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THE NEW YORK MIDTOWN DISPERSION STUDY (MID-05) METEOROLOGICAL DATA

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July 25, 2006

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DISCLAIMER

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Abstract

The New York City midtown dispersion program, MID05, examined atmospheric transport in the deep urban canyons near Rockefeller Center. Little is known about air flow and hazardous gas dispersion under such conditions, since previous urban field experiments have focused on small to medium sized cities with much smaller street canyons and examined response over a much larger area. During August, 2005, a series of six gas tracer tests were conducted and sampling was conducted over a 2 km grid. A critical component of understanding gas movement in these studies is detailed wind and meteorological information in the study zone. .To support data interpretation and modeling, several meteorological stations were installed at street level and on roof tops in Manhattan. In addition, meteorological data from airports and other weather instrumentation around New York City were collected. This document describes the meteorological component of the project and provides an outline of data file formats for the different instruments.   These data provide enough detail to support highly-resolved computational simulations of gas transport in the study zone.

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1.0 Introduction

In August 2005 a series of six tracer studies were conducted in near Rockefeller Center as part of the New York City Urban Dispersion Program (UDP). Collectively these studies are known as MID05 they examined outdoor releases of Perfluorocarbon Tracer (PFT) tracers and Sulfur hexafluoride (SF_6), indoor releases of PFTs, and subway releases of PFTs. Depending on the test, up to 160 samplers were used to measure SF_6 and up to 80 samplers were used to measure PFTs during the sampling event. Samplers were located covering a 2 km square grid as well as being in the building being tested and along several subway lines. A critical component of understanding gas movement in these studies is detailed wind and meteorological information.

This document provides details on the meteorological equipment used and data that were collected by Brookhaven National Laboratory (BNL) during the UDP, MID05. Intense Operation Periods (IOPs) were conducted on August .8, 12, 14, 18, 20 and 24 in which portable meteorological instrumentation was deployed and operated from 6A.M. to 12 A.M., Eastern Standard Time (EST). In addition, a mesonet was formed using local area airports and other installed weather instrumentation as well as roof top instrumentation installed specifically for the UDP tests. Mesonet data were collected continuously from at least a week prior to the first IOP and for several weeks after the last IOP. This report focuses on data collected during the sampling period of August 8th - 24th.

1.1 Organization of this report

Instrumentation: The instrumentation is described in a general way in Section 2.

Locations: Location sites are named and described in Section 3. The location sites are described independently from the instrumentation located there. Thus a wind station and a mini Sodar can occupy the same location, for example a roof top on a building.

Deployment procedures: Section 4 describes the procedures followed in deploying, aligning, and data recording.

Data Organization: The structure of the data files from the different instruments is discussed in section 5.

Data Processing: Section 6 provides review of the data processing methods used for the wind and sodar data sets.

Quality Assurance: Section 7 reviews several techniques used for quality assurance. Tests were performed at the BNL meteorology field to determine the quality of the sodar and 3D sonic anemometer data.

2.0 Instrumentation

Several different types of weather instrumentation were available for data collection during the MID05 study period. Data from surrounding weather stations at airports, Universities, and National Oceanic and Atmospheric Administrations (NOAA) National Weather Service (NWS) stations were available. This data is referred to as the mesonet for these experiments. The mesonet stations are described briefly in this section and the data collected is described in Section 5. In addition, mini Sodars and sonic anemometers were installed on rooftops and building setbacks for the duration of the test period. Sonic anemometers were also installed at street level during the IOPs. The data format for these instruments is described in Appendix A and B.

2.1 Mesonet Data

Mesonet data was collected from several locations. General information on the different types of stations is provided below. Data collected and stored as part of the MID05 experiment are discussed in chapter 5 and Appendix B of this report.

2.1.1 ASOS Stations

The Automated Surface Observing Systems (ASOS) program is a joint effort of the National Weather Service (NWS), the Federal Aviation Administration (FAA), and the Department of Defense (DOD). The ASOS systems serve as the nation's primary surface weather observing network. ASOS is designed to support weather forecast activities and aviation operations and, at the same time, support the needs of the meteorological, hydrological, and climatological research communities. ASOS stations report basic weather elements including:

- Sky condition: cloud height and amount (clear, scattered, broken, overcast) up to 12,000 feet
- Visibility: (to at least 10 statute miles)

- Basic present weather information: type and intensity for rain, snow, and freezing rain
- Obstructions to vision: fog, haze
- Pressure: sea-level pressure, altimeter setting
- Ambient temperature, dew point temperature
- Wind direction, speed and character (gusts, squalls)
- Precipitation accumulation
- Selected significant remarks including- variable cloud height, variable visibility, precipitation beginning/ending times, rapid pressure changes, pressure change tendency, wind shift, peak wind.

More information on these sites can be found at http://www.nws.noaa.gov/asos/

2.1.2 City College New York (CCNY) Meteorological Station

The NOAA-CREST weather station, located on the roof of the Marshak Science Building on Convent Avenue north of 135th Street in Manhattan, began operation on 12 December, 2003. The station’s sensors collect data each second and compute one-minute averages. The station's sensor array collects data in one-minute cycles controlled by the program resident in a datalogger at the site. The datalogger is polled and the information downloaded to the host computer in the Steinman Hall Engineering Building via the campus internet. Archived data is available on the NOAA-CREST web site. Data includes wind speed, direction and their vectors; air, dew point, wet bulb, heat index and wind chill temperatures; relative humidity; air pressure; rain; plant trans-evaporation and solar flux. More information on this weather station can be found at http://icerd.engr.ccny.cuny.edu/noaa/wc/

2.1.3 Stevens Institute of Technology

The New York Harbor Observing and Prediction System (NYHOPS) was established to permit an assessment of ocean, weather, environmental, and vessel traffic conditions throughout the New York Harbor region. The system is designed to provide a knowledge of meteorological and oceanographic conditions both in real-time and forecasted out to 48 hours in the Hudson River, the East River, NY/NJ Estuary, Raritan Bay, Long Island Sound and the coastal waters of New Jersey. For more information see http://hudson.dl.stevens-tech.edu/NYHOPS/

NOAA DCNET/URBANet

DCNet/URBANet is a NOAA program designed to test and evaluate the feasibility of acquiring wind turbulence measurements within the complex topology of the urban environment. They maintain weather instrumentation to provide three-dimensional wind speed and direction, relative humidity, temperature and other derived weather variables. In New York City they maintain stations at the Environmental Measurement Laboratory (EML) and Times Square. More information can be found at http://dcnet.atdd.noaa.gov/.

2.2 MID05 Wind Data

Data collected specifically for the MID05 tests included street level sonic anemometers and roof top level anemometers and mini Sodars.

2.2.1 Sonic Anemometers

The three-dimensional sonic anemometer (3Dsonic) model 81000 manufactured by R.M. Young Co. was used for turbulence measurements in this project. The instrument provided velocity measurements in 3 dimensions (u, v, and w) and sonic temperature (Tsonic). The instrument brochure with all specifications is given in Appendix C. Table 1, below, provides key characteristics for the measurements.

Table 1 Specifications and Settings for 3D sonic anemometers during MID05

Variable	Settings
Internal sampling rate	160 Hz

Output sample rate	10 Hz
Output format	ASCII
Output variables	u, v, w, Tsonic
Wind speed range	+/- 40 m/s
Wind speed resolution	±0.01 m/s
Valid wind elevation angles	±60 deg

Sonic anemometers are well suited for urban locations, especially at street level, where wind speeds have considerable vertical flow and where wind velocities can be quite small. However, a limitation in this type of instrument is that measurements become suspect with the elevation from horizontal exceeds ±60º. 3Dsonic data where this limitation is exceeded is flagged in the data file. The ASCII digital output from the 3Dsonic is collected by a laptop PC running a customized program called “ECCheck.”

Figure 1 Roof top installation of 3D sonic anemometer.

2.2.2 Mini Sodars

Sodar (sonic detection and ranging) systems were used to remotely measure the vertical turbulence structure and the wind profile of the lower layer of the atmosphere. Sodars operate on the principle of acoustic backscattering. The mini Sodar, the instrument used in this study, was developed by AeroVironment Inc. in the late 1980's to measure wind profiles in helicopter landing areas where noise levels were extreme. It was made commercially available in 1994 and has been deployed in situations where winds within the lowest 200 m are needed and ambient noise in the lower frequency range (1000–2000 Hz) is high. It was determined that the optimum frequency to operate Sodar in these conditions was near 4500 Hz. The same conclusion was reached by Crescenti and Baxter (1998) and Crescenti (1998) for the urban environment where automobiles and HVAC systems can add considerable ambient noise. The following table lists the specifications for the mini Sodar. Figure 2 shows a picture of a mini Sodar installed on the roof of the MetLife building.

Table 2 Settings for Mini Sodars used during MID05

Parameter	Settings
Maximum Sampling Altitude	200 m
Minimum sampling Altitude	15 m
Height Resolution	10 m
Transmit frequency	4500 Hz
Averaging interval	2 min
Wind speed range	0–35 m/s
Wind speed accuracy	< 0.2 m/s
Wind direction accuracy	< 5 deg
Power input (electrical)	30 W
Power output (acoustic avg)	40 W
Voltage	120/220 VAC
Weight	255 lbs
Antenna ht	1.2 m
Antenna Width	1.2 m
Antenna length	1.5 m
Total ht with collar	2.1 m
Beam width	16
Beam zenith angles	6 deg

Figure 2 Mini Sodar on the MetLife Building with 3DSonic anemometer in the left background.

3.0 Instrumentation Location and Data File Identification

3.1 Instrument Location Codes (ID codes)

A set of ID codes has been developed in order to provide unambiguous reference to any meteorological data in the project. Table 3 presents the station ID codes, a narrative description of the location, latitude, longitude, ground elevation in meters above mean sea level (MSL), and instrument elevation in meters above ground level. Latitude and longitude values are based on the WGS 84 datum.

Table 3 Station identification codes, location and geographic locaters

Station Identifier	Location	Latitude	Longitude	Ground Elevation (m) (msl)	Wind sensor Elevation (m)
Regional Meteorological Stations					
cpk	Central park, NOAA ASOS	40.7833	-73.967	39.6	25
ewr	Newark Airport ASOS	40.7167	-74.1667	2.3	10
field	BNL meteorological field	40.87083	-72.6167	27.4	3
fok	Westhampton Gabreski Airport	40.85	-72.6333	20.4	10
hpn	White Plains Westchester Co Airport	41.0667	-73.7	115.5	10
hwv	Shirley Brookhaven Airport	40.8167	-72.8667	25	10
isp	Islip Long Island Macarthur Airport	40.8	-73.1	25.6	10
lga	New York LaGuardia Airport	40.7833	-73.8833	3.4	10
jfk	New York J F Kennedy Int'l Airport	40.6333	-73.7667	3.4	10
Roof top meteorological stations					

ccny	CCNY Roof, NOAA GPS station	40.8192	-73.95	98	58
eml	Environ Meas Lab, 15th floor, roof	40.72842	-74.0066	5	82
gm1	GM Building Roof (3D sonic anemometer)	40.76357	-73.9725	- -	225
gm2	GM Building Roof (mini Sodar)	40.76352	-73.9724	- -	225
lbr1	Bldg A, 745 Seventh Ave, Roof installation	dcnet	dcnet	- -	- -
lbr2	Bldg A, S side setback, above 49th St.	40.76041	-73.9833	- -	~32
met1	MetLife Building (3D sonic anemometer)	40.75342	-73.9765	- -	247
met2	MetLife Building (mini Sodar)	40.75321	-73.9764	- -	247
mgh1	McGraw-Hill roof, SE corner	40.75946	-73.9812	17.7	213
mgh2	McGraw-Hill setback, N side, 49th St.	40.76011	-73.9832	--	30
opp	One Penn Plaza, roof, SW corner	40.75168	-73.9933	10.7	233
ppz	Park Ave Plaza roof station	40.75922	-73.9738	--	182
Street Level Meteorological Stations					
s1	6th Ave btwn 49th and 50th St. Rockefeller Center west entrance.	40.75944	-73.9806	18	3
s2	49th Street btwn 6th and 7th Aves.	40.75967	-73.9825	17	3
s3	1221 6th Ave., on 48th St.	40.75931	-73.9825	17.6	3
s4	On curb in front of 1230 6th Ave.	40.75879	-73.9811	17.6	3
s5	On curb on 6th btwn 50th and 51st Sts.	40.76021	-73.9801	18.9	3

s6	On curb, 50th St btwn 6th and Bdwy.	40.75995	-73.9808	18.2	3
s7	On 7th Ave btwn 48th and 49th Sts.	40.76011	-73.9839	16.1	3
s8	7th Ave. btwn 49th and 50th Sts.	40.7607	-73.9834	16.1	3
s9	50th St btwn 6th and 7th aves.	40.7608	-73.9827	16.5	3
s10	49th St btwn 7th and 6th Aves	40.7603	-73.983	16.1	3
s11	45th St btwn 6th and 7th Aves.	40.757	-73.9835	17	3
s12	54th St. btwn 6th and 7th Aves.	40.76278	-73.9793	20	3
sit1	Stevens Inst. of Tech., Admin Roof	40.7608	-73.9827	32	51.8

Figure 3 shows pictures of the street level sonic anemometer installations. Maps are provided with the locations of roof top instrumentation, Figure 4, and street level instrumentation, Figure 5.

Figure 3 shows the street level sonic anemometers at all 12 locations.

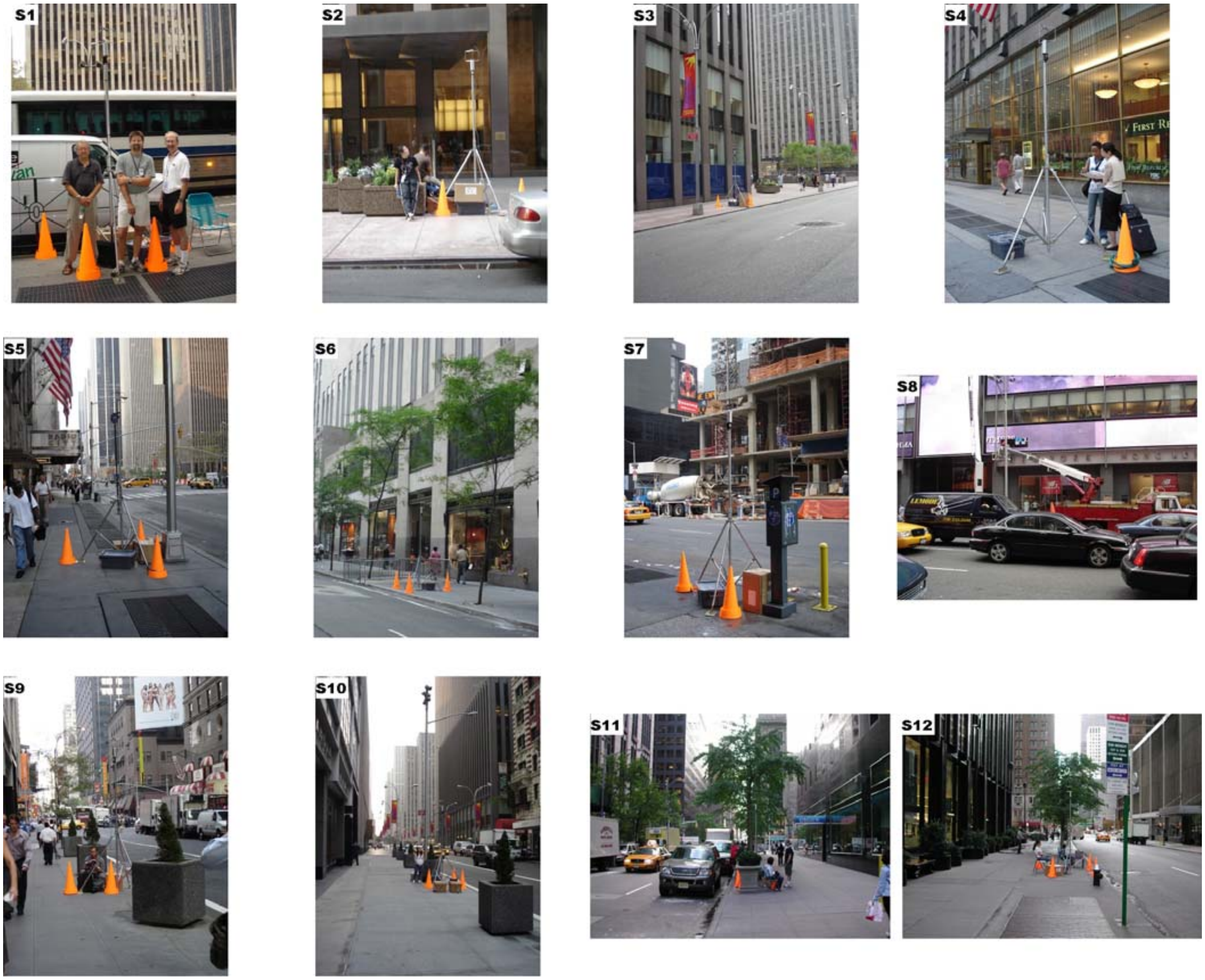


Figure 3 Photographs of the twelve street locations for sonic anemometers used in MID05 tests.

