42.5	21	34.2	15	867.2	866.3	30.16	10.78
19	35.36	32.85	4.3	5	59.3	28	33.6	15.8	868.4	865.3	30.58	11.08
21	22.99	14.23	2.5	1.5	60	18	34.3	14	867.1	867.2	32.56	10.26
23	24.09	20.3	5	3.33	78	43	29.7	16.5	869.4	867	23.81	7.83
26	26.82	21.65	4.2	2.5	64	31	32.1	15	865.3	863.4	28.41	7.85
28	21.9	19.22	5	5.4	60	25	28.5	15.1	868.2	864.9	19.62	9.92
30	18.61	14.78	5	6.3	65.5	26.5	29.8	17	866.8	864.2	23.78	6.91
M.Total	306.67	235.8										
Jan 02	42.7	29.5	2.3	4.3	56	31	31.9	14.7	866.2	865	31.75	2.41
4	23.54	20.03	7.5	6	67.5	12.5	33.1	14.6	869.7	868.6	30.43	4.14
6	21.35	18.1	5	4.5	57	19	32.9	15	871	868.6	28.4	4.21
9	39.96	37.2	4	6	58.3	37.6	34.6	18.8	868	863.9	28.23	3.91
11	19.16	14.31	7	9.25	68	54.5	26	12.5	866.9	864.9	15.64	8.45
13	9.52	16.33	3	9.5	75.5	57	25.8	10.3	867.6	866.4	15.98	8.79
16	22.99	8.14	3.25	6.3	77	73	24.7	14.8	868.6	867.1	17.48	7.72
18	13.57	9.85	6	3	83	46.5	28.8	16.3	865.9	863.9	22.98	6.52
20	16.97	12.04	2.5	6	73	45.5	27.8	18 05	868.2	867.1	19.33	8.97
23	22.99	19.86	5	3.33	78	43	29.7	16.5	869.4	867	23.81	7.83
25	19.71	15.18	3.25	3.25	74.5	41.5	30.5	16.2	869.1	867.1	25.24	5.21
27	26.28	19.05	3	6	62.5	24	33.7	16.6	866.5	864.5	28.54	4.45
30	21.79	19.05	2	6	59	29.6	34.2	20	867.5	866.8	28.33	5.55
M.Total	300.53	238.64										

West slimes dam

Feb 01	16.97	26.14	6	5.5	76.5	45	29	15.6	867.1	865	22.57	6.91
3	12.59	15.03	0.75	5	74	45.5	30.8	16.4	868.4	866.9	21.08	5.43
6	31.86	16.97	5.5	4.7	80.3	40	31.2	17.7	871.3	868.7	28.07	4.37
8	12.59	7.84	2	4	80.5	40	31.3	19.3	868.9	866.7	25.99	6.46
10	17.52	7.37	1.75	5.5	78.5	37.5	30	15.8	869.5	867.8	18.98	8.12
13	33.94	22.45	5.5	5.7	60	24.7	32.4	16	869.6	867.3	28.7	3.49
15	21.9	39.8	4.5	6.75	52.5	17.5	33.2	12.6	870.8	867.9	30.12	2.01
17	24.09	15.33	5.5	3.5	56	25	33.1	15.3	868.1	866.1	28.07	3.45
20	13.79	20.33	5.5	6.3	74.7	52.6	27.5	16.8	869.7	867.9	16.31	5.81
22	16.42	31.75	0.75	2	83.5	40	29.7	15	867.2	865.6	17.48	8.85
24	16.42	16.51	3.5	4	75.5	41.5	30	15.3	870.5	868.8	25.11	5.79
27	18.06	17.32	1.3	6	81.7	41	31.2	17.3	868.4	866.2	24.57	4.83
M.Total	236.15	236.84										
Mar 01	13.69	15.16	1	2.5	85	37	30.4	14.9	868.1	866.1	19.73	6.21
3	11.5	14.08	4	5	84	57	25.1	16.5	869.9	868.5	19.18	7.84
6	28.47	24.09	3.3	4.7	81.3	39.7	28.5	14.7	872.2	869.5	22.29	6.44
8	13.69	2.15	6.5	3.5	69	38.5	28.9	16.3	869.9	867.7	25.8	4.86
10	8.21	12.15	3.5	1.25	76	57	27.7	14.1	870.2	868.4	21.1	4.97
13	19.7	18.13	3.7	6.2	72	38	27.4	13.6	871.6	869.4	23.36	5.67
15	9.85	13.27	2	3	86	48	28.8	14.3	869.4	867.5	20.77	5.76
17	16.42	16.51	2	3.5	82	38.5	28.8	13.3	872.3	869.8	18.95	6.33
20	30.66	17.52	1.7	4	62	28.3	32.5	13.9	870	867.6	24.27	3.33
22	10.62	7.66	4	4	60	27.5	32	14.8	868.4	867	21.11	3.71
24	0.98	6.6	3.75	3	75	87	22.5	14.2	868.1	867.2	12.81	4.96
27	7.34	4.12	1.3	3	90	80	21.4	14.2	867.5	866.4	6.33	4.13
29	8.21	5.93	3.75	7	84.5	52	25.7	15.3	870	868.7	14.75	6.53
31	11.5	9.03	5.25	8	80.5	60.5	22.9	15.3	870.1	867.9	7.56	5.59
M.Total	190.84	166.4										
Total	2068.4	1755.4										
April 3	14.78	14.19	2.7	6	86.3	41.7	23.8	8.2	873.2	871.7	18.88	6.28
5	12.04	8.21	1.5	6.5	89	36.5	25.1	10.4	871.5	869.5	20.39	4.64
7	10.9	7.96	5.75	2.5	81	37	26.2	12.2	873.2	870.9	18.92	6.35
10	20.47	17.65	2.8	1	77.3	32.7	27.6	11.7	871.1	868.8	19.62	3.78
12	6.89	9.44	6.5	5.5	77	39.5	22.1	11	875.6	875.1	20.67	3.15
14	15.33	14.54	3	3.75	80.5	59	23.1	9.05	871.6	869.7	20.78	3.5
17	19.71	17.19	2.3	2.7	75.3	26.7	26.7	9.03	869.2	867.4	21.59	2.34
19	12.59	12.89	1.5	4.5	87	70	24.3	10.75	871.7	870.3	14.33	4.85
21	8.98	10.71	2	3.25	72.4	27	27.9	12.75	866.7	863.7	19.29	3.33
24	20.8	14.24	0	0	80.3	39	24.8	12.6	864.9	862.8	12.7	5.77

