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HYDROBOD, a GIS-based hydrological soil information system for Lower Austria

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Lower Austria is Austria's largest state, covering a total area of more than 19.000 km², with surface elevations between 150 and 2.000 m above sea level. Climate ranges from semi-arid to semi-humid.

Different questions of hydrology and water management require some soil parameters, which were not available coherently throughout the whole area before this study. A special interest was to obtain a database which should allow to estimate runoff coefficients in a further step. However, this database should also assist to solve questions of water balance, like evapotranspiration, on a catchment scale. The desired parameters include for instance soil layer depth (down to the rocky base), storage capacity, saturated vertical conductivity, and surface roughness.

The actual project should provide a continuous data set of these soil parameters on a GIS base, using a grid of 50×50 m^2, in three layers down to 1 m below surface level. The frame of the study was defined as the whole area of the state, plus a buffer of 1 km beyond the boundary. This area was extended in some parts, in order to include smaller catchments which exceed the buffer.

Different base data sets are available for this study, such as a highly resolved elevation grid, a GIS layer which assigns land use, or a geological map with quite good resolution, and soil maps for arable land.

Transfer functions were defined for arable land and forests, which allowed to estimate the percentage of different grain size classes and of humus, and they were calibrated and validated using data from monitoring networks. These estimations were the basis for further calculations to obtain the desired data. While arable land is very well classified in Austria, a special challenge was the fact that in forest land monitoring points were available only very scarcely, and neither was a coherent mapping of forest soils available. Another problem was encountered because Lower Austria has a common border with Czech Republic, where the buffer also had to be filled up with parameters, so the Czech classification of soil properties had to be "translated" into the own classification.

Among the results of this study, there are different grids and maps with the required parameters. Moreover, by using the above mentioned parameters and a cell-by-cell calculation model, a classification was made to classify different soil reaction types with regard to heavy rainfall.

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Hydrological studies in experimental and representative basins in Brazil: the experience of the REHIDRO network

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Experimental and numerical studies in Experimental and Representative Basins are essential for a proper understanding of hydrological processes at different scales, in particular in semiarid environments, allowing the generation of knowledge and water resources planning. This work presents comparative analysis among different basins in the Brazilian semiarid, and the Cerrado Biome. The Hydrological Network REHIDRO has been focused on developing joint hydrological studies, involving the Federal Rural University of Pernambuco State (UFRPE), the Federal University of Pernambuco State (UFPE), the University of Brasília (UnB), the Federal University of Alagoas State (UFAL), the Federal University of Sergipe State (UFS) and the Brazilian Corporation for Agricultural Research (EMBRAPA Cerrados and EMBRAPA Tabuleiros).

Advances in network performing a comparison between the basins and instrumentation employed in their respective monitoring procedures will be discussed, and the perspectives toward joint investigations upon hydrological experimentation and modeling. The Tapacurá Representative Catchment has been studied by UFPE. It is one of the main sub-catchments that supply the Recife Metropolitan Region, northeastern Brazil. The Tapacurá catchment covers an area of about 470 km^2. Monitoring and modeling studies have been carried out on stream flow data from January 1997, using the data from a gauging station. The results show that the most sensitive hydrological parameters are the base flow, time of concentration and soil evaporation, which affect the catchment hydrology. The Tapacurá Representative Catchment involves the Gameleira Experimental Basin, where stream flow, sediment transport, and moisture dynamics have been monitored.

The Ipanema catchment is part of the São Francisco River basin, and it is located in the Brazilian drought polygon. The São Francisco Basin has an area representing 8% of Brazilian territory. An experimental (Jatobá) and representative (Mimoso) catchments have been monitored as part of the network by the UFRPE, both in the Pernambuco State. Those catchments are part of the Ipanema River basin. The Mimoso representative catchment has an area of 149 km^2, comprising non perennial rivulets, and an alluvial valley which is exploited for small scale irrigation in the area, mainly for vegetables. The upper catchment is partially covered by dense caatinga forest. Demonstrative experimental plots have been instrumented and studies related to irrigation management techniques and soil conservation alternatives were carried out. A network of 86 piezometers

has been monitored both for water levels and salinity, since 1994. Stream flow and sediment transport has been monitored since 2002. Emphasis has been also placed on investigating the spatio-temporal structures of variation of soil moisture, under different soil use scenarios. The Olho D'água creek is also a São Francisco River tributary, draining a smaller catchment (83.1 km^2) in the Brazilian semiarid region. Part of such catchment is under the establishment of an experimental hydrological monitoring network in order to assess hydrological processes in a catchment that represents 45% (12689 km^2) of Alagoas state (*c.* 839000 inhab.). Hydrometeorological and fluvial processes have been estimated in order to assess water balance and remote rainfall data quality, by the UFAL research Group.