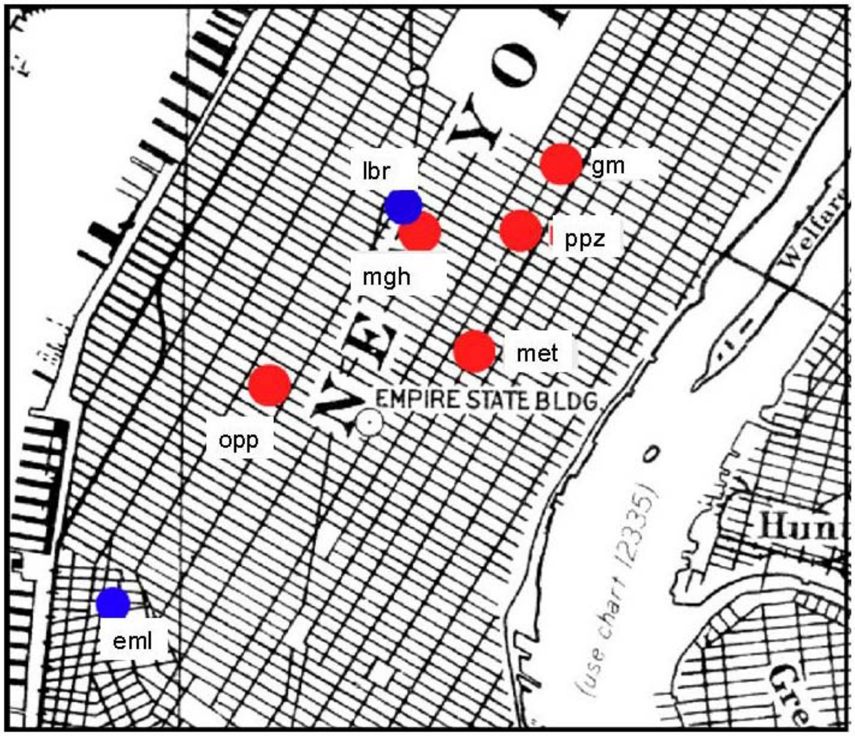
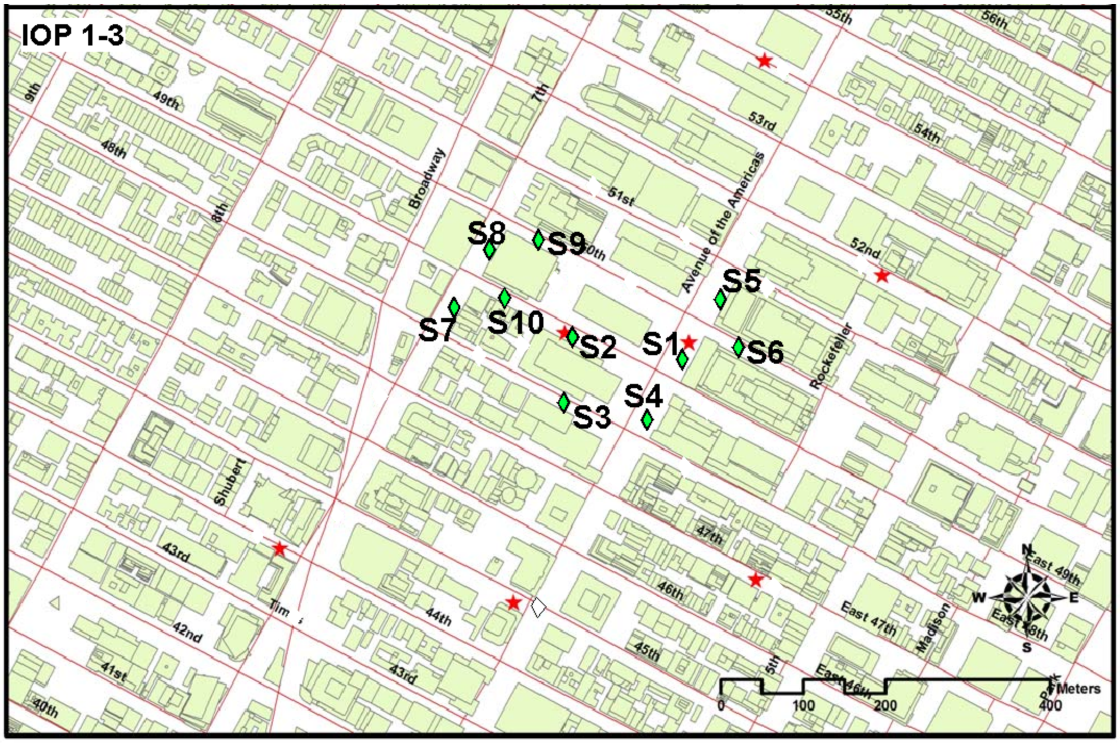


Figure 4 Map showing locations of roof top stations deployed for the MID05 experiment.



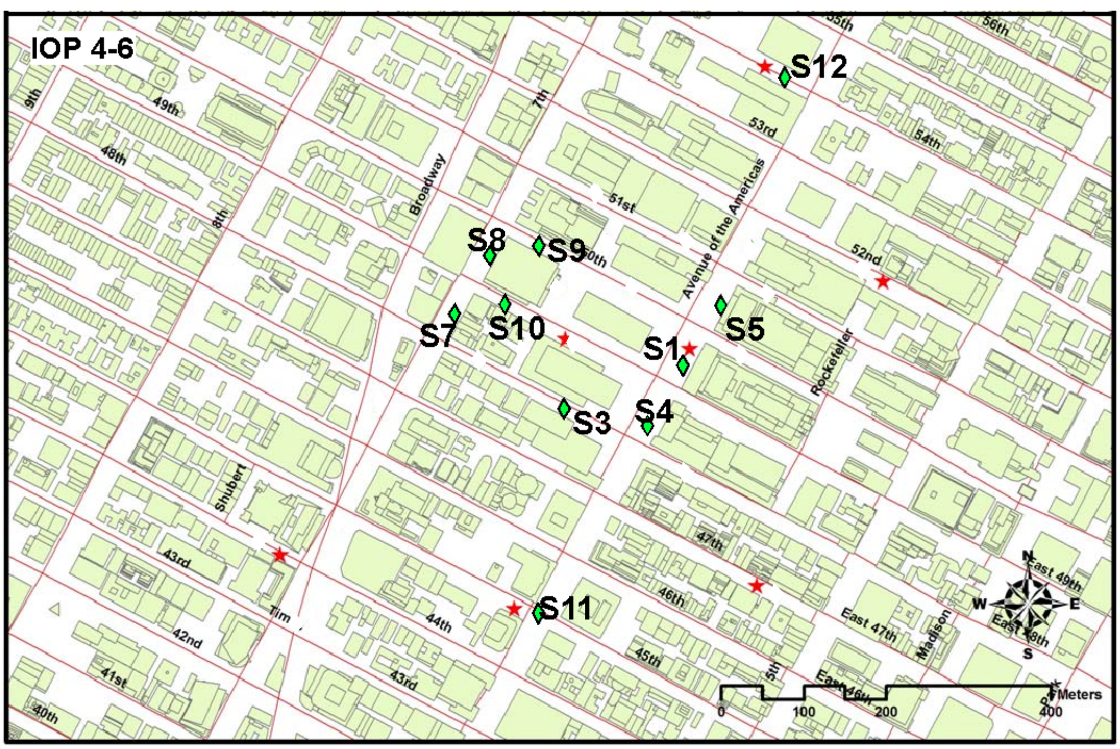


Figure 5 Map showing the locations of street sonic anemometer stations during IOPs 1 -3 and IOPs 4 - 6.

4.0 Deployment

The deployments of roof top meteorological stations were all completed prior to the first IOP (Intensive Operations Period). The buildings were selected based on geographical location and ability to gain access. The installations took place within the month preceding the first IOP. Installation included mounting the equipment to the roof or setback, testing of equipment response, and calibration. Installations included two setback stations, one at the McGraw Hill building (mgh2) and one at the Lehman Brothers building (lbr2). The exact installation procedure varied due to the facilities available to us on each building. All equipment was tied into building power with a Marine battery available for backup. Each station was checked for performance one day prior to each IOP. At this time stations that were not operating were restarted.

There were six IOPs during the MID05 experiment. In order to facilitate the coordination of the large number of participants, it was arranged that the BNL staff responsible for deploying the street level sonic anemometers would meet at the Tick Tock Diner, on the northwest corner of 8th Avenue and 35th street, at 0400 hours (EST) each morning. Two vans loaded with the 10 3D sonic anemometers and associated towers left BNL by 0245 hours to arrive at the diner by 0400. MID05 student team members met BNL staff and formed three teams of three people to install the equipment. The vans were driven to two staging areas, the first was 100 feet north of the northeast corner of 6th Ave and 49th street. The second location was 300 feet east of the south east corner of 7th Ave and 49th street. There were 3 teams each installing 3 or 4 stations. For consistency, all BNL and student team members reported to the same location for each IOP. The installation procedure involved unloading the vans and placing the 3D Sonic anemometer and tower on a cart with associated equipment (computer to run operations, and installation hardware). The team members wheeled the carts and carried the equipment to each of the predesignated locations. For each of the six IOPs the same equipment and the same team members went to the same station. The towers and the anemometers were identical units. The computers collecting the data had similar physical characteristics and were running identical data acquisition software. All ten street level stations were set up and running by 0600 EST except on the first IOP where delays prevented a few of the instruments from starting on time. The sonic anemometers were aligned parallel to 6th and 7th Avenues or perpendicular to the street they were set up on. This insured that all the instruments would be oriented in the same direction. The compass heading for 6th Avenue is 29 degrees. Once the stations were up and running BNL staff that deployed the equipment “roamed” from station to station confirming operation. At 1200 hours (EST) the stations were shut down, disassembled and brought back to be loaded into one of the vans waiting at the staging areas.

Between IOPs the equipment was brought back to BNL. The batteries were recharged and the anemometers were checked for proper operation. The data were copied from the laptops to thumb drives and then copied again to a central computer. Any and all repairs, if necessary, were made during this time.

Equipment failures involving street level stations were minimal. Data recovery from the street level stations was above 95 percent of the total expected. We experienced a slightly higher failure rate on the roof top stations. These failures were mainly due to exposure to extreme heat. We measured rooftop temperatures to be 50 ºC and higher. The computers collecting the data were shutting down due to the excessive temperature in the enclosures. Some of the instrumentation power supplies overheated and failed. To compensate for the heat between the 3rd and 4th IOP, fans and vents were installed in the enclosures to remove the excessive heat inside and to circulate cooler air from the outside. In addition, cables were run to allow instrumentation to be located in shady areas and reduce the heat loading. These modifications corrected most of the problems with the rooftop stations. Data recovery from the rooftop stations was better than 80 percent over the six IOPs. After taking the steps to reduce heat loading on the equipment, data recovery was near 100%.

After the final IOP all of the roof top equipment was removed within two weeks. Data collected from roof top equipment was similarly copied from the laptops to a central computer. All of the data was post processed and went through a QA/QC process.

5.0 Data Organization

The two goals of this technical report are to provide a complete description of the meteorological measurement sub-task to the MID05 experiment, and to provide a description of the data set that accompanies this report.

5.1 Time Recording and Averaging

In all data in this report, all dates and times are recorded and reported in Eastern Standard Time, unless otherwise specified. The EST time zone is -5 hours different than Greenwich Mean Time. Time is written from year to seconds left to right. For example a time of 20050806,072634 is equal to 8/6/2005 7:26:34., using the United States date format, For all data sets averaged over a time-interval, the date/time mark represents the center of the averaging time. For instance, if an averaging interval is 300 seconds (5 minutes), the 0900 h average is derived from data samples from 085730 to 090230.

5.2 Data processing levels

Data are segregated into three levels.

Level 0: Level 0 data are the raw data collected by the recording device available at the location. The raw 10 Hz data from the 3DSonic instrument are included here. Archive ASOS data downloaded from the NWS or other on line sources are collected here exactly as received. In some cases raw level 0 data are cleaned to remove obviously bad records, spikes, and dropouts. As the original data are not altered, these files remain in the level 0

Level 1: The raw data becomes level 1 after they are processed by applying calibration coefficients, wind direction rotations, and any corrections to produce data in true physical units.

Level 2: Level 2 data are finalized, corrected, and calibrated data sets. Derived variables are also included at level 2.

In this report, Level 0 and Level 1 data are provided. A listing of all level 0 data files is presented in Appendix A and all level 1 data files are listed in Appendix B. Level 0 data are grouped into folders based on the instrumentation or location for ASOS stations. There is one Level 0 folder for each instrument used. Table 4 lists all of the Level 0 folders. These folders contain the raw data collected as part of the MID05 field study. For 3D Sonic anemometer data as received data use a file extension dat while files that have had obviously bad records removed use an extension of da1. Detailed descriptions of format and contents of the Level 0 data files are in section 5.4.

Table 4 Station identification codes and level 0 File Folder name.

Station Identifier	Level 0 Folder Name
Regional Meteorological Stations	
cpk	cpk_Central_Park_asos
ewr	ewr_NewarkAirport_asos
hpn	hpn_airport_asos
isp	isp_IslipAirp[ort_asos
lga	lga_LaGuardiaAirport_asos
jfk	jfK_KennedyAirport_asos
sit1	sit_Stevens_HoweCenter
Roof Top Meterological Stations	
ccny	CCNY

eml	eml_NYC002
gm1	gm1_GMBldg_roof_met
gm2	gm1_GMBldg_roof_Sodar
lbr1	lbr1_BldgA_roof
lbr2	lbr2_LehmanBrothers_setback
met1	metl1_met
met2	metl2_sodar
mgh1	mgh1_McGrawHill_roof
mgh2	mgh2_McGrawHill_setback
opp	opp_OnePennPlaza_roof_met
ppz	ppza_ParkPlaza_roof
Street Level Meteorological Stations	
s1	s1
s2	s2
s3	s3
s4	s4
s5	s5
s6	s6
s7	s7
s8	s8
s9	s9
s10	s10
s11	s11
s12	s12

Level 1 data files contain data processed from the Level 0 files. Processing depends on the file but typically involves calculating averages over a time period or aligning data to correspond to true North. For example, the 3DSonic data are collected every 0.1 seconds. This data is reviewed by computer software, bad records are omitted, and a five minute (300 second) average of the data is calculated. Level 1 data are grouped into eight folders IOP1, IOP2, IOP3, IOP4, IOP5, IOP6, meso, and field. IOP folders contain the data from street level sonic anemometers designated as s1 – s12. This data was collected only during the 6 hour period of each IOP. The meso folder contains all of the ASOS weather station data and rooftop meteorological station data. This data were collected for the entire month of August 2005. The field folder contains the sonic anemometer data used on side-by-side comparisons of these instruments conducted at the BNL meteorological field.

5.3 Level 1 Data File Naming Convention

Level 1 Data files are named using a set pattern. Any file or folder names that belong to a particular IOP will begin with the IOP followed by an underscore and an optional descriptive text. For example, a folder might be named iop1_08AugustRelease.

Each data set is identified by the following three sets of ID codes:

a) Experiment ID: "mid" is the ID code for this experiment.

b) IOP ID: The entire data set is subdivided into groups called Intensive Operation periods.
IOPs have a specific start and stop time as defined in the IOP information file. In addition to IOPs, an ID is available to designate meteorological data from all permanent weather stations such as NOAA ASOS stations at airports, the DCNet/URBANet stations and any BNL stations. THE ID for this data is meso. The IDs for these projects are: **meso, iop1, iop2, iop3, iop4, iop5, iop6**.

c) Station ID: In each IOP a set of particular stations are defined. A station here is defined as a particular set of instrumentation that produces a specific data set. For example, an ASOS airport station, a mini Sodar, and a BNL street tripod are all separate stations, even if they are co-located. In the case of the roof of the MetLife building, a sodar and a BNL meteorological station are co-located, so they are given stations names of met1 and met2. Station IDs are provided in Table 3 above.

An example file name is mid_meso_met1_rmy3d_300av.dat. This file will contain all of the data from the met1 station (Metropolitan Life roof top, 3D Sonic anemometer), from the meso folder for the MID05 field campaign. Recall that meso data were collected for the entire month of August 2005. So this file will contain the 3D Sonic data from the Metropolitan Life rooftop on a five minute (300 second) averaging period for the entire month of August.

5.4 Meteorological Data Summary

5.4.1 Sonic Anemometer Data

The sonic anemometer wind stations provided information of the 3-dimensional turbulent winds. Stations were deployed on rooftops (*eml, gm1, lbr1, met1, mgh1, opp, ppz*), building setbacks (*lbr2, mgh2*), and the street stations during iop1—iop6(*s1-s12*). The wind stations were comprised of (a) the RMY 3D sonic anemometer, (b) a tripod, 3 or 6 m high, or a mounting pole in the case of *gm1*, and (c) a data acquisition system with battery backup, AC converter, and laptop PC. The data acquisition program was a custom built program called ECCheck.exe.

Table 5 summarizes of all the 3D-sonic turbulence data collected for the UDP MID05 experiment. The roof stations and street stations are shown with their identifiers. The columns are labeled according to the date from August 2nd to September 3rd. The first column contains the Station ID. A full description of the station locations is in Table 3. The numbers in each cell are the file sizes in Mbytes for each station and for each day. A dash means no data were collected on that day. A number of 0 indicates that less than 1 Mbyte was collected on that day.

Table 5. Summary of data collected by each sonic anemometer station for each day of the experiment. The numbers are in Mbytes of raw data for each day. Note that a full day of 10-Hz data produces a file of 58 Mbytes.

	AUGUST 2005																														SEP 2005		
STATION:	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	01	02	03
gm1:	-	-	26	58	58	58	58	58	58	58	33	-	-	-	-	14	58	58	58	58	58	58	58	58	58	58	58	58	58	58	32	-	-
lbr2:	-	-	-	-	-	-	-	-	16	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	31	-	-
mgh1:	-	-	-	0	-	-	-	-	-	-	-	-	41	35	-	28	58	58	58	58	58	58	58	58	58	58	58	58	58	58	28	-	-
mgh2:	-	-	-	31	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	26	-	-
metl1:	58	58	58	58	58	58	58	58	57	58	21	-	22	-	-	20	58	58	58	58	58	6	46	58	58	58	58	49	-	-	-	-	58
opp:	-	0	-	-	-	-	-	-	0	22	44	-	-	-	-	36	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	26
ppz:	-	-	32	22	-	-	-	-	-	-	-	-	-	-	23	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	22
s1:	-	-	-	-	-	-	13	-	-	-	16	-	13	-	-	-	16	-	16	-	-	-	17	-	-	-	-	-	-	-	-	-	-
s2:	-	-	-	-	-	-	16	-	-	-	12	-	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
s3:	-	-	-	-	-	-	14	-	-	-	15	-	16	-	-	-	16	-	15	-	-	-	16	-	-	-	-	-	-	-	-	-	-
s4:	-	-	-	-	-	-	15	-	-	-	16	-	13	-	-	-	13	-	16	-	-	-	17	-	-	-	-	-	-	-	-	-	-
s5:	-	-	-	-	-	-	16	-	-	-	16	-	13	-	-	-	16	-	15	-	-	-	16	-	-	-	-	-	-	-	-	-	-
s6:	-	-	-	-	-	-	8	-	-	-	17	-	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
s7:	-	-	-	-	-	-	15	-	-	-	14	-	16	-	-	-	15	-	13	-	-	-	17	-	-	-	-	-	-	-	-	-	-
s8:	-	-	-	-	-	-	15	-	-	-	0	-	13	-	-	-	16	-	16	-	-	-	17	-	-	-	-	-	-	-	-	-	-
s9:	-	-	-	-	-	-	5	-	-	-	17	-	13	-	-	-	15	-	15	-	-	-	16	-	-	-	-	-	-	-	-	-	-
s10:	-	-	-	-	-	-	13	-	-	-	10	-	15	-	-	-	16	-	15	-	-	-	17	-	-	-	-	-	-	-	-	-	-
s11:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15	-	16	-	-	-	16	-	-	-	-	-	-	-	-	-	-
s12:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16	-	15	-	-	-	17	-	-	-	-	-	-	-	-	-	-

Table 5 provides the information collected from the street-level 3D sonic anemometers used during each IOP. Data were collected during each IOP from approximately 06:00 to 12:00 EST. The anemometers provided 3D velocity measurements (u, v, w), speed of sound (SOS), and sonic temperature (TSonic) every 0.1 seconds. The first tracer release of each IOP occurred 6:00. From Table 5 it is clear that data were not always collected during the IOP time period of 6:00 – 12:00. This was due to machine failures attributed to overheating. Table 6 shows the operating times of all the street level 3D sonic instrumentation based on obtaining a valid 300 second average of the 10 Hz data. If the Table cell is shaded gray it indicates that data were unavailable for at least 30 minutes over the time period form 6:00 – 12:00.

Table 6 Street level 3D anemometer operating times (EST).