West slimes dam

26	16.42	15.2	0	4.5	69	16.5	26.5	5.05	865.3	862.8	18.83	3.05
28	7.88	10.04	1.25	2.5	72.5	17.5	26.4	1.5	868.3	867.4	19.65	1.8
M.Total	166.79	152.26										
May 01	12.37	12.76	3.7	4.3	89	76.7	19.3	9.17	869.7	869.3	4.79	3.17
3	7.12	9.58	3	5	92.5	66	23.3	10.7	870.2	869.3	5.17	8.13
5	6.57	9.25	4.5	7	91	48	22.6	8.15	871.8	869.4	16.07	4.41
8	12.04	12.56	3.3	2	90.3	49	22.8	10.8	866.1	863.5	16.38	3.69
10	6.57	9.25	2	4	96	47	19.2	3.9	872.7	871.9	18.06	2.33
12	10.4	8.86	0	0	96.5	45	21.5	4.8	874.9	872.5	15.28	4.59
15	12.59	16.42	2	0	75.7	39	19.1	5.75	875.9	874.3	17.32	2.43
18	9.3	7.66	2	6	83.5	34.3	22.7	4.3	870.1	874	16.98	1.89
23	18.61	16.42	0	6	92.5	32	15.5	1.6	871.3	871.5	9.19	2.76
26	4.93	3.83	5	5	84	47	20	4.3	876.7	874.3	13.47	4.13
29	10.95	14.23	2.3	2.7	89	35	19.6	4.1	877.1	875.4	14.39	3.18
31	6.57	3.28	5	12	89.5	45.5	17.9	3.4	876.5	874.2	15.31	2.99
M.Total	118.02	124.1										
Total	569.62	552.72										

APPENDIX 3

WEST - Summer

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapaaa   Independent variable: wspmaaa

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	15.1439	3.00297	5.04298	.00001
Slope	0.34327	0.552324	0.621501	.53709

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	24.674696	1	24.674696	.38626	.53709
Error	3194.0210	50	63.8804		
Total (Corr.)	3218.6957	51			

Correlation Coefficient = 0.087556   R-squared = .77 percent
Stnd. Error of Est. = 7.99252

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapaaa   Independent variable: wsamaaa

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	16.1651	2.74132	5.89682	.00000
Slope	0.177241	0.622551	0.284702	.77705

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	5.2093909	1	5.2093909	.081055	.77705
Error	3213.4863	50	64.2697		
Total (Corr.)	3218.6957	51			

Correlation Coefficient = 0.0402303   R-squared = .16 percent
Stnd. Error of Est. = 8.01684

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapaaa   Independent variable: hudamaaa

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	35.4139	6.54297	5.4125	.00000
Slope	-0.264893	0.0923388	-2.86871	.00602

West - Summer

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	454.89444	1	454.89444	8.2295	.00602
Error	2763.8012	50	55.2760		
Total (Corr.)	3218.6957	51			

Correlation Coefficient = -0.375937 R-squared = 14.13 percent
Stnd. Error of Est. = 7.43478

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapaaa Independent variable: hudpmaaa

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	25.7376	2.7384	9.39878	.00000
Slope	-0.225434	0.0648842	-3.4744	.00107

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	625.96224	1	625.96224	12.0715	.00107
Error	2592.7334	50	51.8547		
Total (Corr.)	3218.6957	51			

Correlation Coefficient = -0.440995 R-squared = 19.45 percent
Stnd. Error of Est. = 7.20102

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapaaa Independent variable: maxtempaaa

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	24.2023	3.19791	7.56817	.00000
Slope	-0.211156	0.0870635	-2.42531	.01895

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	338.79825	1	338.79825	5.8821	.01895
Error	2879.8974	50	57.5979		
Total (Corr.)	3218.6957	51			

Correlation Coefficient = -0.324437 R-squared = 10.53 percent
Stnd. Error of Est. = 7.58933

WEST · summer

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapaaa — Independent variable: mintempaa?

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	12.7908	9.6225	1.32926	.18980
Slope	0.267251	0.624915	0.427659	.67074

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	11.730603	1	11.730603	.18289	.67074
Error	3206.9651	50	64.1393		
Total (Corr.)	3218.6957	51			

Correlation Coefficient = 0.0603699 — R-squared = .36 percent
Stnd. Error of Est. = 8.0087

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapaaa — Independent variable: apamaaa

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	338.151	591.508	0.571677	.57010
Slope	-36.9728	68.0719	-0.543143	.58944

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	18.879210	1	18.879210	.29500	.58944
Error	3199.8165	50	63.9963		
Total (Corr.)	3218.6957	51			

Correlation Coefficient = -0.0765865 — R-squared = .59 percent
Stnd. Error of Est. = 7.99977

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapaaa — Independent variable: appmaaa

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	933.534	592.734	1.57496	.12157
Slope	-105.734	68.3706	-1.54649	.12829

WEST - Summer

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	146.93053	1	146.93053	2.3916	.12829
Error	3071.7651	50	61.4353		
Total (Corr.)	3218.6957	51			

Correlation Coefficient = -0.213656 R-squared = 4.56 percent
Stnd. Error of Est. = 7.83807

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapaaa Independent variable: raqnaaa

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	3.27426	3.88248	0.843341	.40305
Slope	0.586203	0.161764	3.62383	.00068

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	669.52216	1	669.52216	13.1321	.00068
Error	2549.1735	50	50.9835		
Total (Corr.)	3218.6957	51			

Correlation Coefficient = 0.456082 R-squared = 20.80 percent
Stnd. Error of Est. = 7.14027

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapaaa Independent variable: dradnaaa

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	18.596	3.37916	5.50313	.00000
Slope	-0.265119	0.492701	-0.538094	.59290

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	18.531817	1	18.531817	.28954	.59290
Error	3200.1639	50	64.0033		
Total (Corr.)	3218.6957	51			

Correlation Coefficient = -0.0758786 R-squared = .58 percent
Stnd. Error of Est. = 8.0002

MISP - Summer

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapbbb — Independent variable: wsambbb

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	5.03694	1.89093	2.66374	.01534
Slope	0.644819	0.395364	1.63095	.11937

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	23.851688	1	23.851688	2.66000	.11937
Error	170.36949	19	8.96682		
Total (Corr.)	194.22118	20			

Correlation Coefficient = 0.350438 — R-squared = 12.28 percent
Stnd. Error of Est. = 2.99446

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapbbb — Independent variable: wspmbbb

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	9.82613	1.63363	6.0149	.00001
Slope	-0.344787	0.271078	-1.27191	.21875

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	15.239433	1	15.239433	1.61776	.21875
Error	178.98175	19	9.42009		
Total (Corr.)	194.22118	20			

Correlation Coefficient = -0.280115 — R-squared = 7.85 percent
Stnd. Error of Est. = 3.06922

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapbbb — Independent variable: hudambbb

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	18.3549	3.91196	4.692	.00016
Slope	-0.15338	0.0568951	-2.69584	.01432

MISI - Summer

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	53.735848	1	53.735848	7.26753	.01432
Error	140.48533	19	7.39396		
Total (Corr.)	194.22118	20			

Correlation Coefficient = -0.525998 R-squared = 27.67 percent
Stnd. Error of Est. = 2.71918

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapbbb Independent variable: hudrmbbb

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	12.8959	1.65383	7.79763	.00000
Slope	-0.128136	0.0401341	-3.19271	.00479

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	67.815675	1	67.815675	10.19337	.00479
Error	126.40551	19	6.65292		
Total (Corr.)	194.22118	20			

Correlation Coefficient = -0.590904 R-squared = 34.92 percent
Stnd. Error of Est. = 2.57933

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapbbb Independent variable: maxtempbbb

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	-12.3554	5.63924	-2.19096	.04112
Slope	0.678797	0.187836	3.61378	.00185

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	79.115995	1	79.115995	13.05939	.00185
Error	115.10519	19	6.05817		
Total (Corr.)	194.22118	20			

Correlation Coefficient = 0.63824 R-squared = 40.73 percent
Stnd. Error of Est. = 2.46133