The Japaratuba river basin (1700 km^2) is one of the six main river basins in the State of Sergipe, Northeastern Brazil. In this basin several activities have been put into practice over the last two centuries such as mining, cattle rising, pasture, and sugar cane cultivation. These activities have been impacting the water resources in the region, particularly in the Siriri river sub-basin (308 km^2). As a consequence, the natural vegetation has been removed affecting the hydrologic processes, bank interactions and flood plains. The bank vegetation not only increases the groundwater recharge, but also helps in the reduction of the pollutant and sediment load reaching the river. Hence, an evaluation of the influence of bank vegetation on runoff and sediment load of the Siriri river basin would be of great help in the process of preserving the bank vegetation, and avoiding river sedimentation. In addition, the identification of the impacts on the processes of soil erosion and transport would help the research group from UFS and Embrapa Tabuleiros to figure out adequate land use scenarios for this basin. Water samples have also been collected over the past two years at five sites for water quality verification. Flow discharge and total rainfall have been registered at daily basis (1983-2013), land use and land cover have also been monitored over time.

The study area of UnB research Group is part of the contribution area of the Descoberto reservoir. The Descoberto reservoir is responsible for 63% of the urban water supply of the Brazilian Federal District. The Descoberto reservoir basin has an area of about 420 km^2 and the main tributary river has an area of about 114 km^2. Flow, rainfall, sediments and nutrient loads has been collected at the main tributary rivers. Six sub-basins have been investigated and monitored, with areas ranging from 16 km^2 to 114 km^2.

The Upper Jardim Experimental River Basin covers an area of about 105 km^2, and is located in a rural zone of the Federal District, Brazil, in the core region of the Cerrado biome (Brazilian savanna). Since 2001, in order to generate a database to support hydrological studies in a typical rural catchment of the Brazilian savanna, EMBRAPA Cerrados (Savannas Agricultural Research Center), in partnership with the University of Brasilia (UNB), and other institutions, has intensively characterized and monitored this area. Moreover, the water table variation is monthly monitored by using 56 piezometric wells distributed all over the area.

Assessing changes in drought/wetness episodes in drainage basins, in Portugal, using the Standardized Precipitation Index

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The nature of the precipitation regime, the uncertainties in trends in hydrological variables, and the increasing demand for water for different uses, give way to different studies of the distribution of precipitation in time and space, and consequences for the availability and management of water resources and water related events, such as droughts and floods. Moreover, it is sometimes important to apply simple tools that can provide insight into the temporal and spatial variability of precipitation deficits and surpluses which might affect in a different way the society, the environment and the economy at the local and regional scales, depending on specific conditions.

The location of mainland Portugal on the Northeast Atlantic region, in South-western Europe, together with other geographical features, makes this territory vulnerable to extreme dry/wet hydro-meteorological events, driven by the strong variability in precipitation. Thus, this study focuses mainly on using the Standardized Precipitation Index (SPI) to analyzing drought/wetness episodes at the drainage basin scale, for mainland Portugal. This index's main advantages are related with its versatility and capacity for monitoring the development and persistence of dry and wet hydro-meteorological situations on various time scales that are pertinent to assess *e.g.* water availability for agriculture, streamflow, reservoir storage and groundwater supplies.

In this work the SPI was calculated from monthly precipitation data, recorded in the period 1941-2012 at 53 precipitation stations scattered across the country. The SPI series were calculated at short (3 and 6-month) and long (12 and 24-month) time scales, on which precipitation deficits/surpluses can affect different components of the hydrologic cycle. By applying an appropriate interpolation algorithm - the inverse distance weighting - to the SPI values, spatial grids were obtained for all the months and main time scales (SPI-3, SPI-6, SPI-9, SPI-12 and SPI-24). These grids were used to obtain the statistics for selected drainage basins, using a zonal statistics function; the dry and wet episodes were classified (moderate to extreme), based on the SPI values. The variability and trends in the SPI time series and in the areas affected by dryness and wetness were studied. The main drought and flood episodes were also assessed. The annual SPI shows a significant increase in the extent of dry extremes and a non-significant decrease in the extent of wet extremes. For shorter time scales, the behavior depends on the season. Nevertheless, some drought episodes were restricted to the southern regions while others affected the whole territory.

The understanding of changes (in time and space) observed in many hydrological variables, and their impact