Station ID	IOP1 August 8	IOP2 August 12	IOP3 August 14	IOP4 August 18	IOP5 August 20	IOP6 August 24
s1	6:40 – 12:00	5:10 – 12:00	5:00 – 10:35	5:15 – 12:00	5:15 – 12:00	5:05 – 12:00
s2	5:30 – 12:15	5:25 – 6:20 7:35 – 8:05 8:20 – 9:05 10:00-12:05	5:00 – 11:55	--	--	--

s3	6:15 – 12:00	5:45 – 11:55	5:25 – 12:00	5:15 – 12:00	5:35 – 11:55	5:20 – 12:00
s4	5:45 – 12:10	5:30 – 12:00	5:25 – 10:35	5:10 – 12:00	5:15 – 12:00	5:05 – 12:00
s5	5:25 – 12:00	5:10 – 12:05	5:10 – 10:30	5:30 – 12:00	5:40 – 12:00	5:15 – 12:00
s6	6:15 – 6:20 6:35 – 8:45 9:50 – 9:55 10:05 – 10:30	5:10 – 12:05	5:05 – 10:30	--	--	--
s7	5:45 – 12:10	5:45 – 11:45	5:25 – 12:05	5:30 – 12:00	5:25 – 12:00*	5:05 – 12:00
s8	5:45 – 11:50	6:05 – 12:10	5:05 -8:00 8:25 – 10:25 11:25 11:40 – 11:50 12:00 – 12:05	5:20 – 12:05	5:35 – 12:00	5:05 – 12:05
s9	7;00 – 7:35 7:55 – 9:25 9:50	5:25 – 12:20	6:25 – 11:55	5:45 – 11:55	5:30 – 11:55	5:25 – 12:00
s10	5:30 – 6:25 7:45 – 12:10	5:10 – 9:30	5:15 – 11:55	5:10 – 12:05**	5:40 – 12:00	4:45 – 12:00
s11	--	--	--	5:45 – 12:00	5:20 – 12:00	5:10 – 12:00
s12	--	--	--	5:55 – 12:25	6:00 – 12:15	5:15 – 12:00#

* Invalid data for five-minute average at 6:20.
** Invalid data for five-minute average at 5:40, 5:55, and 6:00.
# Invalid data for five-minute average at 10:45.

To summarize Table 6, four stations s1, s6, s9, and s10 were not successful in keeping data loss to less than ½ hour over the six hour sampling period in IOP 1. This was in part due to logistical considerations which were corrected after the first IOP and in part due to equipment problems. In IOP 2, two stations failed to collect data over the entire period, s2 and s10. In IOP3, five stations failed to collect continuous data. Four of them failed almost simultaneously at 10:30 in the morning. This was attributed to overheating of the computer equipment that is part of the data acquisition system. Fans were installed and measures were taken to provide more shade for this equipment after IOP3. Once this was done, all equipment was successful in data acquisition for the last 3 IOPs.

The rooftop and setback stations also had data acquisition problems. Nominally, the data were collected continuously for the entire month of August 2005. In Table 5, any value less than 58

Mbytes of data collection for a day indicates partial failure. A blank in table 5 indicates that no data were collected on that day. Table 7 presents the time of data collection from rooftop sonic anemometers during the six IOPs. A shaded table cell indicates that data were not obtained for at least 30 minutes during the six hour IOP.

Table 7 Roof top and set back 3D anemometer operating times during the IOPs.

Station ID	IOP1 August 8	IOP2 August 12	IOP3 August 14	IOP4 August 18	IOP5 August 20	IOP6 August 24
gm1	6:00 – 12:00	6:00 – 8:25 8:40 – 12:00*	--	6:00 – 12:00	6:00 – 12:00	6:00 – 12:00
lbr2	--	6:00 – 12:00	6:00 – 12:00	6:00 – 12:00	6:00 – 12:00	6:00 – 12:00
mgh1	--	--	7:05 – 12:00	6:00 – 12:00	6:00 – 12:00	6:00 – 12:00
mgh2	6:00 – 12:00	6:00 – 12:00	6:00 – 12:00	6:00 – 12:00	6:00 – 12:00	6:00 – 12:00
metl1	6:00 – 12:00	6:00- 8:45	6:00 – 12:00	6:00 – 12:00	6:00 – 12:00	6:00 – 12:00
opp	--	6:00 – 12:00	--	6:00 – 12:00	6:00 – 12:00	6:00 – 12:00
ppz	--	--	--	6:00 – 12:00	6:00 – 12:00	6:00 – 12:00

* Instrument gm1 failed at 13:50 on August 12th and was restarted on August 17th at 18:15.

Seven roof top or setback sonic anemometers were deployed. In the first and third IOP, three of the seven were successful in collecting data. In the second IOP, four of the seven operated properly. All seven stations were available 100% of the time during the last 3 IOPs.

5.4.2 Mini sodar data

Mini sodar instrumentation was installed on the Met Life building on August 3rd 2005 and the General Motors Building on August 19th. After installation the sodars operated continually over the remainder of the IOPs. Therefore, data are available for all IOPs from the mini Sodar installed at the Met Life building and the 5th and 6th IOP for the mini Sodar installed at the General Motors building. The mini Sodar data includes a three-dimensional wind-field at elevations of 20 – 200 m above the instrument in 20 m intervals. A complete description of the raw data is in Appendix A and the description of the processed data is in Appendix B.

5.4.3 Mesonet data

Table 8 presents the meteorological variables measured at the mesonet stations from the nominal period starting at midnight (time 00:00:00) August 1, 2005 to September 4, 2005, time (00:00:00). Due to instrumentation problems a continuous record was not kept on all instruments as described in sections 5.4.2. The mesonet included all rooftop and setback stations, regional ASOS stations, DCUrbanet stations, CCNY stations and Stevens Institute of Technology stations. Continuous data over the time period was available from the ASOS and DCUrbanet stations.

Table 8 Meteorological variables measured at the mesonet stations.

Station ID	Sample duration (s)	Variables measured
ccny	1	s,d,t,rh,p
cpk	1	s,d,t,rh,ppt,p
eml	1	s,d,t,rh
ewr	0.5	s,d,t,rh,p,ppt
gm1	0.1	s,d,w,tsonic
gm2	1	u,v,w (20-150m)
jfk	1	s,d,t,rh,p,ppt
lbr1	0.5	u,v
lbr2	0.1	u,v,w,tsonic
lga	1	s,d,t,rh,p,ppt
met1	0.1	u,v,w,tsonic
met2	1	u,v,w (20-150 m)
mgh1	0.1	u,v,w,tsonic

mgh2	0.1	u,v,w tsonic
opp	0.1	u,v,w,tsonic
ppz	0.1	u,v,w,tsonic
sit1	1	s,d,t,rh

Key to table 8.

d –	direction (º true North)
p -	barometric pressure (mbar)
ppt –	precipitation (mm/hr)
rh –	relative humidity (%)
s –	wind speed (m/s)
t –	temperature (ºC)
tsonic –	Sonic temperature (ºC)
u –	velocity from east (m/s)
v–	velocity from north (m/s)
w –	velocity from below (m/s)

6. DATA PROCESSING

Data were collected on the ten 3D Sonic anemometers and the two mini Sodars that were deployed during each IOP. The raw data were processed to provide 5 minute averages of the sonic anemometer data and 15 minute averages of the sodar data. Sodar data were collected from 20 – 200 m above the installation height at 10 m increments. This section describes the data processing steps and the output files that were generated.

6.1 Sonic Anemometer Data Processing

<u>Clean raw data files:</u>

Raw 3D sonic data files are described in Appendix A. Raw files are stored in the "**level0**" folder

mid_level0 -> stationID_ShortDesc -> daqID$yyyyMMdd.dat

example:
mid_level0 -> gm1_GMBldg_roof_met -> UDP01$20050821.dat

where the stationID is described above in Table 3 (e.g. gm1), the ShortDesc is an arbitrary short descriptive string, daqID is identifies the data acquisition system, in this case the laptop assigned ID UDP01, yyyyMMdd is the data of the first record in this data file. The "dat" raw files are large, about 58 MB per day. This file is a Level 0 file.

Each raw data file is first scanned to remove bad records. Bad records occur during rain or in rare cases (<0.01%) during collection by the data collection program ECCheck. The program

01_clean_all_rmy3d.pl is a PERL program that reads each record of the raw data file and discards all bad records. It can be found in the directory **mid -> sw -> rmy3d ->.** The cleaned files are saved with names like

mid_level0 -> gm1_GMBldg_roof_met -> gm1_yyyyMMdd.da1

where the "**da1**" extension identifies a cleaned raw data file. Since the only thing that has been done is to remove bad records, this is also a Level 0 data file.

Average cleaned data files:

After the raw files are cleaned of any bad records, the program **02_avg_all_rmy3d.pl** produces averages of the 10 Hz data. This program is also in the **mid -> sw -> rmy3d ->** directory. Averaging times are user-defined, but typically a 300 sec (5 min) averaging time is selected. *Note, in all cases, when averages are made, the time mark of the average is the center of the averaging period.* In the example above, the averaged data file is saved in the following way:

mid -> level1 -> meso -> gm1_GeneralMotors_met -> mid_meso_gm1_rmy3d_av300.dat

All processed data are stored the following hierarchy:

mid *(main project data set)*
  level1 *(first level of processed data)*
    meso *(IOP data subdivision, includes iop1, … iop6)*
      gm1_GeneralMotors_met *(station ID)*
        mid_meso_gm1_rmy3d_av300.dat *(5-min averaged data)*

An example of an averaged data file is given in Table 9.

Table 9 File format for 3D sonic anemometer data processed and averaged over a 5 minute period.

DATE (local std)			WSPD	VSPD	WDIR	SIGMA-THETA		U (EAST)		V (NORTH)		W (UP)	
date	jd	time	m/s	m/s	degT	Yamartino	Vector	av	stdev	av	stdev	av	stdev
2005-08-04	(216)	13:15:00,	1.91,	1.49,	170.8,	48.49,	17.63,	-0.24,	1.08,	1.47,	1.04,	0.06,	0.65,
2005-08-04	(216)	13:20:00,	2.88,	2.73,	153.6,	30.54,	4.34,	-1.21,	1.11,	2.44,	0.89,	-0.10,	0.68,
2005-08-04	(216)	13:25:00,	1.76,	1.45,	171.6,	52.30,	14.43,	-0.21,	1.15,	1.43,	0.96,	-0.05,	0.56,

where the data columns include:

date(year -month -day),

ID (modified Julian day),

time (hours:minutes:seconds) – midpoint of the averaging period,

WSPD – scalar average wind speed (m/s)

VSPD – vector average wind speed (m/s)

degT - º true North

Yamartino – The standard deviation of the wind direction as determined using the EPA approved Yamartino method.

Vector – The standard deviation of the wind direction as determined from the ratio of the vector-mean speed and the mean scalar wind speed.

U (two columns) – the mean scalar average (m/s) and standard deviation of vector wind speed from the East.

V(two columns) – the mean scalar average (m/s) and standard deviation of vector wind speed from the East.

W(two columns) – the mean scalar average (m/s) and standard deviation of vector wind speed from below.

6.2 Mini Sodar Data Processing

<u>Raw Sodar Processing</u>

HT	SPD	DIR	W	SDW	IW	GSPD	GDIR	U	SDU	NU	IU	SNRU	V	SDV	NV	IV	SNRV	NW	SNR W
200	4.93	145	-0.16	0.34	187	7.15	138	-4.44	0.32	18	174	5	2.16	0.38	11	168	5	17	4
190	5.25	136	-0.34	0.31	201	6.89	107	-5.02	0.4	12	158	5	1.53	0.48	11	160	5	24	5
180	5.29	141	-0.17	0.33	186	6.81	133	-4.9	0.31	22	173	6	1.99	0.43	14	162	6	21	5
170	5	151	-0.15	0.3	186	6.66	117	-4.26	0.38	36	195	6	2.61	0.35	22	171	6	28	5
160	4.35	135	0	0.45	210	7.14	134	-4.19	0.45	48	233	8	1.17	0.41	39	215	8	41	6
150	3.98	141	-0.11	0.39	270	9.38	79	-3.71	0.46	50	261	9	1.46	0.53	40	196	9	49	8
140	4.19	144	-0.05	0.41	304	8.83	147	-3.8	0.5	46	258	9	1.76	0.81	41	189	9	57	9
130	3.97	136	-0.06	0.4	309	7.38	99	-3.8	0.57	52	290	10	1.14	0.79	37	193	10	50	9
120	3.92	138	-0.05	0.51	372	11.18	102	-3.7	0.61	57	317	11	1.29	0.78	49	207	11	60	10
110	3.9	140	-0.06	0.51	389	7.3	139	-3.63	0.56	61	316	12	1.42	0.72	53	223	12	63	11
100	3.25	141	-0.15	0.54	401	7.16	118	-3.01	0.57	69	305	12	1.21	0.7	55	246	12	67	13
90	3.19	134	-0.06	0.52	444	6.45	101	-3.08	0.58	67	320	15	0.81	0.6	64	278	15	66	15
80	3.34	137	-0.03	0.57	495	7.11	125	-3.18	0.61	65	380	15	1.02	0.6	70	412	15	67	15
70	3.13	133	-0.03	0.6	508	8.23	87	-3.04	0.54	71	430	18	0.76	0.61	70	413	18	71	15
60	3.27	131	0	0.54	544	6.42	168	-3.2	0.49	69	404	16	0.67	0.49	72	399	16	71	18
50	2.39	119	-0.03	0.44	565	4.19	120	-2.39	0.43	72	436	19	0	0.31	72	618	19	72	18
40	2.53	116	-0.11	0.25	802	3.84	115	-2.52	0.42	72	600	22	-0.13	0.18	72	1268	22	72	25
30	2.95	123	-0.09	0.24	1434	5.79	121	-2.95	0.49	72	778	21	0.21	0.05	72	4509	21	72	20
20	2.55	95	-0.04	0.09	4912	4.5	102	-2.33	0.43	71	1159	16	-1.05	0.15	72	4191	16	72	23

The mini Sodar Acoustic Signal Processor (ASP) produces binary data that is stored and collected from the sodar on a regular basis. The binary records are processed by a program called **SodarPro** to produce raw ASCII data files. The ASCII data files are stored in the level0 data folder as (for example):

mid_level0 -> gm2_GMBldg_roof_sodar -> 050820dv.dat

where the previously described folder/file nomenclature is followed. The raw ASCII data file name has the yyMMdd to identify the data set. The SodarPro program divides the data into individual days.

The sodar dv files are organized in “data tables” showing all setup data and the measured winds at each level for each time. Table 10 shows an example of the data table.

Table 10 mini Sodar data table

```
GM1     08/20/2005 00:05:03 TO 08/20/2005 00:10:02 VR3.14  4500   800   100    90    20     0     0
300 10 15 5 -120 0 10 5 64 960 6 5 5 -800 800 -800 800 -800 800 1 10 29 500 68 1 19 7 0 0 0 10 2
3 COMPONENT 19HTS ZENITH 16-16 ARA 029 SEPANG 090 MXHT     0 UNOISE   122 VNOISE   144
                    WNOISE   157 ANTENNA STATUS:   OK AC STATUS: OFF BATTV  3.970
```

where the first three lines are the setup data and include the date and time period of the measurement (8-25-05 from 00:05:03 to 00:10:02) (the third line is wrapped in this example) used by the code, the fourth line is a header and each elevation level follows from the highest to lowest. A complete description of the header data is presented in Appendix A.

In the processing we convert the raw ASCII data files to raw time series files using a PERL program **a01_read_sodar_dat.pl** which produces time series ASCII data files that have the sodar wind data for each individual level. In this way, we can process sodar data exactly as if it were made by an individual anemometer magically held at the level. This program is found in the directory **mid -> sw -> sodar ->.** A time series data file is labeled

mid_level0 -> gm2_GMBldg_roof_sodar -> gm2_30.dat

where the data file name includes the station name and the sodar level (30 m in this example). These files are used to generate the time series average files and are not presented in the data package.

Note the wspd/wdir in the sodar wind table and in the time series ascii files are computed by the sodar using the u, and v, wind directions and the sodar alignment angle shown in the table header. The alignment angle is set in the installation configuration file and is shown in header line 3 following the string "ARA". The time series file is a simple translation of the sodar raw ASCII wind tables. No data processing or calibrations are applied to the data in the time series files.

6.2.1 Averaging the Sodar Time Series Data

The time series data files are averaged with the PERL program **a02_sodar_dat_avg.pl.** this file is stored in the directory **mid -> sw -> sodar ->**

The program produces level1 data files such as:

mid -> level1 -> meso -> gm2_GMBldg_sodar -> gm2_030_av900.dat

where the sodar wind level and the averaging time are shown in the file name (30 m and 900 sec in this example.

```
Program: a02_sodar_dat_avg
Version: 2.1
EditDate: 2005/11/22
Runtime 2005-11-22 (326) 21:47:33
platform: BNL
expname: mid
iopname: meso
sitename: gm2
sensorname: 30
datapath: /Users/mike/data/urban
rawpath: /Users/mike/data/urban/mid/level0/gm2_GMBldg_roof_sodar
```

```
rawid: _30.dat
outpath: /Users/mike/data/urban/mid/meso/gm2_GMBldg_sodar
avgsecs: 900
timezone: -5
MaxSamps: 2e+20
Nsamp_min: 1
missing: -999
snr_threshold: 5
rotation: 29
StartTime: 2005,8,1,0,0,0
EndTime: 2005,9,30,0,0,0
------------------------------------------------------------------------------------------------------------------------------------
   DATE (local std)          WSPD  VSPD  WDIR   SIGMA-THETA   U (EAST)        V (NORTH)     W (UP)
                               m/s   m/s   degT   Yamartino Vector  av      stdev   snr     av      stdev   snr     av      stdev    snr
--------------------------------------------------------------------------------------------------------------------------------
2005-08-19 (231) 17:15:00,   4.60,   4.39,  138.7,  16.67,   3.69,  -2.89,   1.11,   11.3,   3.30,   0.82,   11.3,   0.40,   0.92,   13.2
2005-08-19 (231) 17:30:00,   3.88,   3.86,  125.7,   5.68,   0.42,  -3.13,   1.17,   11.0,   2.25,   0.89,   11.0,   0.57,   0.93,   13.3
2005-08-19 (231) 17:45:00,   4.74,   4.73,  124.4,   3.75,   0.16,  -3.90,   1.26,   11.0,   2.67,   0.75,   11.0,   0.32,   0.97,   12.7
```

This file has an extensive header which provides information on the data processing. The time mark is the time at the center of the averaging period. WSPD is the scalar wind speed. VSPD and WDIR are vector averaged wind speed and direction based on the wind vector. In processing, the ‘Av_u’ and ‘Av_v’ columns of the raw time series files are rotated by the ARA angle described above and this vector is used to compute the average U and V columns and the vector averaged VSPD and WDIR columns. Sigma-theta by the Yamartino method uses unit vectors from the raw u and v data and sigma-theta by the vector method uses the ratio of vector speeds, VSPD to WSPD.