MIS? · Summer

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapbbb   Independent variable: mintempbbb

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	-0.973143	4.99011	-0.195014	.84745
Slope	0.59323	0.329675	1.79944	.08785

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	28.279741	1	28.279741	3.23798	.08785
Error	165.94144	19	8.73376		
Total (Corr.)	194.22118	20			

Correlation Coefficient = 0.381583   R-squared = 14.56 percent
Stnd. Error of Est. = 2.95529

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapbbb   Independent variable: apambbb

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	26.0723	391.442	0.0666058	.94759
Slope	-2.08805	45.0544	-0.046345	.96352

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	.0219533	1	.0219533	.002148	.96352
Error	194.19923	19	10.22101		
Total (Corr.)	194.22118	20			

Correlation Coefficient = -0.0106317   R-squared = .01 percent
Stnd. Error of Est. = 3.19703

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapbbb   Independent variable: appmbbb

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	203.179	364.058	0.558095	.58330
Slope	-22.5286	42.0066	-0.536311	.59797

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	2.8963547	1	2.8963547	.287630	.59797
Error	191.32483	19	10.06973		
Total (Corr.)	194.22118	20			

Correlation Coefficient = -0.122117 R-squared = 1.49 percent
Stnd. Error of Est. = 3.17328

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapbbb Independent variable: radnbbb

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	0.198653	2.37788	0.0835423	.93429
Slope	0.32327	0.096682	3.34364	.00341

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	71.947744	1	71.947744	11.17992	.00341
Error	122.27344	19	6.43544		
Total (Corr.)	194.22118	20			

Correlation Coefficient = 0.60864 R-squared = 37.04 percent
Stnd. Error of Est. = 2.53682

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapbbb Independent variable: dradnbbb

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	10.2842	2.41109	4.26538	.00042
Slope	-0.327773	0.322219	-1.01724	.32182

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	10.031248	1	10.031248	1.03477	.32182
Error	184.18993	19	9.69421		
Total (Corr.)	194.22118	20			

Correlation Coefficient = -0.227263 R-squared = 5.16 percent
Stnd. Error of Est. = 3.11355

EAST - Summer

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapiii   Independent variable: wsamiii

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	11.8153	2.63539	4.48333	.00004
Slope	1.55487	0.598494	2.59796	.01229

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	400.90658	1	400.90658	6.7494	.01229
Error	2969.9334	50	59.3987		
Total (Corr.)	3370.8400	51			

Correlation Coefficient = 0.344868   R-squared = 11.89 percent
Stnd. Error of Est. = 7.70705

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapiii   Independent variable: wspmiii

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	13.5927	3.00867	4.51783	.00004
Slope	0.886782	0.553374	1.6025	.11534

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	164.66932	1	164.66932	2.5680	.11534
Error	3206.1707	50	64.1234		
Total (Corr.)	3370.8400	51			

Correlation Coefficient = 0.221023   R-squared = 4.89 percent
Stnd. Error of Est. = 8.00771

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapiii   Independent variable: hudamiii

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	46.1471	6.00413	7.6859	.00000
Slope	-0.401204	0.0847343	-4.73485	.00002

EAST - summer

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	1043.5161	1	1043.5161	22.419	.00002
Error	2327.3239	50	46.5465		
Total (Corr.)	3370.8400	51			

Correlation Coefficient = -0.556392 R-squared = 30.96 percent
Stnd. Error of Est. = 6.8225

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapiii Independent variable: hudpmiii

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	26.6696	2.83634	9.40283	.00000
Slope	-0.218737	0.0672049	-3.25478	.00204

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	589.32456	1	589.32456	10.5936	.00204
Error	2781.5154	50	55.6303		
Total (Corr.)	3370.8400	51			

Correlation Coefficient = -0.418127 R-squared = 17.48 percent
Stnd. Error of Est. = 7.45857

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapiii Independent variable: maxtempiii

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	-12.0308	9.34205	-1.28781	.20374
Slope	1.0179	0.313932	3.24243	.00211

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	585.63513	1	585.63513	10.5133	.00211
Error	2785.2049	50	55.7041		
Total (Corr.)	3370.8400	51			

Correlation Coefficient = 0.416816 R-squared = 17.37 percent
Stnd. Error of Est. = 7.46352

EAST - summer

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapiii — Independent variable: mintempiii

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	9.92804	9.79689	1.01339	.31575
Slope	0.53256	0.63624	0.837043	.40655

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	46.582214	1	46.582214	.70064	.40655
Error	3324.2578	50	66.4852		
Total (Corr.)	3370.8400	51			

Correlation Coefficient = 0.117555 R-squared = 1.38 percent
Stnd. Error of Est. = 8.15384

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapiii — Independent variable: apamiii

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	664.209	600.193	1.10666	.27374
Slope	-74.3586	69.0714	-1.07655	.28685

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	76.362886	1	76.362886	1.15895	.28685
Error	3294.4771	50	65.8895		
Total (Corr.)	3370.8400	51			

Correlation Coefficient = -0.150512 R-squared = 2.27 percent
Stnd. Error of Est. = 8.11724

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapiii — Independent variable: appmiii

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	1199.35	598.023	2.00553	.05033
Slope	-136.258	68.9808	-1.97531	.05377

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	244.00811	1	244.00811	3.9018	.05377
Error	3126.8319	50	62.5366		
Total (Corr.)	3370.8400	51			

Correlation Coefficient = -0.26905 R-squared = 7.24 percent
Stnd. Error of Est. = 7.90801

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapiii Independent variable: radniii

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	2.05857	4.23042	0.486611	.62906
Slope	0.683844	0.182625	3.74452	.00054

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	758.18409	1	758.18409	14.0214	.00054
Error	2271.0744	42	54.0732		
Total (Corr.)	3029.2585	43			

Correlation Coefficient = 0.500287 R-squared = 25.03 percent
Stnd. Error of Est. = 7.35345

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapiii Independent variable: dracniii

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	17.1195	4.20466	4.07157	.00020
Slope	0.0357436	0.632407	0.0565199	.95520

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	.2303862	1	.2303862	.003194	.95520
Error	3029.0281	42	72.1197		
Total (Corr.)	3029.2585	43			

Correlation Coefficient = 8.72088E-3 R-squared = .01 percent
Stnd. Error of Est. = 8.49233

WEST - spring.

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapaa — Independent variable: wsamaa

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	12.2982	3.86208	3.18434	.00399
Slope	0.308339	0.617799	0.499093	.62226

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	12.727097	1	12.727097	.24909	.62226
Error	1226.2443	24	51.0935		
Total (Corr.)	1238.9714	25			

Correlation Coefficient = 0.101352 R-squared = 1.03 percent
Stnd. Error of Est. = 7.14797

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapaa — Independent variable: wspmaa

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	18.9351	4.621	4.09762	.00041
Slope	-0.817027	0.744589	-1.09729	.28340

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	59.187707	1	59.187707	1.20404	.28340
Error	1179.7837	24	49.1577		
Total (Corr.)	1238.9714	25			

Correlation Coefficient = -0.218567 R-squared = 4.78 percent
Stnd. Error of Est. = 7.01125

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapaa — Independent variable: hudamaa

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	26.0406	7.20685	3.61331	.00139
Slope	-0.198571	0.117727	-1.68671	.10462

West - Spring.