Techniques for removal of sporadic errors have been provided by Fleming (Fleming and Hill, 1982) and Taylor(Taylor, 1982). The Chauvenet’s Criterion method was used to reject outlying points. Noise in the SODAR data occurs often as sporadic bursts which are effectively removed by the Chauvenet’s criterion, described above. Occasionally an averaging time block will be primarily “bad” data and in this case Chauvenet’s criterion fails to work properly because it will remove the good data points which are in a minority. An ad hoc method was developed from trial and error. When an averaged block is dominated by noise, the resulting value of the vector mean speed,Sv, tends to jump significantly from surrounding good data. An example time series might be Sv = {. . , 1.45, 1.96, 2.21, 22.34, 15.55, 1.45, 1.98, . . .}. The final cleaning process compares the current value of Sv with the previous value. If the time gap since the last good block is less than 2 hours and if the difference between Sv(now)-Sv(last) < 10 m/s, then the block is recorded, otherwise it is rejected. This last procedure removes almost all of the sporadic periods of noise. The final output table contains only the data that has padded the quality assurance checks.

Table 11 Results from the three-step cleaning process for SODAR wind time series from different levels above the roof.

Z	N	Nerror	% bad
20	42596	1105	3
40	42596	3817	9
60	42596	7767	18

The SODAR deployment period was 471.4 days and during this time the data recovery was 94.1%. Outages were due to software crashes and a power failure. Of the recovered data, the number of bad winds, Nerror, varied from 3% at 20 m to 18% data loss at 60 m.

7. Equipment Quality Assurance Tests

Equipment were installed and used following manufacturers specifications. However, it is difficult to determine the quality of the data. One approach that provides confidence in data quality is comparison between outputs of instruments that are collocated. For this reason, comparisons were done between the mini Sodar and 3D Sonic anemometers on the rooftops at Met Life and the General Motors buildings.

Although the mini Sodar provides wind data at elevations of 20 – 200 m and the anemometer provides data at 6 m, the general wind directions should be consistent. Wind velocities should be slightly less at the lower elevations. Figure 6 contains eight graphs of the 15 minute averaged wind data taken during the field campaign. The top row of three graphs are mini Sodar wind velocity comparisons between 20 – 40 m, 30 – 40 m, and 40 – 60 m. Beneath this are three graphs for the comparison of the wind direction at these three elevations. The bottom two graphs in the Figure are the comparison of wind speed and direction from the mini Sodar (red) at 40 m and the sonic anemometer (blue).

The wind speeds shown in Figure 6 at 20 and 30 meter elevations were substantially lower than at 40 m. In addition the wind directions were much different at the lower elevations as compared to 40 m. This suggests that the lower elevation data from the sodar are not representative of the regional winds. The comparison of sodar data at 40 and 60 meters is much better. Both the wind speed and directions are closely aligned. Considerable differences were found between the wind directions from the anemometer and the sodar located on the Met Life building, Figure 6. A quality assurance check was performed on the software used to process both data streams. The processing programs were checked on a step-by-step basis and compared with hand calculations. Both the anemometer and sodar processing programs were demonstrated to be operating correctly.   This further supports the finding that the sodar wind data below 40 m are not representative of the winds in the area. After verifying the software, comparison plots of sodar and anemometer data were made for short time blocks throughout the time series.

Figure 7 is identical to Figure 6 except the data are from the mini Sodar and anemometer on the roof top of the GM building. In this case, the wind speed and direction compare as expected at all three elevations. The mini Sodar data at 40 m and the sonic anemometer data are consistent at this site.

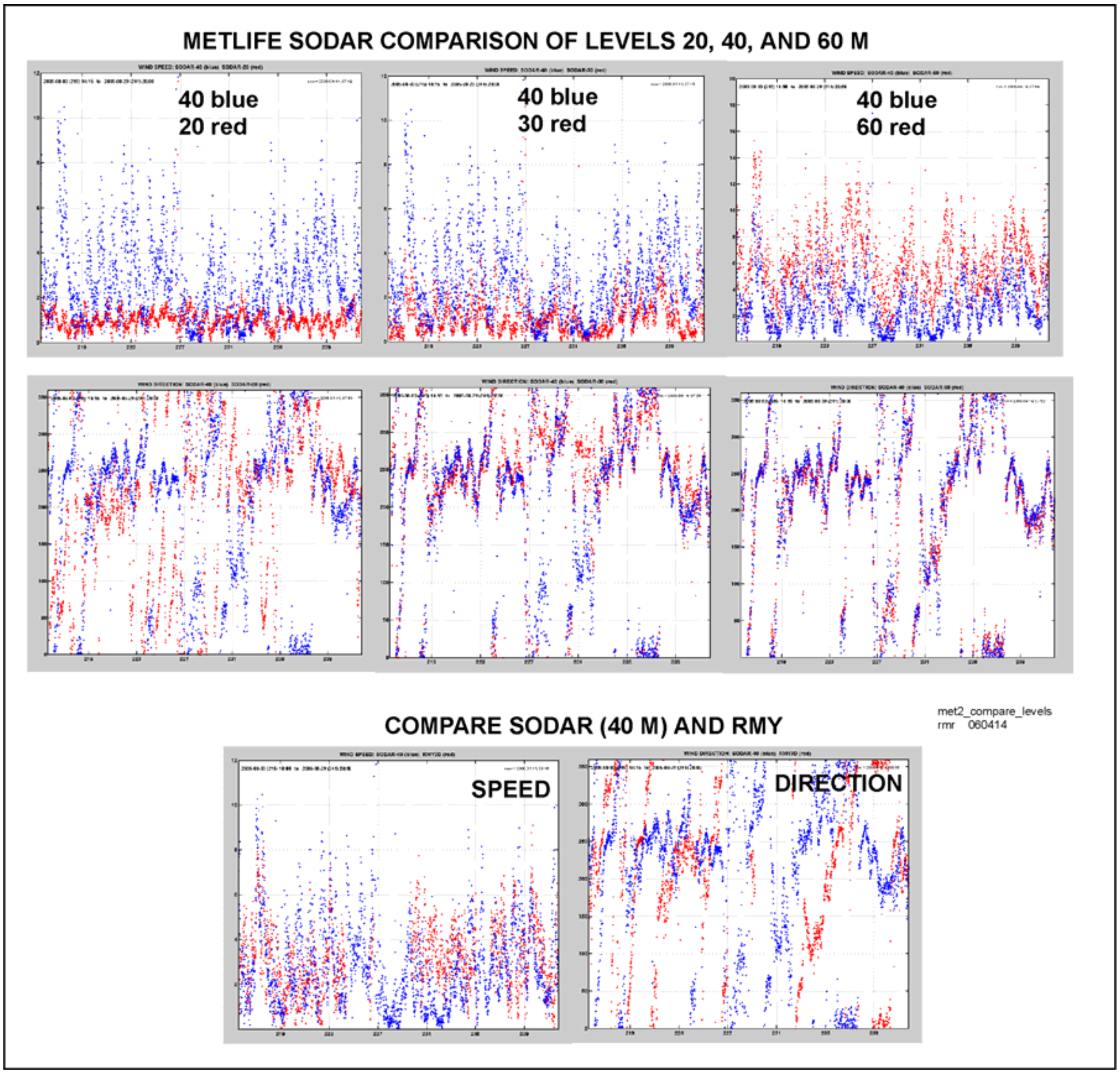


Figure 6 The mini Sodar and wind measurements from the MetLife building roof.
The sodar 40-m level is used as a standard for comparison here. The 40-m measurements are shown in blue. In the top two rows the sodar wind speeds and directions at 20, 30, and 60 m are compared to the 40-m level. The bottom row compares the speed and direction of the sonic anemometer (red)to the sodar 40-m level (blue). All of these data are 900 sec (15 min) averages.

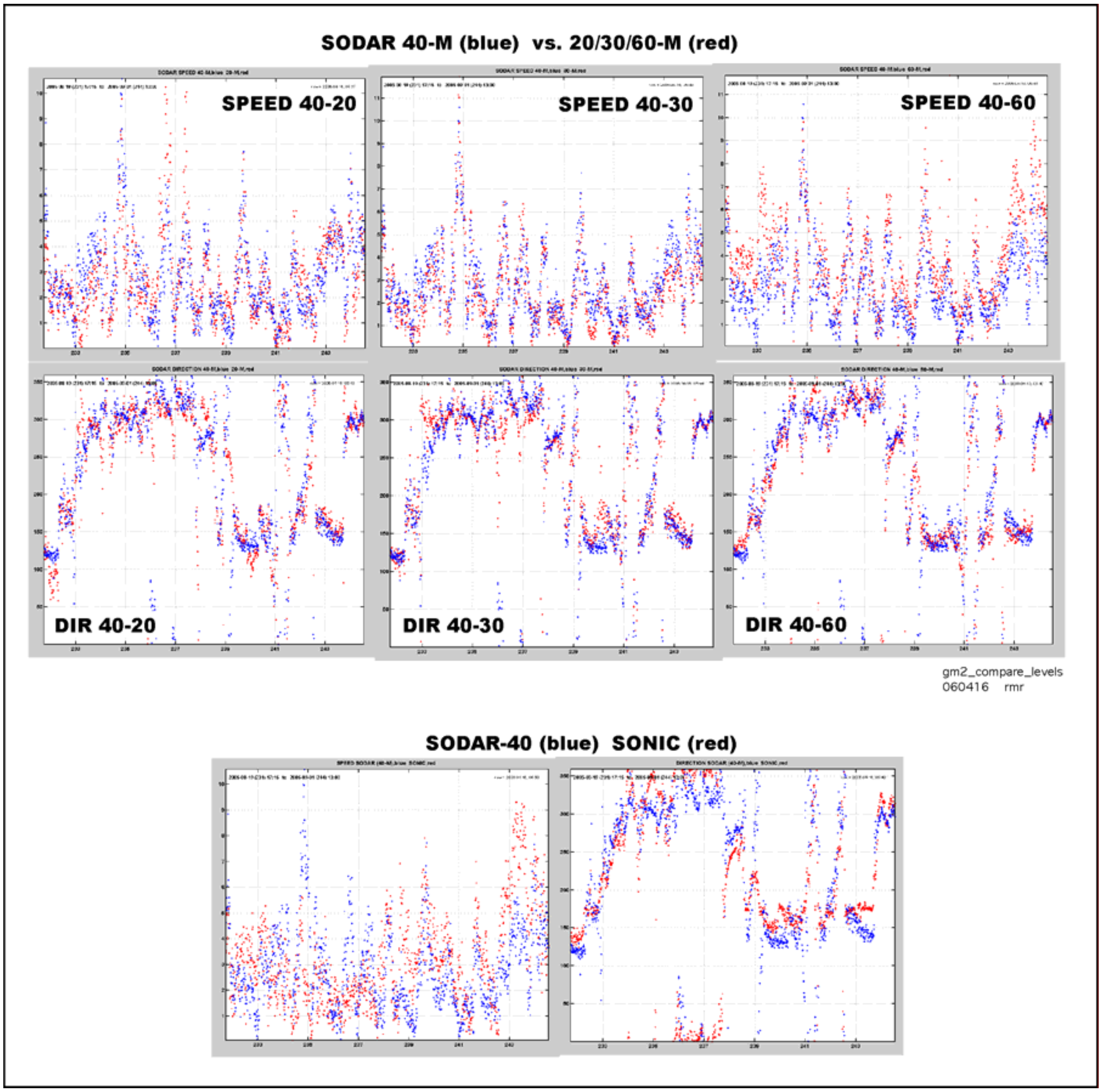


Figure 7 The mini Sodar and wind measurements from the General Motors Building (gm) roof. The sodar 40-m level is used as a standard for comparison here. The 40-m measurements are shown in blue. In the top two rows the sodar wind speeds and directions at 20, 30, and 60 m are compared to the 40-m level. The bottom row compares the speed and direction of the sonic anemometer to the sodar 40-m level. All of these data are 900 sec (15 min) averages.

7.1 Windrose Intercomparison at Mesonet Stations

Figure 8 is a compilation of simple wind roses for stations in the mesonet array during the MID05 test period in the month of August, 2005 for 16 different direction bins. Wind roses are presented for the ASOS stations at Kennedy Airport (JFK) and LaGuardia airport (LGA); roof top 3Dsonic anemometers at One Penn Plaza (OPP), Metropolitan Life Building (MET1), Park

Plaza (PPZ), General Motors Building (GM1) and the McGraw Hill building (MGH1); and mini Sodars at 60 m above the roof top at Metropolitan Life (MET2) and General Motors (GM2) buildings. The wind rose shows the percentage of time that the wind is blowing from one of the 16 direction bins. Wind speeds are color coded with the inner red region representing 0 – 3 m/s, the white region is 3 – 7 m/s, and the outer red regions is >7 m/s. In some cases the percentages do not add up to 100% because of equipment failures that occurred during the month (heat problems). Nevertheless, one can see a tremendous scatter in the wind directions at the different stations. This highlights the need for very localized data to accurately predict dispersion in urban environments..

The ASOS stations at JFK and LGA airports are consistent and show a dominant southerly wind. The LGA station also shows a sea/land breeze related to flow in and out of Long Island Sound. Examining the figure it is clear that the wind patterns at these two airport ASOS stations are considerably different than the Manhattan Mesonet stations.

The raw data sets were carefully checked to assure that the instruments were installed correctly and that the data processing was done properly. The exact same processing software was used in the BNL meteorological field comparisons (section 7.2) and the results there were quite good (average wind speeds within 0.1 m/s and wind direction within 2º).

The miniSodar data shown in Figure 8 are from time series of winds at the 60 m range gate. Comparison with the wind roses at 40, 50, and 70 m show similar and consistent results. The comparison between **MET1** (MetLife building 6-m tower) and **MET2** (MetLife building miniSodar at 60 m) is somewhat similar. However, they are dissimilar enough as to call into question the value of roof stations as a predictor of higher level winds. The comparisons of

GM1 (General Motors building rooftop) and **GM2** (General Motors building sodar at 60 m) are different as discussed above.

The 3D sonic rooftop wind direction measurements from OPP, PPZ and GM1, are generally similar showing, roughly, a N-S preference and a dominant southerly flow.

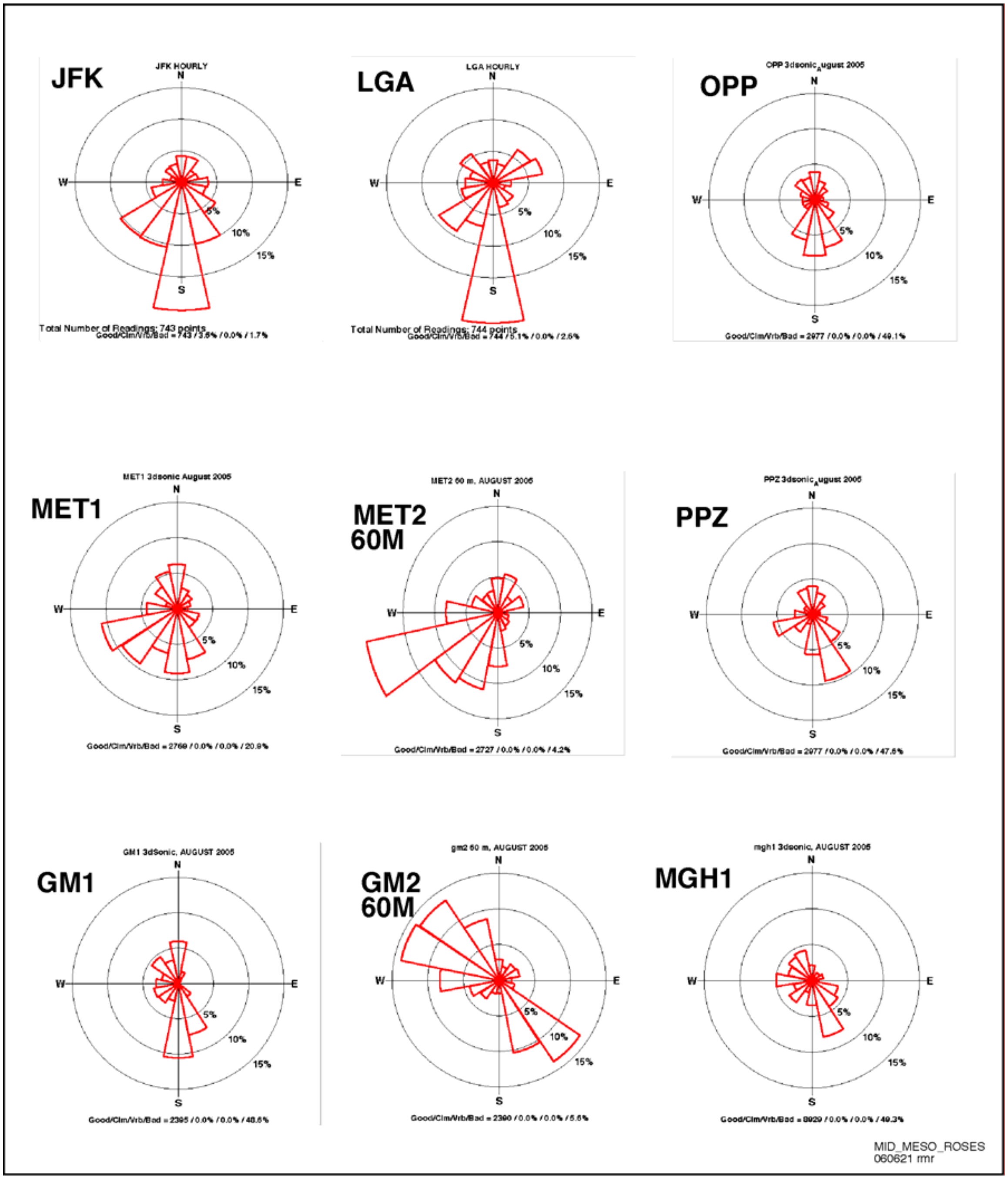


Figure 8 Directional Wind Rose from nine mesonet stations in August 2005.

7.2 Wind Intercomparisons in the BNL Meteorological Field

7.2.1 Field Comparisons of the mini Sodar at BNL

A mini Sodar has been evaluated through comparison of measurements made at the BNL meteorological tower. The BNL meteorological tower has calibrated anemometers at heights of 10 m and 88 m. The sodar was placed in the meteorological field approximately 100 m from the base of the tower. A comparison of the winds is shown in the figures below:

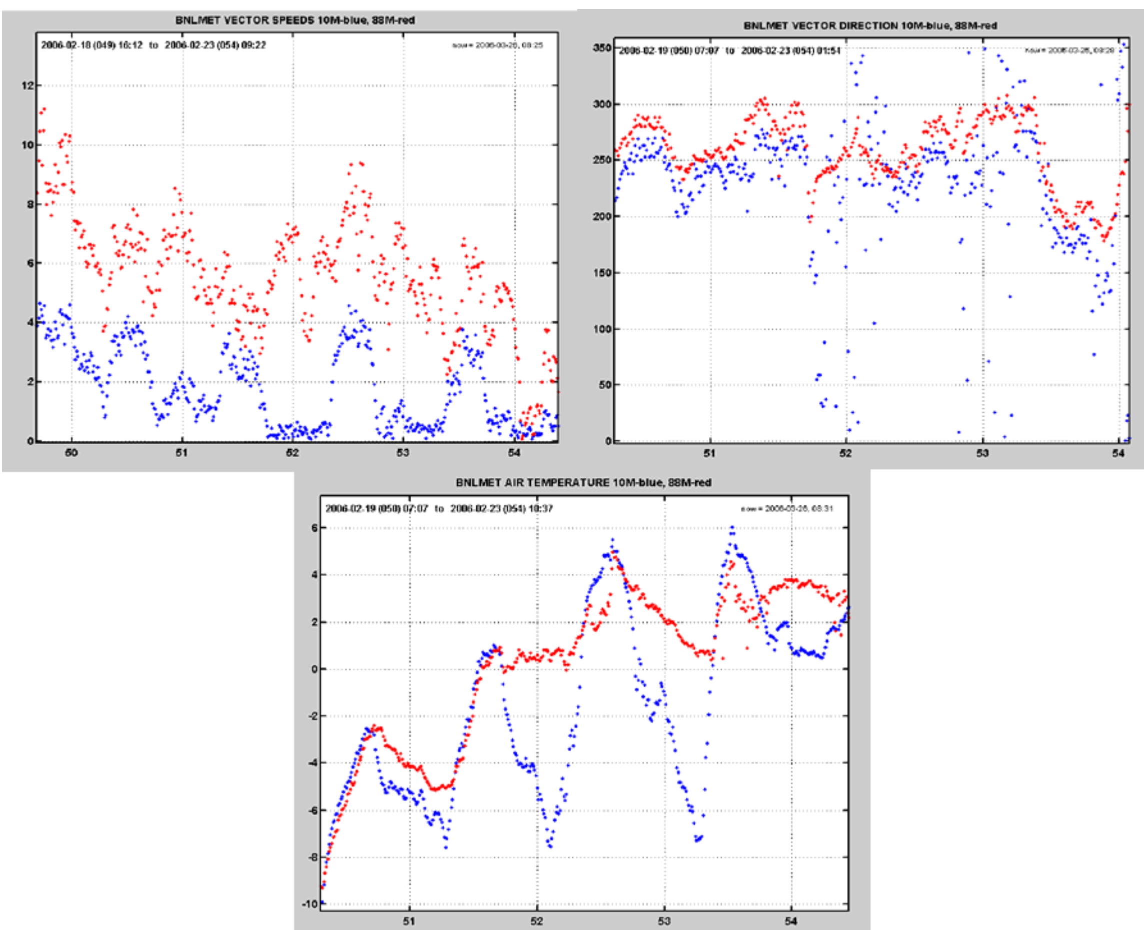


Figure 9 The vector speed, vector direction, and air temperature at 10 m (blue) and 88 m (red) from the BNL meteorological tower.

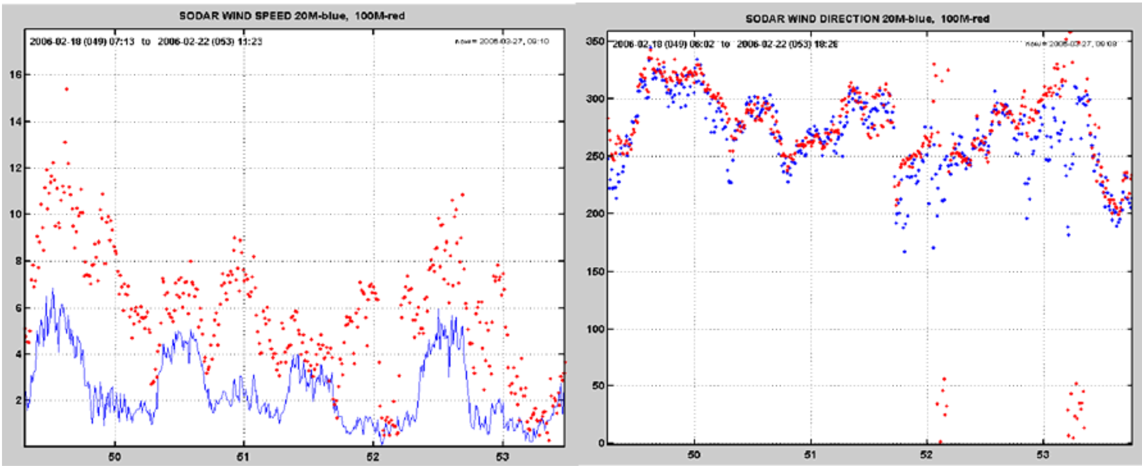


Figure 10 Wind speed and direction measured by the mini Sodar at 20 m (blue) and 100 m (red).

Prior to field deployment the new ASC miniSodar (called SODAR-2) was operated in the BNL meteorological field (BNLMET) from June 21 – June 30, 2005 where the 90 m tower collects precise wind measurements at 10 m and 88 m. The sodar averaged wind profiles for two minutes. BNLMET data are sampled at one hertz and the data acquisition system makes one minute averages.

The sodar data were processed with the same processing routines as used for the Manhattan study on the General Motors building (**gm2**). Nine hundred second averages, 15 minutes, were calculated of the wind speed and direction at 10 m intervals from 20 m to 200 m. Figure 11 compares data from three levels, (20 m, 40 m, and 90 m) with the tower wind measurements taken from the 88 m level. The wind roses consider three groups, 0 – 3 m/s (red near center of the figure), 3 – 7 m/s (white regions), and > 7 m/s red in the outer region of the circle. The figure demonstrates that the comparison between the 90 m sodar and the 88 m tower wind roses is quite good. The wind roses from lower levels show the expected effects of friction and summer time nocturnal inversions. The sodar data file header below shows the processing parameters.

SODAR2 DATA AVERAGING HEADER

```
a02_sodar_dat_avg.pl (Ver: 105, 060625)
Runtime 2006-06-25 (176) 12:45:56
platform: BNL
expname: mid
iopname: field
sitename: sodar2_0602
height: 40
datapath:
rawpath: /Volumes/hd2/data2/sodar/sodar0602/level0
Raw file name ID: _040.dat
outpath: /Users/mike/data/urban/mid/level1/field/sodar2_0602
avgsecs: 900
timezone: -5
MaxSamps: 1e+20
Nsamp_min: 1
missing: -999
snr_threshold: 5
rotation: -78
StartTime: 2006,02,10,11,00,00
EndTime: 2006,03,15,15,00,00
Record times are the center of the averaging time.
Time is in Eastern Standard Time.
Height is the center of the range gate.
Comments:
  This series was an evaluation of the performance of one of the two new
 miniSodar systems before deployment in the Manhattan mesonet.  This
 sodar was deployed on the GM building (station gm2) during the UDP
 experiment "mid-05".
 060625-rerun program with rotation = -78 deg. This represents a
 correction of -90 and an axis rotation of 12 deg, from MagN to
 TrueN.  When I apply this angle, the sodar agrees almost exactly
 with the BnlMet tower data at 88 m.
```

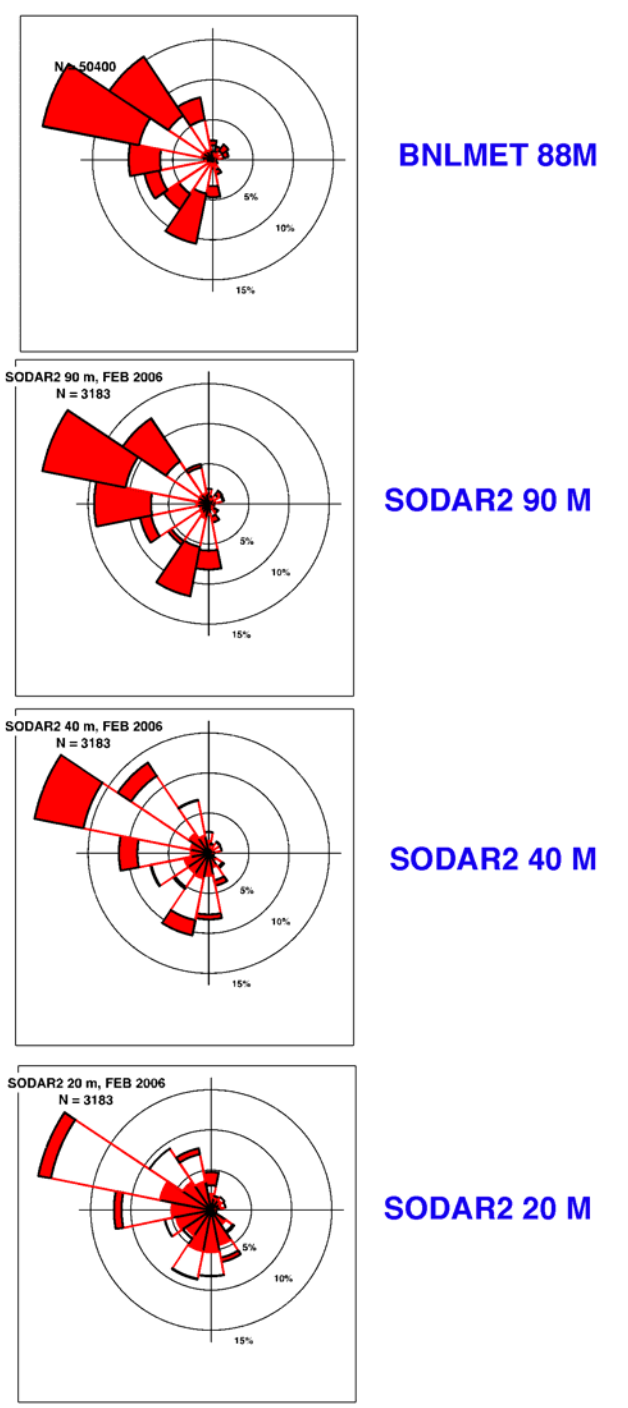


Figure 11 Comparison of Wind Speed and Direction for the miniSodar at 20, 40, 60, and 90 meters and the BNL meteorological tower at 88 m.

7.1.2 Side-by-side comparison of 3D Sonic Anemometers

After the field campaign in August 2005, the 3D Sonic anemometers were brought back to BNL. In September, these instruments were tested at the BNL meteorological field in a side-by- side comparisons over several days. Four series of tests were completed based on when the instrumentation was returned. In general, one or more instruments were used in more than one series to provide a measure of consistency between tests. Figure 12 plots the mean speed and mean direction of each group. This was a mid-summer exercise and the winds were generally weak and showed strong nocturnal variability. Average wind speeds for the days tested ranged from 0.3 m/s to 1.4 m/s. Table 12 compares the deviation from the group mean speed and direction based on 5 minute averages. The horizontal speed and direction are compared in this analysis. In almost all cases, each anemometer agreed with the group mean by, <0.1 m/s in speed and by < 2 deg in direction. Note the direction bias is dependent on proper alignment during installation. A few instruments showed high standard deviations about the mean in wind direction.

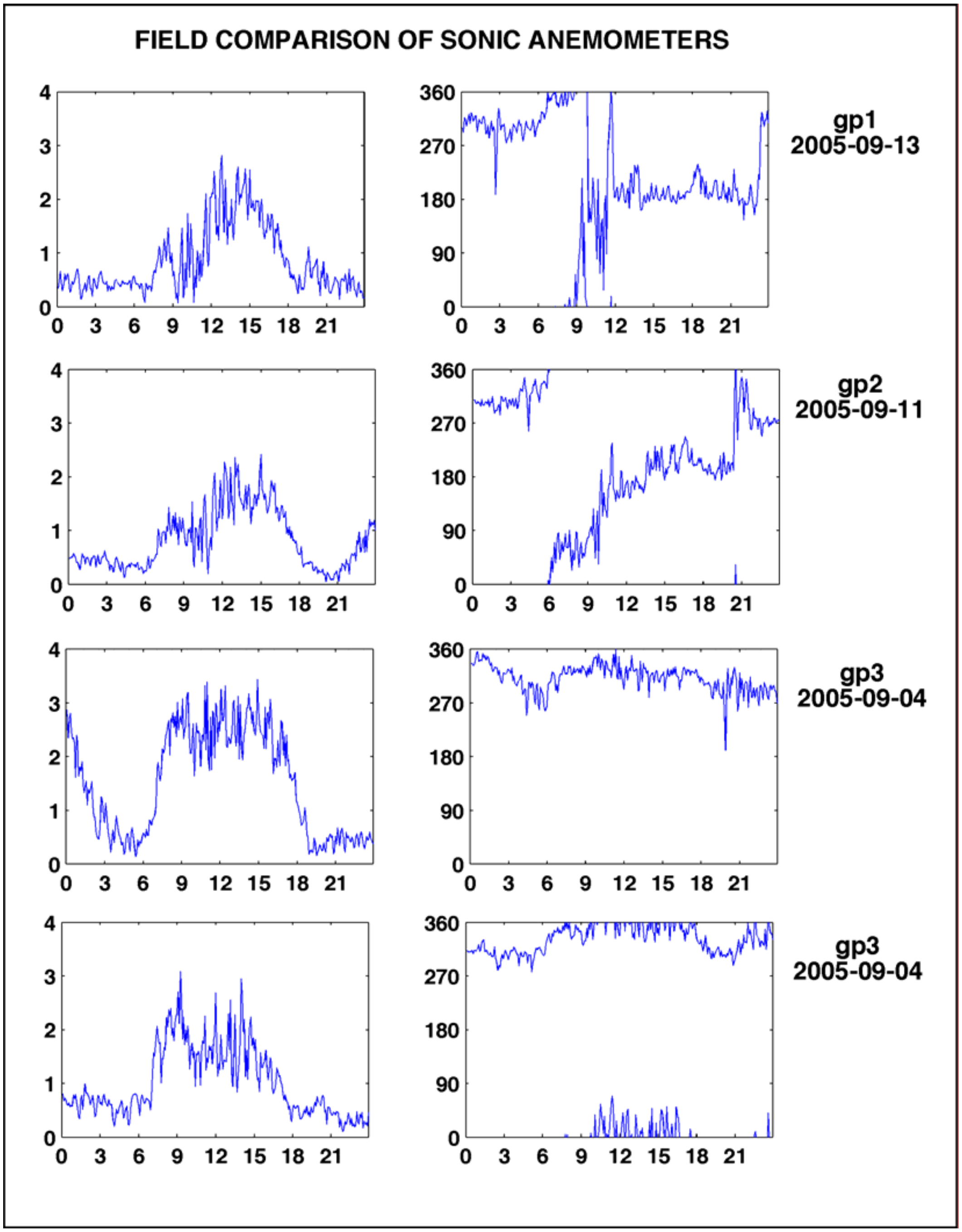


Figure 12 The group mean wind speed (left column) and direction (right column) during each of the intercomparison periods.

Table 12 The mean bias and standard deviation for each sonic anemometer during the four-part field test.

GROUP: GP1   MEAN VEL: 0.4 m/s, 204.1 degT
START: 20050913, 000000, STOP: 20050913,235500, Npts = 288

	Wind Speed		**Wind Direction**	
RMY SN	BIAS	STD DEV	BIAS	STD DEV
SN 320	0.039	0.100	-0.1	15.7
SN 358	0.039	0.118	-0.1	14.4
SN 362	0.061	0.110	1.0	15.5
SN 363	0.055	0.108	1.1	14.5
SN 364	-0.027	0.230	0.7	24.6
SN 365	0.064	0.107	0.3	14.0
SN 366	0.056	0.253	-1.1	26.8
SN 367	0.062	0.110	-1.7	16.5
SN 597	0.017	0.094	-1.4	14.7
SN 607	0.017	0.512	5.1	53.0

GROUP: GP2   MEAN VEL: 0.3 m/s, 194.3 degT
START: 20050911,000000, STOP: 20050911,235500, Npts = 288

	Wind Speed		**Wind Direction**	
RMY SN	BIAS	STD DEV	BIAS	STD DEV
SN 595	0.066	0.235	-3.0	23.8
SN 602	0.055	0.241	-2.8	23.9
SN 608	0.087	0.341	7.0	35.9

GROUP: GP3   MEAN VEL: 1.4 m/s, 320.4 degT
START: 20050901,000000, STOP: 20050901,235500, Npts = 288

	Wind Speed		**Wind Direction** RMY SN B	
RMY	BIAS	STD DEV	BIAS	STD DEV
SN 358	0.055	0.108	-1.0	5.5
SN 601	-0.046	0.521	-2.5	23.4
SN 606	0.004	0.139	-0.5	7.4
SN 610	0.010	0.106	-0.1	5.3
SN 611	0.003	0.100	0.8	5.4
SN 614	0.032	0.110	-0.5	5.6
SN 621	0.046	0.108	-1.1	5.6

GROUP: GP4   MEAN VEL: 0.9 m/s, 343.3 degT
START: 20050904,000000, STOP: 20050904,235500, Npts = 288

	Wind Speed		**Wind Direction**	
RMY SN	BIAS	STD DEV	BIAS	STD DEV
SN 320	0.009	0.109	-0.4	7.0
SN 358	0.026	0.124	-0.3	8.0
SN 364	0.094	0.178	-0.0	8.3
SN 598	-0.023	0.104	-1.0	7.5

SN 608	0.014	0.438	3.1	26.3
SN 616	0.013	0.110	0.5	6.6

Table 12 shows that some of the 3D sonic anemometers exhibit a large standard deviation in the wind direction. For example, machines SN 607 in group 1, SN 608 in group 2 and 4. Further examination of the performance of these machines is presented in Figure 13 which contains a comparison of the difference between the mean wind direction of the group and the wind direction of three individual instruments, SN 320, SN 364, and SN 607. From table 12, the mean direction 204º true North and instrument SN 607 had a bias of 5.1 and standard deviation of 53º. This is considerably more scatter than the others and this is evident in Figure 13. This suggests that values for wind speed and direction can be viewed with high confidence for instruments SN 320 and SN 364, while this is not the case for instrument SN 607. Based on the data in Figure 12, the performance of instruments SN 601 and SN 608 are also suspect.

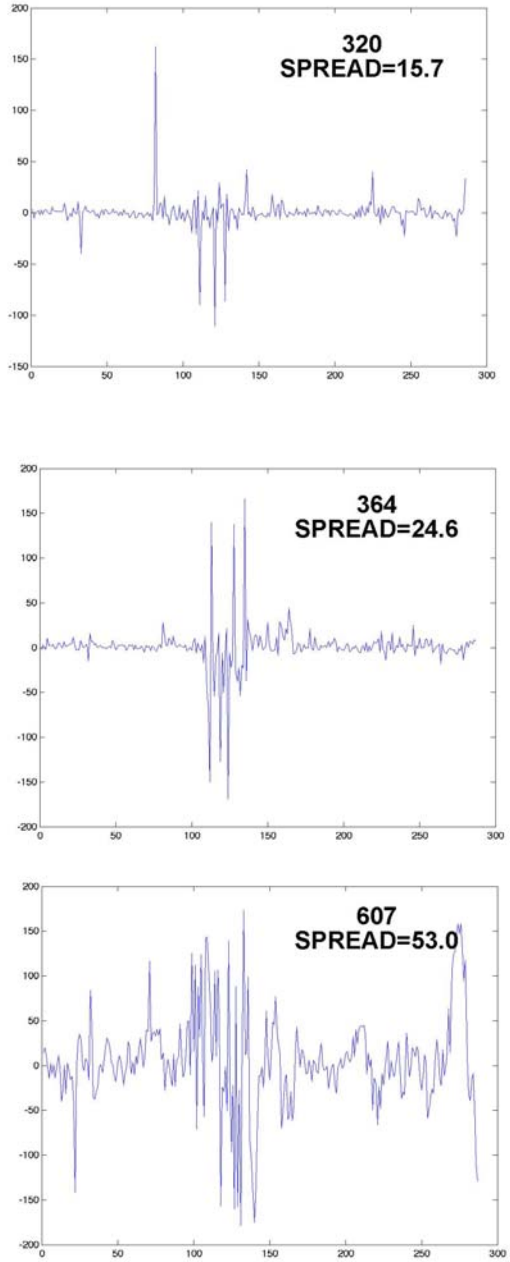


Figure 13 Comparison of measured wind direction to the group mean wind direction for instruments SN 320, SN 364, and SN 607 in group 1.