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	131.30464	1	131.30464	2.8450	.10462
Error	1107.6668	24	46.1528		
Total (Corr.)	1238.9714	25			

Correlation Coefficient = -0.325544 R-squared = 10.60 percent
Stnd. Error of Est. = 6.79358

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapaa Independent variable: hudpmaa

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	20.9613	3.31233	6.32827	.00000
Slope	-0.231275	0.102879	-2.24802	.03403

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	215.50694	1	215.50694	5.0536	.03403
Error	1023.4645	24	42.6444		
Total (Corr.)	1238.9714	25			

Correlation Coefficient = -0.417061 R-squared = 17.39 percent
Stnd. Error of Est. = 6.53026

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapaa Independent variable: maxtempaa

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	-2.86951	10.9265	-0.262619	.79509
Slope	0.598368	0.382495	1.56438	.13082

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	114.64765	1	114.64765	2.4473	.13082
Error	1124.3238	24	46.8468		
Total (Corr.)	1238.9714	25			

Correlation Coefficient = 0.304195 R-squared = 9.25 percent
Stnd. Error of Est. = 6.84447

West - spring.

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapaa — Independent variable: mintempaa

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	17.7215	5.19824	3.40914	.00231
Slope	-0.306497	0.423153	-0.724317	.47587

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	26.504299	1	26.504299	.52464	.47587
Error	1212.4671	24	50.5195		
Total (Corr.)	1238.9714	25			

Correlation Coefficient = -0.146261 R-squared = 2.14 percent
Stnd. Error of Est. = 7.1077

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapaa — Independent variable: apamaa

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	-6.2614	31.1187	-0.20121	.84223
Slope	2.36263	3.60824	0.654788	.51883

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	21.745124	1	21.745124	.42875	.51883
Error	1217.2263	24	50.7178		
Total (Corr.)	1238.9714	25			

Correlation Coefficient = 0.13248 R-squared = 1.76 percent
Stnd. Error of Est. = 7.12164

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapaa — Independent variable: appmaa

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	506.748	419.073	1.20921	.23836
Slope	-56.8286	48.3406	-1.17559	.25129

West - Spring.

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	67.459664	1	67.459664	1.38200	.25129
Error	1171.5118	24	48.8130		
Total (Corr.)	1238.9714	25			

Correlation Coefficient = -0.233341 R-squared = 5.44 percent
Stnd. Error of Est. = 6.98663

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapaa Independent variable: radnaa

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	1.53921	6.15273	0.250168	.80459
Slope	0.553028	0.264934	2.08742	.04764

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	190.37722	1	190.37722	4.3573	.04764
Error	1048.5942	24	43.6914		
Total (Corr.)	1238.9714	25			

Correlation Coefficient = 0.391992 R-squared = 15.37 percent
Stnd. Error of Est. = 6.60995

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapaa Independent variable: dradnaa

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	18.8852	4.41513	4.27739	.00026
Slope	-0.856358	0.750086	-1.14168	.26485

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	63.822033	1	63.822033	1.30343	.26485
Error	1175.1494	24	48.9646		
Total (Corr.)	1238.9714	25			

Correlation Coefficient = -0.226963 R-squared = 5.15 percent
Stnd. Error of Est. = 6.99747

M'SP - spring.

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapbb | Independent variable: wsambb

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	24.1323	3.9481	6.11238	.00000
Slope	0.0547468	0.631559	0.0866851	.93164

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	.4012257	1	.4012257	.007514	.93164
Error	1281.4768	24	53.3949		
Total (Corr.)	1281.8781	25			

Correlation Coefficient = 0.0176918 R-squared = .03 percent
Stnd. Error of Est. = 7.30718

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapbb | Independent variable: wspmbb

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	28.4462	4.74046	6.00074	.00000
Slope	-0.674273	0.763836	-0.882745	.38613

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	40.311574	1	40.311574	.77924	.38613
Error	1241.5665	24	51.7319		
Total (Corr.)	1281.8781	25			

Correlation Coefficient = -0.177334 R-squared = 3.14 percent
Stnd. Error of Est. = 7.19249

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapbb | Independent variable: hudambb

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	44.4186	6.55644	6.77481	.00000
Slope	-0.33194	0.107118	-3.09882	.00490

MISP - spring.

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	366.32390	1	366.32390	9.6027	.00490
Error	915.55416	24	38.14809		
Total (Corr.)	1281.8781	25			

Correlation Coefficient = -0.534576   R-squared = 28.58 percent
Stnd. Error of Est. = 6.17641

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapbb   Independent variable: hudpmbb

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	28.4112	3.60187	7.8879	.00000
Slope	-0.133368	0.111872	-1.19214	.24486

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	71.665215	1	71.665215	1.42121	.24486
Error	1210.2129	24	50.4255		
Total (Corr.)	1281.8781	25			

Correlation Coefficient = -0.236445   R-squared = 5.59 percent
Stnd. Error of Est. = 7.10109

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapbb   Independent variable: maxtempbb

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	10.7064	11.3193	0.94585	.35365
Slope	0.484825	0.396245	1.22355	.23300

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	75.265984	1	75.265984	1.49707	.23300
Error	1206.6121	24	50.2755		
Total (Corr.)	1281.8781	25			

Correlation Coefficient = 0.242313   R-squared = 5.87 percent
Stnd. Error of Est. = 7.09052

misp · spring.

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapbb Independent variable: mintempbb

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	27.6092	5.30291	5.20642	.00002
Slope	-0.266847	0.431674	-0.618169	.54229

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	20.090423	1	20.090423	.38213	.54229
Error	1261.7876	24	52.5745		
Total (Corr.)	1281.8781	25			

Correlation Coefficient = -0.12519 R-squared = 1.57 percent
Stnd. Error of Est. = 7.25083

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapbb Independent variable: apambb

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	424.85	452.586	0.938718	.35723
Slope	-46.0592	52.0621	-0.884697	.38510

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	40.484370	1	40.484370	.78269	.38510
Error	1241.3937	24	51.7247		
Total (Corr.)	1281.8781	25			

Correlation Coefficient = -0.177713 R-squared = 3.16 percent
Stnd. Error of Est. = 7.19199

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapbb Independent variable: appmbb

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	234.927	509.509	0.461086	.64889
Slope	-24.2793	58.7737	-0.413098	.68320

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	9.0503163	1	9.0503163	.170650	.68320
Error	1272.8277	24	53.0345		
Total (Corr.)	1281.8781	25			

Correlation Coefficient = -0.084025   R-squared = .71 percent
Stnd. Error of Est. = 7.28248

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapbb   Independent variable: radnbb

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	11.5088	6.84617	1.68105	.10572
Slope	0.558797	0.289925	1.92739	.06585

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	171.81927	1	171.81927	3.7148	.06585
Error	1110.0588	24	46.2525		
Total (Corr.)	1281.8781	25			

Correlation Coefficient = 0.366111   R-squared = 13.40 percent
Stnd. Error of Est. = 6.80092

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapbb   Independent variable: dradnbb

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	31.7405	4.44204	7.14548	.00000
Slope	-1.34024	0.777969	-1.72274	.09780

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	141.07225	1	141.07225	2.9678	.09780
Error	1140.8058	24	47.5336		
Total (Corr.)	1281.8781	25			