Appendix A: LEVEL 0, TOP LEVEL FOLDERS

Each instrument used in the MID05 has a level 0 folder containing all of the raw data collected during the field campaign. A listing of all of the folders in the level 0 folder is shown below.

```
                        Date         Folder Name
   4 rmr  rmr    136 Oct 27  2005 ccny
   4 rmr  rmr    136 Oct 27  2005 cpk_Central_Park_asos
   3 rmr  rmr    102 Oct 27  2005 eml_nyc002
   4 rmr  rmr    136 Oct 27  2005 ewr_NewarkAirport_asos
  54 rmr  rmr   1836 Oct 27  2005 gm1_GMBldg_roof_met
  16 rmr  rmr    544 Oct 27  2005 gm2_GMBldg_roof_sodar
   5 rmr  rmr    170 Oct 27  2005 hpn_airport_asos
   4 rmr  rmr    136 Oct 27  2005 isp_IslipAirp[ort_asos
   3 rmr  rmr    102 Oct 27  2005 jfk_KennedyAirport_asos
   4 rmr  rmr    136 Oct 27  2005 lbr1_BldgA_roof
  49 rmr  rmr   1666 Oct 27  2005 lbr2_LehmanBros_setback
   3 rmr  rmr    102 Oct 27  2005 lga_laguardia airport_asos
  63 rmr  rmr   2142 Oct 27  2005 metl1_met
  33 rmr  rmr   1122 Oct 27  2005 metl2_sodar
  41 rmr  rmr   1394 Oct 27  2005 mgh1_McGrawHill_roof
  59 rmr  rmr   2006 Oct 27  2005 mgh2_McGrawHill_setback
  60 rmr  rmr   2040 Oct 27  2005 opp_OnePennPlaza_roof_met
  84 rmr  rmr   2856 Oct 27  2005 ppza_ParkPlaza_roof
  16 rmr  rmr    544 Oct 27  2005 s1
  16 rmr  rmr    544 Oct 27  2005 s10
  10 rmr  rmr    340 Oct 27  2005 s11
  10 rmr  rmr    340 Oct 27  2005 s12
  10 rmr  rmr    340 Oct 27  2005 s2
  17 rmr  rmr    578 Oct 27  2005 s3
  17 rmr  rmr    578 Oct 27  2005 s4
  17 rmr  rmr    578 Oct 27  2005 s5
  12 rmr  rmr    408 Oct 27  2005 s6
  16 rmr  rmr    544 Oct 27  2005 s7
  19 rmr  rmr    646 Oct 27  2005 s8
  16 rmr  rmr    544 Oct 27  2005 s9
   4 rmr  rmr    136 Oct 27  2005 sit_Stevens_HoweCenter
```

The level 0 folder contains all of the raw data that are collected from the following sources:

ASOS: (cpk, ewr, hpn, isp, jfk, lga): NOAA automated weather stations. The raw file here has a name such as cpk2005 which has data from 1 Jan 2005 to 1 Sep 2005 which covers both the MSG and MID experiments. The header of the ASOS file is shown below

```
Station: cpk
Year: 2005
Time correction: 0
```

```
                                           wdir
Date         JD   Time           wspd(m/s) (degT) tair(C) tdew(C)  rh(%)slp(hPa) ppt(mm)
2005-01-01 (001) 00:51:00,  5.7,    230,   11.1,    5.6,     69, 1016.8,   0.0
2005-01-01 (001) 01:51:00,  3.6,    240,   11.1,    5.6,     69, 1016.8,   0.0
2005-01-01 (001) 02:51:00,  4.1,    240,   11.1,    5.6,     69, 1016.8,   0.0
2005-01-01 (001) 03:51:00,  4.1,    240,   10.6,    5.6,     71, 1016.8,   0.0
```

ASOS records are reported hourly, typically at 50 minutes after the hour, and are a five-minute average of the measurement suite. The file contains columns for the date, Julian date, time (EST), wind speed (m/s), wind direction (True North), air temperature (ºC), dew point temperature (ºC), barometric pressure (kPa), and precipitation (mm).

BNL Rooftop and Setback Sonics (gm1, lbr2, metl1, mgh1, mgh2, opp, ppza): BNL installed seven sonic anemometer stations on roof tops and setbacks. These are all identical instruments collecting three components of wind and the sonic temperature at a 10 Hz sampling rate.

There are two file types in this folder. The original files have names such as UDP01$20050805.dat where the first five characters designate the data acquisition computer and the last eight are the starting date for the file.

The second type of file has a form such as gm1_20050826.da1 where the location is identified along with the date. These files called the “da1” files are exactly the same as the first type but the data here are cleaned and any short records are removed. The header and a few data lines for the da1 files is given below:

PROGRAM rmy3d_clean_v3b.pl (ver v3b, 0509030): requires two arguments. The program reads each raw data file and combs through for short data lines. Experience indicates that at worst, we get about 0.3% bad data lines. When short lines occur several other lines are lost completely. Spike values are also bad lines with missing data. All short or bad lines (spikes) are removed from the file.

```
v3a 050928 rmr -- modify input to binary and set up for DOS-generated
    raw data files.  Output files are Unix format (\cJ) end-0f-line.
v3b 050930 rmr -- check for non numeric spike values.
2005-08-26 00:00:25.09 01   -1.38  -3.65   0.54 343.80   20.16   0
2005-08-26 00:00:25.19 01   -0.64  -3.29  -0.18 343.80   20.16   0
2005-08-26 00:00:25.29 01   -0.55  -3.24  -0.03 343.76   20.11   0
...
```

<u>BNL Rooftop Sodar Stations</u> (gm2, metl2): Two mini Sodar systems were deployed on two different rooftop locations in Midtown. The raw data from the sodar system is organized in daily files with names such as 050807dv.dat which gives the date as yyMMdd as the file name.

The data in the raw files are organized into data tables. A new data table is created at the end of each averaging period (1 minute) for this experiment. A typical table is shown here (pardon the small print). Header information follows.

BNLSD 03/15/2006 00:01:10 TO 03/15/2006 00:02:01 VR6.25 4500 800 100 50 10 0 0 MXHT 80 ITOP 90 STABILITY Neutr

120 10 15 5 -120 0 10 5 64 960 6 5 5 -800 800 -800 800 -400 400 1 10 116 500 68 1 19 7 0 0 0 10 2

3 COMPONENT 20HTS ZENITH 16-16 ARA 116 SEPANG 090 MXHT 0 UNOISE 22 VNOISE 22 WNOISE 32 ANTENNA STATUS: N/A AC STATUS: N/A

HT	SPD	DIR	W	SDW	IW	GSPD	GDIR	U	SDU	NU	IU	SNRU	V	SDV	NV	IV	SNRV	NW	SNRW
200	99.99	9999	-0.06	0.25	33	99.99	9999	-5.19	2.32	2	22	4	99.99	99.99	0	23	3	2	13
190	99.99	9999	0.34	0.62	36	99.99	9999	-3.89	1.04	3	25	4	99.99	99.99	0	22	3	7	13
180	16.08	298	-0.07	0.43	37	16.70	304	0.60	1.06	5	24	4	16.07	0.00	1	22	3	7	13
170	2.80	334	0.35	0.39	36	2.84	257	1.73	0.60	3	26	4	2.20	0.00	1	23	4	10	16
160	10.54	307	-0.03	0.67	45	14.04	317	2.00	1.07	6	28	5	10.35	0.30	3	23	4	13	17
150	7.39	294	0.00	0.60	42	12.62	288	-0.26	2.56	12	32	6	7.39	0.48	9	29	6	12	17
140	6.90	303	0.06	0.48	48	10.75	311	0.88	0.68	10	36	7	6.84	0.57	12	35	7	13	17
130	7.29	282	0.21	0.49	52	9.15	291	-1.76	0.85	13	48	9	7.07	0.93	11	35	7	13	22
120	6.37	280	0.03	0.73	54	8.78	272	-1.75	0.71	13	56	11	6.12	0.54	13	44	9	13	16
110	5.81	276	0.05	0.62	74	9.40	257	-2.03	0.43	13	68	12	5.44	0.66	12	50	9	13	22
100	6.01	266	0.21	0.88	81	9.61	276	-3.00	0.61	13	67	14	5.21	0.76	13	57	11	13	27
90	5.13	292	0.21	0.73	125	13.20	324	-0.34	2.47	13	80	14	5.12	0.66	13	81	13	13	30
80	5.38	264	0.18	0.79	109	8.02	281	-2.88	0.82	13	101	13	4.54	0.73	13	101	16	13	27
70	5.39	266	0.22	0.81	157	7.52	274	-2.73	0.79	13	175	18	4.65	0.57	13	121	15	13	32
60	6.12	280	-0.02	0.91	176	8.91	288	-1.72	0.62	13	208	18	5.87	0.53	13	169	19	13	24
50	5.51	287	-0.21	0.73	242	8.47	270	-0.90	0.63	13	295	19	5.44	0.57	13	209	19	13	32
40	5.17	301	-0.38	0.62	335	6.68	306	0.43	0.75	13	300	18	5.15	0.44	13	255	17	13	28
30	4.91	286	-0.36	0.64	442	6.63	289	-0.83	0.91	13	381	18	4.84	0.57	13	416	18	13	24
20	2.70	289	-0.13	0.68	666	5.44	243	-0.35	0.78	13	691	21	2.68	0.74	13	474	17	13	31
10	4.66	181	0.05	0.79	797	10.60	184	-4.24	0.69	12	987	6	-1.94	0.51	3	1088	4	13	9

Line 1			
1	Site Name		
2	Start Date/Time		
3	End Date/Time		
4	SW version		
5	freq	Transmit frequency	Hz
6	bw	Filter bandwidth	Hz
7	damp	% Amplitude level	%
8	pulw	Transmit pulsewidth	millisecond
9	rise	Pulse shading	millisecond
10	rofs	In phaseo?set	millivolt
11	jofs	Quadrature o?set	millivolt
Line 2			
1	sec	Wind table time reporting interval	seconds
2	avdst	Wind table altitude reporting interval	meters
3	amp	Fixed amplitude threshold	millivolt
4	snr	Signal to Noise threshold	
5	back	Noise samplecollectiontime	millisecond
6	noms	Not used	
7	nwt	Not used	
8	gd	Percent goodthreshold	%
9	n?t	Number of FFT points	
10	srate	Digital samplingrate	Hz
11	clut	Ground clutter rejection?ag	
12	nbini	Signal searchwindow	# points
13	ngav	Number of pulsesfor gust detection	
14	mincr	C Beam spectra searchlimit (lower)	radial m/s
15	maxcr	C Beam spectra searchlimit (upper)	radial m/s
16	minbr	B Beam spectra searchlimit (lower)	radial m/s
17	maxbr	B Beam spectra searchlimit (upper)	radial m/s
18	minar	A Beam spectra searchlimit (lower)	radial m/s
19	maxar	A Beam spectra searchlimit (upper)	radial m/s
20	wdog	Watchdog timer (enable ?ag)	
21	mxdel	Mixing height amplitude detectionthreshold	millivolt
22	ptdir	Sodar referencefram rotation angle	degrees
23	wmax	Vertical velocity detectionthreshold	m/s
24	phase	Interelementspacing	
25	speci	S ?le output interval increment	
26	specl	S ?le numberof levels output	
27	specm	S ?le ?ag to detail numberof axes recorded	
28	specn	S ?le numberof pulsesaverages	
29	specs	S ?le index of ?rst level recorded	
30	cdia	DFS data axis	
31	cdid	DFS numberof SRATE samplesper level	
32	cdin	DFS numberof pulsesper record	
Line 3			
1	Axes	Number of active beams	
2	Levels	Number of asamplingaltitudes	
3	ZenithV	Zenith angle of V beam	deg
4	ZenithU	Zenith angle of U beam	deg
5	Rotation	Sodar antenna rotation angle	deg
6	Seperation	Deviation of sodar referencefrom orthogonalorientation	deg
7	mixHt	Detected mixing height	meters
8	rmnU	Noise samplefor X beam	millivolt
9	rmnV	Noise samplefor Y beam	millivolt
10	rmnW	Noise samplerfor Z beam	millivolt
11	Antenna status	(optional) status of antenna	
12	AC status	(optional) of UPS	
	(Optionally)		
13	AnemometerTemp	(optional) anemometertemperature	deg C
14	Battery Voltage	(optional) ASP battery voltage (DC systemsonly)	0.25

<u>Other sources</u> (ccny, sit): The two universities CCNY and SIT operate meteorological instrumentation on exposed sites on their campuses. Their data are available from the internet.

<u>DCNet NOAA</u> (lbr1, eml): Two stations are operated by NOAA. The data were collected from NOAA by internet connection. The files have names such as eml_nyc002_rooftop.txt and the first lines in a file look like the example below:

```
Date            Time     tempC, relHumidity, windSpeedMs, windDir,          baroMb
2005-08-01     00:15:00, 21.5,    86,         1.814,          101,          -999.0
2005-08-01     00:30:00, 21.7,    84,         1.661,          110,          -999.0
2005-08-01     00:45:00, 21.6,    84,         1.747,          114,          -999.0
. . .
```

These records are produced each 15 minutes.

Appendix A: Listing of All Folders and Files In Level 0 for MID05

The following lists the folder and file names for all level 0 data. A complete list of folders is found

FOLDER: /Volumes/hd1/mid_level0/ccny:
total 752
-rwxrwxrwx   1 rmr rmr 381316 Sep 12 2005 ccny_08-26-31.txt

FOLDER: /Volumes/hd1/mid_level0/cpk_Central_Park_asos:
total 912
-rwxrwxrwx   1 rmr rmr 460493 Sep 12 2005 cpk2005.dat

FOLDER: /Volumes/hd1/mid_level0/eml_nyc002:
total 304
-rwxrwxrwx   1 rmr rmr 147512 Sep 12 2005 eml_nyc002_rooftop.txt

FOLDER: /Volumes/hd1/mid_level0/ewr_NewarkAirport_asos:
total 912
-rwxrwxrwx   1 rmr rmr 460849 Sep 12 2005 ewr2005.dat

FOLDER: /Volumes/hd1/mid_level0/gm1_GMBldg_roof_met:
total 5166064
-rwxrwxrwx   1 rmr rmr 26519888 Sep 29 2005 UDP01$20050804.dat
-rwxrwxrwx   1 rmr rmr 58751448 Aug 6 2005 UDP01$20050805.dat
-rwxrwxrwx   1 rmr rmr 58751616 Aug 7 2005 UDP01$20050806.dat
-rwxrwxrwx   1 rmr rmr 58751968 Aug 8 2005 UDP01$20050807.dat
-rwxrwxrwx   1 rmr rmr 58751984 Aug 9 2005 UDP01$20050808.dat
-rwxrwxrwx   1 rmr rmr 58751976 Aug 10 2005 UDP01$20050809.dat
-rwxrwxrwx   1 rmr rmr 58751992 Aug 11 2005 UDP01$20050810.dat
-rwxrwxrwx   1 rmr rmr 58751952 Aug 12 2005 UDP01$20050811.dat
-rwxrwxrwx   1 rmr rmr 33536795 Aug 17 2005 UDP01$20050812.dat
-rwxrwxrwx   1 rmr rmr 14157378 Aug 18 2005 UDP01$20050817.dat
-rwxrwxrwx   1 rmr rmr 58751944 Aug 19 2005 UDP01$20050818.dat
-rwxrwxrwx   1 rmr rmr 58751984 Aug 20 2005 UDP01$20050819.dat
-rwxrwxrwx   1 rmr rmr 58752000 Aug 21 2005 UDP01$20050820.dat
-rwxrwxrwx   1 rmr rmr 58752001 Sep 30 2005 UDP01$20050821.dat
-rwxrwxrwx   1 rmr rmr 58751968 Aug 23 2005 UDP01$20050822.dat
-rwxrwxrwx   1 rmr rmr 58750001 Aug 24 2005 UDP01$20050823.dat
-rwxrwxrwx   1 rmr rmr 58751952 Aug 25 2005 UDP01$20050824.dat
-rwxrwxrwx   1 rmr rmr 58752000 Aug 26 2005 UDP01$20050825.dat
-rwxrwxrwx   1 rmr rmr 58751960 Aug 27 2005 UDP01$20050826.dat
-rwxrwxrwx   1 rmr rmr 58752000 Aug 28 2005 UDP01$20050827.dat
-rwxrwxrwx   1 rmr rmr 58751912 Aug 29 2005 UDP01$20050828.dat

```
-rwxrwxrwx   1 rmr  rmr  58752000 Aug 30  2005 UDP01$20050829.dat
-rwxrwxrwx   1 rmr  rmr  58751912 Aug 31  2005 UDP01$20050830.dat
-rwxrwxrwx   1 rmr  rmr  58751928 Oct  1  2005 UDP01$20050831.dat
-rwxrwxrwx   1 rmr  rmr  32435976 Sep  1  2005 UDP01$20050901.dat
-rwxrwxrwx   1 rmr  rmr      2312 Oct  1  2005 UDP01x$20050831.dat
-rw-r--r--   1 rmr  rmr  26115128 Sep 30  2005 gm1_20050804.da1
-rw-r--r--   1 rmr  rmr  57852157 Sep 30  2005 gm1_20050805.da1
-rw-r--r--   1 rmr  rmr  57870448 Sep 30  2005 gm1_20050806.da1
-rw-r--r--   1 rmr  rmr  57870582 Sep 30  2005 gm1_20050807.da1
-rw-r--r--   1 rmr  rmr  57509251 Sep 30  2005 gm1_20050808.da1
-rw-r--r--   1 rmr  rmr  57811488 Sep 30  2005 gm1_20050809.da1
-rw-r--r--   1 rmr  rmr  57643921 Sep 30  2005 gm1_20050810.da1
-rw-r--r--   1 rmr  rmr  57796949 Sep 30  2005 gm1_20050811.da1
-rw-r--r--   1 rmr  rmr  32787390 Sep 30  2005 gm1_20050812.da1
-rw-r--r--   1 rmr  rmr  13923406 Sep 30  2005 gm1_20050817.da1
-rw-r--r--   1 rmr  rmr  57279240 Sep 30  2005 gm1_20050818.da1
-rw-r--r--   1 rmr  rmr  54208295 Sep 30  2005 gm1_20050819.da1
-rw-r--r--   1 rmr  rmr  57538061 Sep 30  2005 gm1_20050820.da1
-rw-r--r--   1 rmr  rmr  57704757 Oct  1  2005 gm1_20050821.da1
-rw-r--r--   1 rmr  rmr  57388651 Oct  1  2005 gm1_20050822.da1
-rw-r--r--   1 rmr  rmr  57279174 Oct  1  2005 gm1_20050823.da1
-rw-r--r--   1 rmr  rmr  56977204 Oct  1  2005 gm1_20050824.da1
-rw-r--r--   1 rmr  rmr  56747394 Oct  1  2005 gm1_20050825.da1
-rw-r--r--   1 rmr  rmr  57456589 Oct  1  2005 gm1_20050826.da1
-rw-r--r--   1 rmr  rmr  57635144 Oct  1  2005 gm1_20050827.da1
-rw-r--r--   1 rmr  rmr  56754563 Oct  1  2005 gm1_20050828.da1
-rw-r--r--   1 rmr  rmr  57062897 Oct  1  2005 gm1_20050829.da1
-rw-r--r--   1 rmr  rmr  56527165 Oct  1  2005 gm1_20050830.da1
-rw-r--r--   1 rmr  rmr  55021969 Oct  1  2005 gm1_20050831.da1
-rw-r--r--   1 rmr  rmr  31640417 Oct  1  2005 gm1_20050901.da1
```

FOLDER: /Volumes/hd1/mid_level0/gm2_GMBldg_roof_sodar:

```
total 18704
-rwxrwxrwx   1 rmr  rmr  231329 Sep  2  2005 050819dv.dat
-rwxrwxrwx   1 rmr  rmr  774720 Sep  2  2005 050820dv.dat
-rwxrwxrwx   1 rmr  rmr  774720 Sep  2  2005 050821dv.dat
-rwxrwxrwx   1 rmr  rmr  774720 Sep  2  2005 050822dv.dat
-rwxrwxrwx   1 rmr  rmr  774720 Sep  2  2005 050823dv.dat
-rwxrwxrwx   1 rmr  rmr  774720 Sep  2  2005 050824dv.dat
-rwxrwxrwx   1 rmr  rmr  774720 Sep  2  2005 050825dv.dat
-rwxrwxrwx   1 rmr  rmr  774720 Sep  2  2005 050826dv.dat
-rwxrwxrwx   1 rmr  rmr  774720 Sep  2  2005 050827dv.dat
-rwxrwxrwx   1 rmr  rmr  774720 Sep  2  2005 050828dv.dat
-rwxrwxrwx   1 rmr  rmr  774720 Sep  2  2005 050829dv.dat
-rwxrwxrwx   1 rmr  rmr  774720 Sep  2  2005 050830dv.dat
-rwxrwxrwx   1 rmr  rmr  774720 Sep  2  2005 050831dv.dat
```

FOLDER: /Volumes/hd1/mid_level0/hpn_airport_asos:
total 2048
-rwxrwxrwx   1 rmr rmr 578254 Sep 12 2005 hpn2004.dat
-rwxrwxrwx   1 rmr rmr 460298 Sep 12 2005 hpn2005.dat

FOLDER: /Volumes/hd1/mid_level0/isp_IslipAirp[ort_asos:
total 2272
-rwxrwxrwx   1 rmr rmr 692959 Sep 12 2005 isp2004.dat
-rwxrwxrwx   1 rmr rmr 460928 Sep 12 2005 isp2005.dat

FOLDER: /Volumes/hd1/mid_level0/jfk_KennedyAirport_asos:
total 912
-rwxrwxrwx   1 rmr rmr 460927 Sep 12 2005 jfk2005.dat

FOLDER: /Volumes/hd1/mid_level0/lbr1_BldgA_roof:
total 288
-rwxrwxrwx   1 rmr rmr 141045 Sep 12 2005 lbr1_BldgA.txt

FOLDER: /Volumes/hd1/mid_level0/lbr2_LehmanBros_setback:
total 4931584
-rwxrwxrwx   1 rmr rmr 16742912 Aug 11 2005 UDP21$20050810.dat
-rwxrwxrwx   1 rmr rmr 58788506 Aug 12 2005 UDP21$20050811.dat
-rwxrwxrwx   1 rmr rmr 58790377 Aug 13 2005 UDP21$20050812.dat
-rwxrwxrwx   1 rmr rmr 58787268 Aug 14 2005 UDP21$20050813.dat
-rwxrwxrwx   1 rmr rmr 58823800 Aug 15 2005 UDP21$20050814.dat
-rwxrwxrwx   1 rmr rmr 58782440 Aug 16 2005 UDP21$20050815.dat
-rwxrwxrwx   1 rmr rmr 58826448 Aug 17 2005 UDP21$20050816.dat
-rwxrwxrwx   1 rmr rmr 58786745 Aug 18 2005 UDP21$20050817.dat
-rwxrwxrwx   1 rmr rmr 58827418 Aug 19 2005 UDP21$20050818.dat
-rwxrwxrwx   1 rmr rmr 58783105 Aug 20 2005 UDP21$20050819.dat
-rwxrwxrwx   1 rmr rmr 58825712 Aug 21 2005 UDP21$20050820.dat
-rwxrwxrwx   1 rmr rmr 58788004 Aug 22 2005 UDP21$20050821.dat
-rwxrwxrwx   1 rmr rmr 58788479 Aug 23 2005 UDP21$20050822.dat
-rwxrwxrwx   1 rmr rmr 58827744 Aug 24 2005 UDP21$20050823.dat
-rwxrwxrwx   1 rmr rmr 58784590 Aug 25 2005 UDP21$20050824.dat
-rwxrwxrwx   1 rmr rmr 58825308 Aug 26 2005 UDP21$20050825.dat
-rwxrwxrwx   1 rmr rmr 58785581 Aug 27 2005 UDP21$20050826.dat
-rwxrwxrwx   1 rmr rmr 58784484 Aug 28 2005 UDP21$20050827.dat
-rwxrwxrwx   1 rmr rmr 58826539 Aug 29 2005 UDP21$20050828.dat
-rwxrwxrwx   1 rmr rmr 58786189 Aug 30 2005 UDP21$20050829.dat
-rwxrwxrwx   1 rmr rmr 58788460 Aug 31 2005 UDP21$20050830.dat
-rwxrwxrwx   1 rmr rmr 58785054 Sep 1 2005 UDP21$20050831.dat
-rwxrwxrwx   1 rmr rmr 31369560 Sep 1 2005 UDP21$20050901.dat
-rw-r--r--   1 rmr rmr 16435999 Oct 1 2005 lbr2_20050810.da1
-rw-r--r--   1 rmr rmr 57721588 Oct 1 2005 lbr2_20050811.da1

```
-rw-r--r--   1 rmr  rmr  57727868 Oct  1  2005 lbr2_20050812.da1
-rw-r--r--   1 rmr  rmr  57717684 Oct  1  2005 lbr2_20050813.da1
-rw-r--r--   1 rmr  rmr  47963224 Oct  1  2005 lbr2_20050814.da1
-rw-r--r--   1 rmr  rmr  55467385 Oct  1  2005 lbr2_20050815.da1
-rw-r--r--   1 rmr  rmr  57751951 Oct  1  2005 lbr2_20050816.da1
-rw-r--r--   1 rmr  rmr  57715623 Oct  1  2005 lbr2_20050817.da1
-rw-r--r--   1 rmr  rmr  57755408 Oct  1  2005 lbr2_20050818.da1
-rw-r--r--   1 rmr  rmr  52832185 Oct  1  2005 lbr2_20050819.da1
-rw-r--r--   1 rmr  rmr  57749827 Oct  1  2005 lbr2_20050820.da1
-rw-r--r--   1 rmr  rmr  57719599 Oct  1  2005 lbr2_20050821.da1
-rw-r--r--   1 rmr  rmr  57721380 Oct  1  2005 lbr2_20050822.da1
-rw-r--r--   1 rmr  rmr  57756437 Oct  1  2005 lbr2_20050823.da1
-rw-r--r--   1 rmr  rmr  57708718 Oct  1  2005 lbr2_20050824.da1
-rw-r--r--   1 rmr  rmr  57748099 Oct  1  2005 lbr2_20050825.da1
-rw-r--r--   1 rmr  rmr  57712021 Oct  1  2005 lbr2_20050826.da1
-rw-r--r--   1 rmr  rmr  57708347 Oct  1  2005 lbr2_20050827.da1
-rw-r--r--   1 rmr  rmr  57746510 Oct  1  2005 lbr2_20050828.da1
-rw-r--r--   1 rmr  rmr  57713725 Oct  1  2005 lbr2_20050829.da1
-rw-r--r--   1 rmr  rmr  57721306 Oct  1  2005 lbr2_20050830.da1
-rw-r--r--   1 rmr  rmr  56984425 Oct  1  2005 lbr2_20050831.da1
-rw-r--r--   1 rmr  rmr  30799234 Oct  1  2005 lbr2_20050901.da1
```

FOLDER: /Volumes/hd1/mid_level0/lga_laguardia airport_asos:

```
total 912
-rwxrwxrwx   1 rmr  rmr  460847 Sep 12  2005 lga2005.dat
```

FOLDER: /Volumes/hd1/mid_level0/metl1_met:

```
total 5697008
-rwxrwxrwx   1 rmr  rmr     40800 Jul 28  2005 UDP10$20050728.dat
-rwxrwxrwx   1 rmr  rmr  28883642 Jul 30  2005 UDP10$20050729.dat
-rwxrwxrwx   1 rmr  rmr  58542976 Jul 31  2005 UDP10$20050730.dat
-rwxrwxrwx   1 rmr  rmr  58543088 Aug  1  2005 UDP10$20050731.dat
-rwxrwxrwx   1 rmr  rmr  58543752 Aug  2  2005 UDP10$20050801.dat
-rwxrwxrwx   1 rmr  rmr  58543560 Aug  3  2005 UDP10$20050802.dat
-rwxrwxrwx   1 rmr  rmr  58340176 Aug  4  2005 UDP10$20050803.dat
-rwxrwxrwx   1 rmr  rmr  58585784 Aug  5  2005 UDP10$20050804.dat
-rwxrwxrwx   1 rmr  rmr  58544896 Aug  6  2005 UDP10$20050805.dat
-rwxrwxrwx   1 rmr  rmr  58544816 Aug  7  2005 UDP10$20050806.dat
-rwxrwxrwx   1 rmr  rmr  58544864 Aug  8  2005 UDP10$20050807.dat
-rwxrwxrwx   1 rmr  rmr  58544824 Aug  9  2005 UDP10$20050808.dat
-rwxrwxrwx   1 rmr  rmr  58585664 Aug 10  2005 UDP10$20050809.dat
-rwxrwxrwx   1 rmr  rmr  57523736 Aug 11  2005 UDP10$20050810.dat
-rwxrwxrwx   1 rmr  rmr  58585688 Aug 12  2005 UDP10$20050811.dat
-rwxrwxrwx   1 rmr  rmr  21460496 Aug 12  2005 UDP10$20050812.dat
-rwxrwxrwx   1 rmr  rmr  22602129 Aug 14  2005 UDP10$20050814.dat
-rwxrwxrwx   1 rmr  rmr  20399507 Aug 17  2005 UDP21$20050817.dat
```

```
-rwxrwxrwx   1 rmr  rmr  58751836 Aug 19  2005 UDP21$20050818.dat
-rwxrwxrwx   1 rmr  rmr  58751784 Aug 19  2005 UDP21$20050819.dat
-rwxrwxrwx   1 rmr  rmr  58751834 Aug 20  2005 UDP21$20050820.dat
-rwxrwxrwx   1 rmr  rmr  58751796 Aug 21  2005 UDP21$20050821.dat
-rwxrwxrwx   1 rmr  rmr  58751340 Aug 22  2005 UDP21$20050822.dat
-rwxrwxrwx   1 rmr  rmr   6405526 Aug 22  2005 UDP21$20050823.dat
-rwxrwxrwx   1 rmr  rmr  46552410 Aug 24  2005 UDP21$20050824.dat
-rwxrwxrwx   1 rmr  rmr  58751817 Aug 25  2005 UDP21$20050825.dat
-rwxrwxrwx   1 rmr  rmr  58751808 Aug 26  2005 UDP21$20050826.dat
-rwxrwxrwx   1 rmr  rmr  58751739 Aug 27  2005 UDP21$20050827.dat
-rwxrwxrwx   1 rmr  rmr  58751515 Aug 28  2005 UDP21$20050828.dat
-rwxrwxrwx   1 rmr  rmr  49775815 Aug 29  2005 UDP21$20050829.dat
-rw-r--r--   1 rmr  rmr     40764 Oct  1  2005 metl1_20050728.da1
-rw-r--r--   1 rmr  rmr  26651020 Oct  1  2005 metl1_20050729.da1
-rw-r--r--   1 rmr  rmr  55893170 Oct  1  2005 metl1_20050730.da1
-rw-r--r--   1 rmr  rmr  56090217 Oct  1  2005 metl1_20050731.da1
-rw-r--r--   1 rmr  rmr  55908446 Oct  1  2005 metl1_20050801.da1
-rw-r--r--   1 rmr  rmr  55940137 Oct  1  2005 metl1_20050802.da1
-rw-r--r--   1 rmr  rmr  54981434 Oct  1  2005 metl1_20050803.da1
-rw-r--r--   1 rmr  rmr  55365411 Oct  1  2005 metl1_20050804.da1
-rw-r--r--   1 rmr  rmr  55210909 Oct  1  2005 metl1_20050805.da1
-rw-r--r--   1 rmr  rmr  53594735 Oct  1  2005 metl1_20050806.da1
-rw-r--r--   1 rmr  rmr  54821639 Oct  1  2005 metl1_20050807.da1
-rw-r--r--   1 rmr  rmr  55308997 Oct  1  2005 metl1_20050808.da1
-rw-r--r--   1 rmr  rmr  55356031 Oct  1  2005 metl1_20050809.da1
-rw-r--r--   1 rmr  rmr  54420979 Oct  1  2005 metl1_20050810.da1
-rw-r--r--   1 rmr  rmr  57200072 Oct  1  2005 metl1_20050811.da1
-rw-r--r--   1 rmr  rmr  21144893 Oct  1  2005 metl1_20050812.da1
-rw-r--r--   1 rmr  rmr  22050800 Oct  1  2005 metl1_20050814.da1
-rw-r--r--   1 rmr  rmr  20098579 Oct  1  2005 metl1_20050817.da1
-rw-r--r--   1 rmr  rmr  57886909 Oct  1  2005 metl1_20050818.da1
-rw-r--r--   1 rmr  rmr  57886758 Oct  1  2005 metl1_20050819.da1
-rw-r--r--   1 rmr  rmr  57887166 Oct  1  2005 metl1_20050820.da1
-rw-r--r--   1 rmr  rmr  57870886 Oct  1  2005 metl1_20050821.da1
-rw-r--r--   1 rmr  rmr  57832551 Oct  1  2005 metl1_20050822.da1
-rw-r--r--   1 rmr  rmr   6306729 Oct  1  2005 metl1_20050823.da1
-rw-r--r--   1 rmr  rmr  45795354 Oct  1  2005 metl1_20050824.da1
-rw-r--r--   1 rmr  rmr  57846162 Oct  1  2005 metl1_20050825.da1
-rw-r--r--   1 rmr  rmr  57748869 Oct  1  2005 metl1_20050826.da1
-rw-r--r--   1 rmr  rmr  57816539 Oct  1  2005 metl1_20050827.da1
-rw-r--r--   1 rmr  rmr  57837592 Oct  1  2005 metl1_20050828.da1
-rw-r--r--   1 rmr  rmr  49001378 Oct  1  2005 metl1_20050829.da1
```

FOLDER: /Volumes/hd1/mid_level0/metl2_sodar:

```
total 224112
-rwxrwxrwx    1 rmr  rmr  1688008 Aug 19  2005 050803dv.dat
```

```
-rwxrwxrwx    1 rmr  rmr  4037760 Aug 19  2005 050804dv.dat
-rwxrwxrwx    1 rmr  rmr  4037760 Aug 19  2005 050805dv.dat
-rwxrwxrwx    1 rmr  rmr  4037760 Aug 19  2005 050806dv.dat
-rwxrwxrwx    1 rmr  rmr  4037760 Aug 19  2005 050807dv.dat
-rwxrwxrwx    1 rmr  rmr  4037763 Aug 19  2005 050808dv.dat
-rwxrwxrwx    1 rmr  rmr  4037760 Aug 19  2005 050809dv.dat
-rwxrwxrwx    1 rmr  rmr  4001308 Aug 19  2005 050810dv.dat
-rwxrwxrwx    1 rmr  rmr  4037767 Aug 19  2005 050811dv.dat
-rwxrwxrwx    1 rmr  rmr  4037762 Aug 19  2005 050812dv.dat
-rwxrwxrwx    1 rmr  rmr  4037760 Aug 19  2005 050813dv.dat
-rwxrwxrwx    1 rmr  rmr  4037760 Aug 19  2005 050814dv.dat
-rwxrwxrwx    1 rmr  rmr  4037760 Sep  2  2005 050815dv.dat
-rwxrwxrwx    1 rmr  rmr  4037760 Sep  2  2005 050816dv.dat
-rwxrwxrwx    1 rmr  rmr  4037774 Sep  2  2005 050817dv.dat
-rwxrwxrwx    1 rmr  rmr  4037760 Sep  2  2005 050818dv.dat
-rwxrwxrwx    1 rmr  rmr  4037760 Sep  2  2005 050819dv.dat
-rwxrwxrwx    1 rmr  rmr  4034839 Sep  2  2005 050820dv.dat
-rwxrwxrwx    1 rmr  rmr  4037760 Sep  2  2005 050821dv.dat
-rwxrwxrwx    1 rmr  rmr  4037760 Sep  2  2005 050822dv.dat
-rwxrwxrwx    1 rmr  rmr  4037760 Sep  2  2005 050823dv.dat
-rwxrwxrwx    1 rmr  rmr  4037760 Sep  2  2005 050824dv.dat
-rwxrwxrwx    1 rmr  rmr  4037760 Sep  2  2005 050825dv.dat
-rwxrwxrwx    1 rmr  rmr  4037760 Sep  2  2005 050826dv.dat
-rwxrwxrwx    1 rmr  rmr  4037760 Sep  2  2005 050827dv.dat
-rwxrwxrwx    1 rmr  rmr  4037760 Sep  2  2005 050828dv.dat
-rwxrwxrwx    1 rmr  rmr  4037760 Sep  2  2005 050829dv.dat
-rwxrwxrwx    1 rmr  rmr  4037760 Sep  2  2005 050830dv.dat
-rwxrwxrwx    1 rmr  rmr  4037760 Sep  2  2005 050831dv.dat
drwxr-xr-x   29 rmr  rmr      986 Oct 27  2005 metl2_sodar_dfs
```