Correlation Coefficient = -0.33174   R-squared = 11.01 percent
Stnd. Error of Est. = 6.89446

EAST - spring

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapii — Independent variable: wsamii

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	24.0818	5.38526	4.47179	.00016
Slope	0.499002	0.861457	0.579254	.56782

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	33.333071	1	33.333071	.33553	.56782
Error	2384.2351	24	99.3431		
Total (Corr.)	2417.5681	25			

Correlation Coefficient = 0.117422 R-squared = 1.38 percent
Stnd. Error of Est. = 9.9671

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapii — Independent variable: wspmii

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	25.0873	6.60242	3.79972	.00087
Slope	0.320866	1.06386	0.301607	.76555

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	9.1286425	1	9.1286425	.090967	.76555
Error	2408.4395	24	100.3516		
Total (Corr.)	2417.5681	25			

Correlation Coefficient = 0.0614488 R-squared = .38 percent
Stnd. Error of Est. = 10.0176

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapii — Independent variable: hudamii

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	58.2887	8.43177	6.91298	.00000
Slope	-0.520269	0.137736	-3.77728	.00092

EAST - spring.

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	901.37026	1	901.37026	14.2679	.00092
Error	1516.1979	24	63.1749		
Total (Corr.)	2417.5681	25			

Correlation Coefficient = -0.610608 R-squared = 37.28 percent
Stnd. Error of Est. = 7.94826

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapii Independent variable: hudpmii

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	34.376	4.82106	7.13038	.00000
Slope	-0.248802	0.14974	-1.66156	.10961

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	249.40953	1	249.40953	2.7608	.10961
Error	2168.1586	24	90.3399		
Total (Corr.)	2417.5681	25			

Correlation Coefficient = -0.321194 R-squared = 10.32 percent
Stnd. Error of Est. = 9.50473

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapii Independent variable: maxtempii

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	3.1774	15.2554	0.20828	.83677
Slope	0.839896	0.534035	1.57274	.12887

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	225.88088	1	225.88088	2.4735	.12887
Error	2191.6873	24	91.3203		
Total (Corr.)	2417.5681	25			

Correlation Coefficient = 0.305668 R-squared = 9.34 percent
Stnd. Error of Est. = 9.55617

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapii — Independent variable: mintempii

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	25.4572	7.33307	3.47156	.00198
Slope	0.129388	0.596936	0.216754	.83023

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	4.7233592	1	4.7233592	.046982	.83023
Error	2412.8448	24	100.5352		
Total (Corr.)	2417.5681	25			

Correlation Coefficient = 0.0442014 R-squared = .20 percent
Stnd. Error of Est. = 10.0267

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapii — Independent variable: apamii

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	28.2242	1.74945	16.1332	.00000
Slope	-0.0295953	0.0102606	-2.88435	.00815

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	622.31606	1	622.31606	8.3195	.00815
Error	1795.2521	24	74.8022		
Total (Corr.)	2417.5681	25			

Correlation Coefficient = -0.50736 R-squared = 25.74 percent
Stnd. Error of Est. = 8.64882

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapii — Independent variable: appmii

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	1166.26	566.24	2.05966	.05044
Slope	-131.441	65.3282	-2.01201	.05557

EAST - spring.

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	348.92668	1	348.92668	4.0482	.05557
Error	2068.6415	24	86.1934		
Total (Corr.)	2417.5681	25			

Correlation Coefficient = -0.379907   R-squared = 14.43 percent
Stnd. Error of Est. = 9.28404

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapii   Independent variable: radnii

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	13.0771	9.67963	1.35099	.18930
Slope	0.600635	0.409918	1.46526	.15583

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	198.51157	1	198.51157	2.1470	.15583
Error	2219.0566	24	92.4607		
Total (Corr.)	2417.5681	25			

Correlation Coefficient = 0.286552   R-squared = 8.21 percent
Stnd. Error of Est. = 9.61565

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapii   Independent variable: dradnii

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	35.7982	6.18473	5.78816	.00001
Slope	-1.61979	1.08318	-1.4954	.14784

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	206.05902	1	206.05902	2.2362	.14784
Error	2211.5091	24	92.1462		
Total (Corr.)	2417.5681	25			

Correlation Coefficient = -0.291949   R-squared = 8.52 percent
Stnd. Error of Est. = 9.59928

WEST - winter

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapa — Independent variable: wsama

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	13.6527	1.27029	10.7477	.00000
Slope	0.667128	0.323885	2.05977	.04475

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	151.88341	1	151.88341	4.2427	.04475
Error	1754.1589	49	35.7992		
Total (Corr.)	1906.0423	50			

Correlation Coefficient = 0.282286 R-squared = 7.97 percent
Stnd. Error of Est. = 5.98324

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapa — Independent variable: wspma

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	14.9102	1.55256	9.60362	.00000
Slope	0.133026	0.241114	0.551712	.58365

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	11.767162	1	11.767162	.30439	.58365
Error	1894.2751	49	38.6587		
Total (Corr.)	1906.0423	50			

Correlation Coefficient = 0.0785723 R-squared = .62 percent
Stnd. Error of Est. = 6.21761

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapa — Independent variable: hudama

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	19.1492	3.88076	4.93439	.00001
Slope	-0.055356	0.0593271	-0.933065	.35536

WEST - winter

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	33.274524	1	33.274524	.87061	.35536
Error	1872.7678	49	38.2198		
Total (Corr.)	1906.0423	50			

Correlation Coefficient = -0.132126 R-squared = 1.75 percent
Stnd. Error of Est. = 6.18221

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapa Independent variable: hudpma

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	13.0045	1.40276	9.27062	.00000
Slope	0.093824	0.0405937	2.31129	.02506

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	187.37246	1	187.37246	5.3421	.02506
Error	1718.6698	49	35.0749		
Total (Corr.)	1906.0423	50			

Correlation Coefficient = 0.313535 R-squared = 9.83 percent
Stnd. Error of Est. = 5.92241

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapa Independent variable: maxtempa

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	14.8462	4.64469	3.19637	.00244
Slope	0.0354133	0.208923	0.169504	.86610

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	1.1169721	1	1.1169721	.028732	.86610
Error	1904.9253	49	38.8760		
Total (Corr.)	1906.0423	50			

Correlation Coefficient = 0.0242078 R-squared = .06 percent
Stnd. Error of Est. = 6.23506

west - winter

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapa   Independent variable: mintempa

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	14.7028	0.988893	14.8679	.00000
Slope	0.358775	0.200357	1.79068	.07952

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	117.06956	1	117.06956	3.2065	.07952
Error	1788.9727	49	36.5096		
Total (Corr.)	1906.0423	50			

Correlation Coefficient = 0.247831   R-squared = 6.14 percent
Stnd. Error of Est. = 6.04232

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapa   Independent variable: apama

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	497.184	230.067	2.16104	.03561
Slope	-55.1431	26.3443	-2.09317	.04153

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	156.44085	1	156.44085	4.3813	.04153
Error	1749.6014	49	35.7062		
Total (Corr.)	1906.0423	50			

Correlation Coefficient = -0.28649   R-squared = 8.21 percent
Stnd. Error of Est. = 5.97546

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapa   Independent variable: appma

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	279.566	231.791	1.20611	.23357
Slope	-30.3028	26.6109	-1.13873	.26035

West - winter

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	49.140247	1	49.140247	1.29671	.26035
Error	1856.9020	49	37.8960		
Total (Corr.)	1906.0423	50			

Correlation Coefficient = -0.160566   R-squared = 2.58 percent
Stnd. Error of Est. = 6.15597

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapa   Independent variable: radna

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	15.0677	4.79736	3.14083	.00286
Slope	0.0321031	0.274463	0.116967	.90736

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	.5320347	1	.5320347	.013681	.90736
Error	1905.5102	49	38.8880		
Total (Corr.)	1906.0423	50			

Correlation Coefficient = 0.0167072   R-squared = .03 percent
Stnd. Error of Est. = 6.23602

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapa   Independent variable: dradna

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	11.5228	4.62312	2.49243	.01824
Slope	1.5443	1.38304	1.1166	.27275

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	63.083046	1	63.083046	1.24679	.27275
Error	1568.4837	31	50.5962		
Total (Corr.)	1631.5668	32			

Correlation Coefficient = 0.196632   R-squared = 3.87 percent
Stnd. Error of Est. = 7.1131

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Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapb Independent variable: wsamb

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	16.1939	1.74527	9.27874	.00000
Slope	0.681954	0.44499	1.53252	.13183

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	158.70908	1	158.70908	2.3486	.13183
Error	3311.2146	49	67.5758		
Total (Corr.)	3469.9237	50			

Correlation Coefficient = 0.213866 R-squared = 4.57 percent
Stnd. Error of Est. = 8.22045

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapb Independent variable: wspmb

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	18.8295	2.09852	8.97271	.00000
Slope	-0.117258	0.325903	-0.359794	.72055

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	9.1429316	1	9.1429316	.129452	.72055
Error	3460.7807	49	70.6282		
Total (Corr.)	3469.9237	50			

Correlation Coefficient = -0.0513314 R-squared = .26 percent
Stnd. Error of Est. = 8.40406

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapb Independent variable: hudamb

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	30.7038	4.99572	6.14602	.00000
Slope	-0.196201	0.076469	-2.56576	.01341

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Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	410.96812	1	410.96812	6.5831	.01341
Error	3058.9555	49	62.4277		
Total (Corr.)	3469.9237	50			

Correlation Coefficient = -0.344147 R-squared = 11.84 percent
Stnd. Error of Est. = 7.90112

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapb Independent variable: hudpmb

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	17.7055	1.99123	8.89173	.00000
Slope	0.0178989	0.057623	0.310621	.75741

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	6.8191732	1	6.8191732	.096486	.75741
Error	3463.1045	49	70.6756		
Total (Corr.)	3469.9237	50			

Correlation Coefficient = 0.0443308 R-squared = .20 percent
Stnd. Error of Est. = 8.40688

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapb Independent variable: maxtempb

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	-1.84766	5.5489	-0.332978	.74057
Slope	0.918329	0.249595	3.67927	.00058

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	751.11488	1	751.11488	13.5370	.00058
Error	2718.8088	49	55.4859		
Total (Corr.)	3469.9237	50			

Correlation Coefficient = 0.465257 R-squared = 21.65 percent
Stnd. Error of Est. = 7.44889

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapb　　　　Independent variable: mintempt

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	15.2655	1.11309	13.7145	.00000
Slope	1.15027	0.22552	5.10055	.00001

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	1203.3772	1	1203.3772	26.016	.00001
Error	2266.5465	49	46.2561		
Total (Corr.)	3469.9237	50			

Correlation Coefficient = 0.588899　　　R-squared = 34.68 percent
Stnd. Error of Est. = 6.80118

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapb　　　　Independent variable: apamb

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	959.784	294.757	3.25618	.00205
Slope	-107.819	33.7519	-3.19444	.00245

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	598.07502	1	598.07502	10.2045	.00245
Error	2871.8486	49	58.6092		
Total (Corr.)	3469.9237	50			

Correlation Coefficient = -0.415162　　　R-squared = 17.24 percent
Stnd. Error of Est. = 7.65566

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapb　　　　Independent variable: appmb

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	876.56	292.166	3.00021	.00423
Slope	-98.545	33.5424	-2.93792	.00502

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	519.68635	1	519.68635	8.6314	.00502
Error	2950.2373	49	60.2089		
Total (Corr.)	3469.9237	50			

Correlation Coefficient = -0.387 R-squared = 14.98 percent
Stnd. Error of Est. = 7.75944

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapb Independent variable: radnb

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	0.172843	5.9205	0.0291939	.97683
Slope	1.04914	0.338724	3.09733	.00323

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	568.12879	1	568.12879	9.5935	.00323
Error	2901.7949	49	59.2203		
Total (Corr.)	3469.9237	50			

Correlation Coefficient = 0.404635 R-squared = 16.37 percent
Stnd. Error of Est. = 7.69547

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapb Independent variable: dradnb

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	4.99797	3.75061	1.33257	.18884
Slope	4.3758	1.19363	3.66596	.00061

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	746.85757	1	746.85757	13.4393	.00061
Error	2723.0661	49	55.5728		
Total (Corr.)	3469.9237	50			

Correlation Coefficient = 0.463937 R-squared = 21.52 percent
Stnd. Error of Est. = 7.45472

EAST - winter

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapi | Independent variable: wsami

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	11.2623	1.31675	8.55309	.00000
Slope	2.18724	0.402003	5.44086	.00000

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	950.27613	1	950.27613	29.6030	.00000
Error	1444.5322	45	32.1007		
Total (Corr.)	2394.8083	46			

Correlation Coefficient = 0.629926 R-squared = 39.68 percent
Stnd. Error of Est. = 5.66575

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapi | Independent variable: wspmi

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	16.4652	1.90745	8.63202	.00000
Slope	0.076922	0.32514	0.236581	.81406

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	2.9749347	1	2.9749347	.055970	.81406
Error	2391.8334	45	53.1519		
Total (Corr.)	2394.8083	46			

Correlation Coefficient = 0.0352455 R-squared = .12 percent
Stnd. Error of Est. = 7.29053

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapi | Independent variable: hudami

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	27.0463	4.23329	6.38896	.00000
Slope	-0.164345	0.0662429	-2.48095	.01691

EAST - winter

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	288.14895	1	288.14895	6.1551	.01691
Error	2106.6593	45	46.8147		
Total (Corr.)	2394.8083	46			

Correlation Coefficient = -0.346875 R-squared = 12.03 percent
Stnd. Error of Est. = 6.84212

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapi Independent variable: hudpmi

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	15.7996	1.72486	9.15991	.00000
Slope	0.0384379	0.0503604	0.763257	.44929

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	30.606516	1	30.606516	.58256	.44929
Error	2364.2018	45	52.5378		
Total (Corr.)	2394.8083	46			

Correlation Coefficient = 0.11305 R-squared = 1.28 percent
Stnd. Error of Est. = 7.2483

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapi Independent variable: maxtempi

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	-2.19726	4.82728	-0.455175	.65117
Slope	0.851405	0.211997	4.01612	.00022

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	631.88150	1	631.88150	16.1292	.00022
Error	1762.9268	45	39.1762		
Total (Corr.)	2394.8083	46			

Correlation Coefficient = 0.513668 R-squared = 26.39 percent
Stnd. Error of Est. = 6.25909

EAST - west

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapi   Independent variable: mintempi

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	13.9185	0.969275	14.3597	.00000
Slope	1.06105	0.189489	5.59954	.00000

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	983.42013	1	983.42013	31.3549	.00000
Error	1411.3882	45	31.3642		
Total (Corr.)	2394.8083	46			

Correlation Coefficient = 0.640817   R-squared = 41.06 percent
Stnd. Error of Est. = 5.60037

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapi   Independent variable: apami

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	16.5782	1.07354	15.4426	.00000
Slope	9.65919E-3	8.43897E-3	1.14459	.25843

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	67.748266	1	67.748266	1.31010	.25843
Error	2327.0600	45	51.7124		
Total (Corr.)	2394.8083	46			

Correlation Coefficient = 0.168195   R-squared = 2.83 percent
Stnd. Error of Est. = 7.19114

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapi   Independent variable: appmi

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	-19.7358	64.7708	-0.304702	.76200
Slope	4.18954	7.41816	0.564769	.57504

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	16.855127	1	16.855127	.31896	.57504
Error	2377.9532	45	52.8434		
Total (Corr.)	2394.8083	46			

Correlation Coefficient = 0.0838939 R-squared = .70 percent
Stnd. Error of Est. = 7.26935

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapi Independent variable: radni

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	-0.688692	5.27215	-0.130628	.89665
Slope	1.00585	0.29758	3.38009	.00151

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	484.90446	1	484.90446	11.4250	.00151
Error	1909.9038	45	42.4423		
Total (Corr.)	2394.8083	46			

Correlation Coefficient = 0.449979 R-squared = 20.25 percent
Stnd. Error of Est. = 6.51478

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapi Independent variable: dradni

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	8.79053	3.58294	2.45344	.01809
Slope	2.63616	1.12635	2.34045	.02375

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	259.87886	1	259.87886	5.4777	.02375
Error	2134.9294	45	47.4429		
Total (Corr.)	2394.8083	46			

Correlation Coefficient = 0.32942 R-squared = 10.85 percent
Stnd. Error of Est. = 6.88788

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapiv — Independent variable: wsamiv

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	24.5122	2.21636	11.0597	.00000
Slope	-2.29555	0.706917	-3.24726	.00370

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	396.43323	1	396.43323	10.5447	.00370
Error	827.09922	22	37.59542		
Total (Corr.)	1223.5325	23			

Correlation Coefficient = -0.569216 — R-squared = 32.40 percent
Stnd. Error of Est. = 6.13151

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapiv — Independent variable: wspmiv

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	23.8538	2.44205	9.76796	.00000
Slope	-1.31077	0.507735	-2.58161	.01702

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	284.47812	1	284.47812	6.6647	.01702
Error	939.05433	22	42.68429		
Total (Corr.)	1223.5325	23			

Correlation Coefficient = -0.482188 — R-squared = 23.25 percent
Stnd. Error of Est. = 6.53332

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapiv — Independent variable: hudamiv

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	45.9936	15.6467	2.93951	.00758
Slope	-0.326264	0.185395	-1.75983	.09234

EAST - autumn

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	150.98610	1	150.98610	3.0970	.09234
Error	1072.5464	22	48.7521		
Total (Corr.)	1223.5325	23			

Correlation Coefficient = -0.351286   R-squared = 12.34 percent
Stnd. Error of Est. = 6.98227

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapiv   Independent variable: hudpmiv

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	23.0899	4.53038	5.09668	.00004
Slope	-0.1076	0.101946	-1.05546	.30267

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	58.969065	1	58.969065	1.11400	.30267
Error	1164.5634	22	52.9347		
Total (Corr.)	1223.5325	23			

Correlation Coefficient = -0.219535   R-squared = 4.82 percent
Stnd. Error of Est. = 7.27562

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapiv   Independent variable: maxtempiv

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	10.4437	10.6954	0.976469	.33945
Slope	0.356005	0.463767	0.767638	.45086

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	31.917299	1	31.917299	.58927	.45086
Error	1191.6152	22	54.1643		
Total (Corr.)	1223.5325	23			

Correlation Coefficient = 0.161512   R-squared = 2.61 percent
Stnd. Error of Est. = 7.35964

EAST - autumn.

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapiv   Independent variable: mintempiv

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	15.8011	3.58639	4.40584	.00022
Slope	0.35915	0.422285	0.850493	.40421

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	38.947996	1	38.947996	.72334	.40421
Error	1184.5845	22	53.8447		
Total (Corr.)	1223.5325	23			

Correlation Coefficient = 0.178416   R-squared = 3.18 percent
Stnd. Error of Est. = 7.3379

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapiv   Independent variable: apamiv

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	861.102	332.826	2.58724	.01681
Slope	-96.6791	38.191	-2.53146	.01901

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	276.00258	1	276.00258	6.4083	.01901
Error	947.52987	22	43.06954		
Total (Corr.)	1223.5325	23			

Correlation Coefficient = -0.474951   R-squared = 22.56 percent
Stnd. Error of Est. = 6.56274

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapiv   Independent variable: appmiv

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	786.725	309.137	2.5449	.01846
Slope	-88.2947	35.5332	-2.48485	.02105

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	268.13881	1	268.13881	6.1745	.02105
Error	955.39364	22	43.42698		
Total (Corr.)	1223.5325	23			

Correlation Coefficient = -0.468136   R-squared = 21.92 percent
Stnd. Error of Est. = 6.58992

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapiv   Independent variable: radniv

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	17.8123	5.72652	3.11049	.00510
Slope	0.047016	0.341432	0.137702	.89173

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	1.0536630	1	1.0536630	.018962	.89173
Error	1222.4788	22	55.5672		
Total (Corr.)	1223.5325	23			

Correlation Coefficient = 0.0293456   R-squared = .09 percent
Stnd. Error of Est. = 7.45434

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapiv   Independent variable: dradniv

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	22.6272	4.0349	5.60788	.00001
Slope	-1.05158	0.973154	-1.08059	.29158

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	61.667708	1	61.667708	1.16768	.29158
Error	1161.8647	22	52.8120		
Total (Corr.)	1223.5325	23			

Correlation Coefficient = -0.224502   R-squared = 5.04 percent
Stnd. Error of Est. = 7.26719

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Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapbba — Independent variable: wsambba

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	19.7897	1.80241	10.9796	.00000
Slope	-1.64528	0.574885	-2.86193	.00906

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	203.64787	1	203.64787	8.1907	.00906
Error	546.99498	22	24.86341		
Total (Corr.)	750.64285	23			

Correlation Coefficient = -0.520863 R-squared = 27.13 percent
Stnd. Error of Est. = 4.98632

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapbba — Independent variable: wspmbba

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	18.3278	2.06421	8.87881	.00000
Slope	-0.693758	0.429178	-1.61648	.12024

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	79.691155	1	79.691155	2.61301	.12024
Error	670.95170	22	30.49780		
Total (Corr.)	750.64285	23			

Correlation Coefficient = -0.325828 R-squared = 10.62 percent
Stnd. Error of Est. = 5.52248

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapbba — Independent variable: hudambba

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	30.1856	12.7083	2.37527	.02667
Slope	-0.174346	0.150578	-1.15785	.25934

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Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	43.114581	1	43.114581	1.34061	.25934
Error	707.52827	22	32.16038		
Total (Corr.)	750.64285	23			

Correlation Coefficient = -0.23966 R-squared = 5.74 percent
Stnd. Error of Est. = 5.67101

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapbba Independent variable: hudpmbba

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	19.798	3.50753	5.64444	.00001
Slope	-0.101601	0.0789292	-1.28724	.21139

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	52.576720	1	52.576720	1.65699	.21139
Error	698.06613	22	31.73028		
Total (Corr.)	750.64285	23			

Correlation Coefficient = -0.264655 R-squared = 7.00 percent
Stnd. Error of Est. = 5.63296

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapbba Independent variable: maxtempbba

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	9.19079	8.37821	1.09699	.28451
Slope	0.277739	0.363291	0.764508	.45269

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	19.426194	1	19.426194	.58447	.45269
Error	731.21666	22	33.23712		
Total (Corr.)	750.64285	23			

Correlation Coefficient = 0.160871 R-squared = 2.59 percent
Stnd. Error of Est. = 5.76516

MA

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapbba | Independent variable: mintempbba

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	13.3836	2.81002	4.76282	.00009
Slope	0.278469	0.33087	0.841626	.40905

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	23.414566	1	23.414566	.70833	.40905
Error	727.22828	22	33.05583		
Total (Corr.)	750.64285	23			

Correlation Coefficient = 0.176615 R-squared = 3.12 percent
Stnd. Error of Est. = 5.74942

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapbba | Independent variable: apambba

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	591.813	269.555	2.19552	.03897
Slope	-66.1274	30.9308	-2.13791	.04388

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	129.12511	1	129.12511	4.5707	.04388
Error	621.51774	22	28.25081		
Total (Corr.)	750.64285	23			

Correlation Coefficient = -0.414752 R-squared = 17.20 percent
Stnd. Error of Est. = 5.31515

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapbba | Independent variable: appmbba

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	471.066	256.228	1.83846	.07953
Slope	-52.3609	29.4516	-1.77786	.08925

mA

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	94.298393	1	94.298393	3.16079	.08925
Error	656.34446	22	29.83384		
Total (Corr.)	750.64285	23			

Correlation Coefficient = -0.354434 R-squared = 12.56 percent
Stnd. Error of Est. = 5.46204

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapbba Independent variable: radnbba

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	14.7131	4.48366	3.28149	.00341
Slope	0.0506773	0.267329	0.189569	.85138

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	1.2241572	1	1.2241572	.035936	.85138
Error	749.41869	22	34.06449		
Total (Corr.)	750.64285	23			

Correlation Coefficient = 0.0403833 R-squared = .16 percent
Stnd. Error of Est. = 5.83648

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapbba Independent variable: dradnbba

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	15.8731	3.24224	4.89572	.00007
Slope	-0.0883361	0.781978	-0.112965	.91108

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	.4351569	1	.4351569	.012761	.91108
Error	750.20769	22	34.10035		
Total (Corr.)	750.64285	23			

Correlation Coefficient = -0.0240772 R-squared = .06 percent
Stnd. Error of Est. = 5.83955

West - A

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapaab — Independent variable: wsamaab

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	14.1798	1.29155	10.9789	.00000
Slope	-1.02986	0.411945	-2.49999	.02037

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	79.790818	1	79.790818	6.24996	.02037
Error	280.86558	22	12.76662		
Total (Corr.)	360.65640	23			

Correlation Coefficient = -0.470359 R-squared = 22.12 percent
Stnd. Error of Est. = 3.57304

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapaab — Independent variable: wspmaab

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	14.611	1.29212	11.3078	.00000
Slope	-0.768391	0.268649	-2.86021	.00910

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	97.759298	1	97.759298	8.18078	.00910
Error	262.89710	22	11.94987		
Total (Corr.)	360.65640	23			

Correlation Coefficient = -0.520634 R-squared = 27.11 percent
Stnd. Error of Est. = 3.45686

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapaab — Independent variable: hudamaab

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	25.1345	8.59194	2.92536	.00784
Slope	-0.162048	0.101804	-1.59177	.12571

West -A

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	37.246763	1	37.246763	2.53372	.12571
Error	323.40964	22	14.70044		
Total (Corr.)	360.65640	23			

Correlation Coefficient = -0.321364　　R-squared = 10.33 percent
Stnd. Error of Est. = 3.83412

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapaab　　Independent variable: hudpmaab

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	13.3011	2.48873	5.34455	.00002
Slope	-0.0425438	0.0560033	-0.759666	.45552

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	9.2187287	1	9.2187287	.577092	.45552
Error	351.43767	22	15.97444		
Total (Corr.)	360.65640	23			

Correlation Coefficient = -0.159878　　R-squared = 2.56 percent
Stnd. Error of Est. = 3.9968

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapaab　　Independent variable: maxtempaab

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	6.52787	5.7852	1.12837	.27132
Slope	0.218414	0.250855	0.87068	.39333

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	12.013660	1	12.013660	.75808	.39333
Error	348.64274	22	15.84740		
Total (Corr.)	360.65640	23			

Correlation Coefficient = 0.182512　　R-squared = 3.33 percent
Stnd. Error of Est. = 3.98088

West - A

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapaab | Independent variable: mintempaab

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	10.0189	1.9475	5.1445	.00004
Slope	0.193876	0.229312	0.845468	.40695

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	11.349560	1	11.349560	.71482	.40695
Error	349.30684	22	15.87758		
Total (Corr.)	360.65640	23			

Correlation Coefficient = 0.177396 R-squared = 3.15 percent
Stnd. Error of Est. = 3.98467

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapaab | Independent variable: apamaab

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	350.638	192.187	1.82446	.08169
Slope	-38.9138	22.053	-1.76456	.09152

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	44.715304	1	44.715304	3.11367	.09152
Error	315.94110	22	14.36096		
Total (Corr.)	360.65640	23			

Correlation Coefficient = -0.352112 R-squared = 12.40 percent
Stnd. Error of Est. = 3.78959

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapaab | Independent variable: appmaab

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	323.327	177.922	1.81724	.08283
Slope	-35.8409	20.4509	-1.75254	.09361

ω-A

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	44.182356	1	44.182356	3.07138	.09361
Error	316.47404	22	14.38518		
Total (Corr.)	360.65640	23			

Correlation Coefficient = -0.350008 R-squared = 12.25 percent
Stnd. Error of Est. = 3.79278

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapaab Independent variable: racnaab

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	10.5939	3.10373	3.41327	.00249
Slope	0.0569686	0.185053	0.30785	.76109

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	1.5469709	1	1.5469709	.094772	.76109
Error	359.10943	22	16.32316		
Total (Corr.)	360.65640	23			

Correlation Coefficient = 0.0654929 R-squared = .43 percent
Stnd. Error of Est. = 4.04019

Regression Analysis - Linear model: Y = a+bX

Dependent variable: evapaab Independent variable: dracnaab

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	12.7065	2.23137	5.69448	.00001
Slope	-0.309009	0.538172	-0.574183	.57167

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	5.3249078	1	5.3249078	.329686	.57167
Error	355.33149	22	16.15143		
Total (Corr.)	360.65640	23			

Correlation Coefficient = -0.121509 R-squared = 1.48 percent
Stnd. Error of Est. = 4.01888