FOLDER: /Volumes/hd1/mid_level0/mgh1_McGrawHill_roof:

```
total 3689664
-rwxrwxrwx   1 rmr  rmr    856634 Aug  5  2005 UDP09$20050805.dat
-rwxrwxrwx   1 rmr  rmr  41410139 Aug 15  2005 UDP09$20050814.dat
-rwxrwxrwx   1 rmr  rmr  35618328 Aug 15  2005 UDP09$20050815.dat
-rwxrwxrwx   1 rmr  rmr  28395518 Aug 18  2005 UDP09$20050817.dat
-rwxrwxrwx   1 rmr  rmr  58751976 Aug 19  2005 UDP09$20050818.dat
-rwxrwxrwx   1 rmr  rmr  58751944 Aug 20  2005 UDP09$20050819.dat
-rwxrwxrwx   1 rmr  rmr  58751936 Aug 21  2005 UDP09$20050820.dat
-rwxrwxrwx   1 rmr  rmr  58751936 Aug 22  2005 UDP09$20050821.dat
-rwxrwxrwx   1 rmr  rmr  58751872 Aug 23  2005 UDP09$20050822.dat
-rwxrwxrwx   1 rmr  rmr  58751920 Aug 24  2005 UDP09$20050823.dat
-rwxrwxrwx   1 rmr  rmr  58751952 Aug 25  2005 UDP09$20050824.dat
-rwxrwxrwx   1 rmr  rmr  58751968 Aug 26  2005 UDP09$20050825.dat
-rwxrwxrwx   1 rmr  rmr  58751968 Aug 27  2005 UDP09$20050826.dat
-rwxrwxrwx   1 rmr  rmr  58751976 Aug 28  2005 UDP09$20050827.dat
```

```
-rwxrwxrwx   1 rmr  rmr  58751936 Aug 29  2005 UDP09$20050828.dat
-rwxrwxrwx   1 rmr  rmr  58751992 Aug 30  2005 UDP09$20050829.dat
-rwxrwxrwx   1 rmr  rmr  58751952 Aug 31  2005 UDP09$20050830.dat
-rwxrwxrwx   1 rmr  rmr  58751976 Sep  1  2005 UDP09$20050831.dat
-rwxrwxrwx   1 rmr  rmr  28355984 Sep  1  2005 UDP09$20050901.dat
-rw-r--r--   1 rmr  rmr    844094 Oct  1  2005 mgh1_20050805.da1
-rw-r--r--   1 rmr  rmr  39563193 Oct  1  2005 mgh1_20050814.da1
-rw-r--r--   1 rmr  rmr  34866694 Oct  1  2005 mgh1_20050815.da1
-rw-r--r--   1 rmr  rmr  27976749 Oct  1  2005 mgh1_20050817.da1
-rw-r--r--   1 rmr  rmr  57888497 Oct  1  2005 mgh1_20050818.da1
-rw-r--r--   1 rmr  rmr  54858020 Oct  1  2005 mgh1_20050819.da1
-rw-r--r--   1 rmr  rmr  57888363 Oct  1  2005 mgh1_20050820.da1
-rw-r--r--   1 rmr  rmr  57888296 Oct  1  2005 mgh1_20050821.da1
-rw-r--r--   1 rmr  rmr  57885214 Oct  1  2005 mgh1_20050822.da1
-rw-r--r--   1 rmr  rmr  57887693 Oct  1  2005 mgh1_20050823.da1
-rw-r--r--   1 rmr  rmr  57887961 Oct  1  2005 mgh1_20050824.da1
-rw-r--r--   1 rmr  rmr  57887760 Oct  1  2005 mgh1_20050825.da1
-rw-r--r--   1 rmr  rmr  57875968 Oct  1  2005 mgh1_20050826.da1
-rw-r--r--   1 rmr  rmr  57887291 Oct  1  2005 mgh1_20050827.da1
-rw-r--r--   1 rmr  rmr  55002807 Oct  1  2005 mgh1_20050828.da1
-rw-r--r--   1 rmr  rmr  57728568 Oct  1  2005 mgh1_20050829.da1
-rw-r--r--   1 rmr  rmr  57856270 Oct  1  2005 mgh1_20050830.da1
-rw-r--r--   1 rmr  rmr  54214083 Oct  1  2005 mgh1_20050831.da1
-rw-r--r--   1 rmr  rmr  27939497 Oct  1  2005 mgh1_20050901.da1
```

FOLDER: /Volumes/hd1/mid_level0/mgh2_McGrawHill_setback:

```
total 6102512
-rwxrwxrwx   1 rmr  rmr  31251840 Aug  6  2005 UDP07$20050805.dat
-rwxrwxrwx   1 rmr  rmr  58710464 Aug  7  2005 UDP07$20050806.dat
-rwxrwxrwx   1 rmr  rmr  58752000 Aug  8  2005 UDP07$20050807.dat
-rwxrwxrwx   1 rmr  rmr  58751904 Aug  9  2005 UDP07$20050808.dat
-rwxrwxrwx   1 rmr  rmr  58751968 Aug 10  2005 UDP07$20050809.dat
-rwxrwxrwx   1 rmr  rmr  58751952 Aug 11  2005 UDP07$20050810.dat
-rwxrwxrwx   1 rmr  rmr  58751968 Aug 12  2005 UDP07$20050811.dat
-rwxrwxrwx   1 rmr  rmr  58542304 Aug 13  2005 UDP07$20050812.dat
-rwxrwxrwx   1 rmr  rmr  58742024 Aug 14  2005 UDP07$20050813.dat
-rwxrwxrwx   1 rmr  rmr  58750984 Aug 15  2005 UDP07$20050814.dat
-rwxrwxrwx   1 rmr  rmr  58751840 Aug 16  2005 UDP07$20050815.dat
-rwxrwxrwx   1 rmr  rmr  58751960 Aug 17  2005 UDP07$20050816.dat
-rwxrwxrwx   1 rmr  rmr  58710719 Aug 18  2005 UDP07$20050817.dat
-rwxrwxrwx   1 rmr  rmr  58751944 Aug 19  2005 UDP07$20050818.dat
-rwxrwxrwx   1 rmr  rmr  58745720 Aug 20  2005 UDP07$20050819.dat
-rwxrwxrwx   1 rmr  rmr  58740912 Aug 21  2005 UDP07$20050820.dat
-rwxrwxrwx   1 rmr  rmr  58751064 Aug 22  2005 UDP07$20050821.dat
-rwxrwxrwx   1 rmr  rmr  58751928 Aug 23  2005 UDP07$20050822.dat
-rwxrwxrwx   1 rmr  rmr  58751912 Aug 24  2005 UDP07$20050823.dat
```

```
-rwxrwxrwx   1 rmr  rmr  58751896 Aug 25  2005 UDP07$20050824.dat
-rwxrwxrwx   1 rmr  rmr  58751872 Aug 26  2005 UDP07$20050825.dat
-rwxrwxrwx   1 rmr  rmr  58745264 Aug 27  2005 UDP07$20050826.dat
-rwxrwxrwx   1 rmr  rmr  58741224 Aug 28  2005 UDP07$20050827.dat
-rwxrwxrwx   1 rmr  rmr  58751480 Aug 29  2005 UDP07$20050828.dat
-rwxrwxrwx   1 rmr  rmr  58751888 Aug 30  2005 UDP07$20050829.dat
-rwxrwxrwx   1 rmr  rmr  58751952 Aug 31  2005 UDP07$20050830.dat
-rwxrwxrwx   1 rmr  rmr  58751928 Sep  1  2005 UDP07$20050831.dat
-rwxrwxrwx   1 rmr  rmr  26234360 Sep  1  2005 UDP07$20050901.dat
-rw-r--r--   1 rmr  rmr  30790682 Oct  1  2005 mgh2_20050805.da1
-rw-r--r--   1 rmr  rmr  57845885 Oct  1  2005 mgh2_20050806.da1
-rw-r--r--   1 rmr  rmr  57888564 Oct  1  2005 mgh2_20050807.da1
-rw-r--r--   1 rmr  rmr  57888229 Oct  1  2005 mgh2_20050808.da1
-rw-r--r--   1 rmr  rmr  57888430 Oct  1  2005 mgh2_20050809.da1
-rw-r--r--   1 rmr  rmr  57888296 Oct  1  2005 mgh2_20050810.da1
-rw-r--r--   1 rmr  rmr  57888430 Oct  1  2005 mgh2_20050811.da1
-rw-r--r--   1 rmr  rmr  57668536 Oct  1  2005 mgh2_20050812.da1
-rw-r--r--   1 rmr  rmr  57855064 Oct  1  2005 mgh2_20050813.da1
-rw-r--r--   1 rmr  rmr  46458699 Oct  1  2005 mgh2_20050814.da1
-rw-r--r--   1 rmr  rmr  54937616 Oct  1  2005 mgh2_20050815.da1
-rw-r--r--   1 rmr  rmr  57888430 Oct  1  2005 mgh2_20050816.da1
-rw-r--r--   1 rmr  rmr  57846823 Oct  1  2005 mgh2_20050817.da1
-rw-r--r--   1 rmr  rmr  57888363 Oct  1  2005 mgh2_20050818.da1
-rw-r--r--   1 rmr  rmr  52708325 Oct  1  2005 mgh2_20050819.da1
-rw-r--r--   1 rmr  rmr  57851513 Oct  1  2005 mgh2_20050820.da1
-rw-r--r--   1 rmr  rmr  57885415 Oct  1  2005 mgh2_20050821.da1
-rw-r--r--   1 rmr  rmr  57888296 Oct  1  2005 mgh2_20050822.da1
-rw-r--r--   1 rmr  rmr  57888229 Oct  1  2005 mgh2_20050823.da1
-rw-r--r--   1 rmr  rmr  57888296 Oct  1  2005 mgh2_20050824.da1
-rw-r--r--   1 rmr  rmr  57888095 Oct  1  2005 mgh2_20050825.da1
-rw-r--r--   1 rmr  rmr  57865918 Oct  1  2005 mgh2_20050826.da1
-rw-r--r--   1 rmr  rmr  57852384 Oct  1  2005 mgh2_20050827.da1
-rw-r--r--   1 rmr  rmr  57886822 Oct  1  2005 mgh2_20050828.da1
-rw-r--r--   1 rmr  rmr  57888162 Oct  1  2005 mgh2_20050829.da1
-rw-r--r--   1 rmr  rmr  57888363 Oct  1  2005 mgh2_20050830.da1
-rw-r--r--   1 rmr  rmr  55744095 Oct  1  2005 mgh2_20050831.da1
-rw-r--r--   1 rmr  rmr  25849030 Oct  1  2005 mgh2_20050901.da1
```

FOLDER: /Volumes/hd1/mid_level0/opp_OnePennPlaza_roof_met:

```
total 5513232
-rw-r--r--   1 rmr  rmr      1853 Sep 29  2005 CleanSummary.dat
-rwxrwxrwx   1 rmr  rmr    815922 Aug  3  2005 UDP05$20050803.dat
-rwxrwxrwx   1 rmr  rmr     38683 Aug 10  2005 UDP05$20050810.dat
-rwxrwxrwx   1 rmr  rmr  22113237 Aug 12  2005 UDP05$20050811.dat
-rwxrwxrwx   1 rmr  rmr  44104486 Aug 12  2005 UDP05$20050812.dat
-rwxrwxrwx   1 rmr  rmr  36107472 Aug 18  2005 UDP05$20050817.dat
```

```
-rwxrwxrwx   1 rmr  rmr  58751968 Aug 19  2005 UDP05$20050818.dat
-rwxrwxrwx   1 rmr  rmr  58751896 Aug 20  2005 UDP05$20050819.dat
-rwxrwxrwx   1 rmr  rmr  58751976 Aug 21  2005 UDP05$20050820.dat
-rwxrwxrwx   1 rmr  rmr  58751968 Aug 22  2005 UDP05$20050821.dat
-rwxrwxrwx   1 rmr  rmr  58752000 Aug 23  2005 UDP05$20050822.dat
-rwxrwxrwx   1 rmr  rmr  58751960 Aug 24  2005 UDP05$20050823.dat
-rwxrwxrwx   1 rmr  rmr  58751968 Aug 25  2005 UDP05$20050824.dat
-rwxrwxrwx   1 rmr  rmr  58751968 Aug 26  2005 UDP05$20050825.dat
-rwxrwxrwx   1 rmr  rmr  58751904 Aug 27  2005 UDP05$20050826.dat
-rwxrwxrwx   1 rmr  rmr  58752000 Aug 28  2005 UDP05$20050827.dat
-rwxrwxrwx   1 rmr  rmr  58751984 Aug 29  2005 UDP05$20050828.dat
-rwxrwxrwx   1 rmr  rmr  58751968 Aug 30  2005 UDP05$20050829.dat
-rwxrwxrwx   1 rmr  rmr  58752000 Aug 31  2005 UDP05$20050830.dat
-rwxrwxrwx   1 rmr  rmr  58751976 Sep  1  2005 UDP05$20050831.dat
-rwxrwxrwx   1 rmr  rmr  58751984 Sep  2  2005 UDP05$20050901.dat
-rwxrwxrwx   1 rmr  rmr  58751976 Sep  3  2005 UDP05$20050902.dat
-rwxrwxrwx   1 rmr  rmr  58751944 Sep  4  2005 UDP05$20050903.dat
-rwxrwxrwx   1 rmr  rmr  58751968 Sep  5  2005 UDP05$20050904.dat
-rwxrwxrwx   1 rmr  rmr  58751968 Sep  6  2005 UDP05$20050905.dat
-rwxrwxrwx   1 rmr  rmr  58751976 Sep  7  2005 UDP05$20050906.dat
-rwxrwxrwx   1 rmr  rmr  58751928 Sep  8  2005 UDP05$20050907.dat
-rwxrwxrwx   1 rmr  rmr  58751960 Sep  9  2005 UDP05$20050908.dat
-rwxrwxrwx   1 rmr  rmr  26152800 Sep  9  2005 UDP05$20050909.dat
-rw-r--r--   1 rmr  rmr    804296 Oct  1  2005 opp_20050803.da1
-rw-r--r--   1 rmr  rmr     36878 Oct  1  2005 opp_20050810.da1
-rw-r--r--   1 rmr  rmr  21788159 Oct  1  2005 opp_20050811.da1
-rw-r--r--   1 rmr  rmr  43455877 Oct  1  2005 opp_20050812.da1
-rw-r--r--   1 rmr  rmr  35575889 Oct  1  2005 opp_20050817.da1
-rw-r--r--   1 rmr  rmr  57888497 Oct  1  2005 opp_20050818.da1
-rw-r--r--   1 rmr  rmr  57796774 Oct  1  2005 opp_20050819.da1
-rw-r--r--   1 rmr  rmr  57888497 Oct  1  2005 opp_20050820.da1
-rw-r--r--   1 rmr  rmr  57888430 Oct  1  2005 opp_20050821.da1
-rw-r--r--   1 rmr  rmr  57888564 Oct  1  2005 opp_20050822.da1
-rw-r--r--   1 rmr  rmr  57888363 Oct  1  2005 opp_20050823.da1
-rw-r--r--   1 rmr  rmr  57888497 Oct  1  2005 opp_20050824.da1
-rw-r--r--   1 rmr  rmr  57888430 Oct  1  2005 opp_20050825.da1
-rw-r--r--   1 rmr  rmr  57888296 Oct  1  2005 opp_20050826.da1
-rw-r--r--   1 rmr  rmr  57888564 Oct  1  2005 opp_20050827.da1
-rw-r--r--   1 rmr  rmr  57841798 Oct  1  2005 opp_20050828.da1
-rw-r--r--   1 rmr  rmr  57888497 Oct  1  2005 opp_20050829.da1
-rw-r--r--   1 rmr  rmr  57888564 Oct  1  2005 opp_20050830.da1
-rw-r--r--   1 rmr  rmr  57780627 Oct  1  2005 opp_20050831.da1
-rw-r--r--   1 rmr  rmr  57888497 Oct  1  2005 opp_20050901.da1
-rw-r--r--   1 rmr  rmr  57886822 Oct  1  2005 opp_20050902.da1
-rw-r--r--   1 rmr  rmr  57888430 Oct  1  2005 opp_20050903.da1
-rw-r--r--   1 rmr  rmr  57888497 Oct  1  2005 opp_20050904.da1
```

-rw-r--r-- 1 rmr rmr 57888497 Oct 1 2005 opp_20050905.da1
-rw-r--r-- 1 rmr rmr 57888497 Oct 1 2005 opp_20050906.da1
-rw-r--r-- 1 rmr rmr 57888363 Oct 1 2005 opp_20050907.da1
-rw-r--r-- 1 rmr rmr 57888430 Oct 1 2005 opp_20050908.da1
-rw-r--r-- 1 rmr rmr 25768764 Oct 1 2005 opp_20050909.da1

FOLDER: /Volumes/hd1/mid_level0/ppza_ParkPlaza_roof:
total 8410448
-rwxrwxrwx 1 rmr rmr 32517392 Aug 5 2005 UDP02$20050804.dat
-rwxrwxrwx 1 rmr rmr 22031719 Aug 16 2005 UDP02$20050805.dat
-rwxrwxrwx 1 rmr rmr 23786328 Aug 17 2005 UDP02$20050816.dat
-rwxrwxrwx 1 rmr rmr 58751992 Aug 18 2005 UDP02$20050817.dat
-rwxrwxrwx 1 rmr rmr 58751992 Aug 19 2005 UDP02$20050818.dat
-rwxrwxrwx 1 rmr rmr 58752000 Aug 20 2005 UDP02$20050819.dat
-rwxrwxrwx 1 rmr rmr 58752000 Aug 21 2005 UDP02$20050820.dat
-rwxrwxrwx 1 rmr rmr 58751992 Aug 22 2005 UDP02$20050821.dat
-rwxrwxrwx 1 rmr rmr 58752000 Aug 23 2005 UDP02$20050822.dat
-rwxrwxrwx 1 rmr rmr 58751940 Aug 24 2005 UDP02$20050823.dat
-rwxrwxrwx 1 rmr rmr 58752000 Aug 25 2005 UDP02$20050824.dat
-rwxrwxrwx 1 rmr rmr 58751992 Aug 26 2005 UDP02$20050825.dat
-rwxrwxrwx 1 rmr rmr 58752000 Aug 27 2005 UDP02$20050826.dat
-rwxrwxrwx 1 rmr rmr 58752000 Aug 28 2005 UDP02$20050827.dat
-rwxrwxrwx 1 rmr rmr 58751960 Aug 29 2005 UDP02$20050828.dat
-rwxrwxrwx 1 rmr rmr 58751960 Aug 30 2005 UDP02$20050829.dat
-rwxrwxrwx 1 rmr rmr 58751920 Aug 31 2005 UDP02$20050830.dat
-rwxrwxrwx 1 rmr rmr 58751984 Sep 1 2005 UDP02$20050831.dat
-rwxrwxrwx 1 rmr rmr 58752000 Sep 2 2005 UDP02$20050901.dat
-rwxrwxrwx 1 rmr rmr 58751992 Sep 3 2005 UDP02$20050902.dat
-rwxrwxrwx 1 rmr rmr 58751992 Sep 4 2005 UDP02$20050903.dat
-rwxrwxrwx 1 rmr rmr 58752000 Sep 5 2005 UDP02$20050904.dat
-rwxrwxrwx 1 rmr rmr 58751960 Sep 6 2005 UDP02$20050905.dat
-rwxrwxrwx 1 rmr rmr 58752000 Sep 7 2005 UDP02$20050906.dat
-rwxrwxrwx 1 rmr rmr 58752000 Sep 8 2005 UDP02$20050907.dat
-rwxrwxrwx 1 rmr rmr 58751976 Sep 9 2005 UDP02$20050908.dat
-rwxrwxrwx 1 rmr rmr 22725560 Sep 9 2005 UDP02$20050909.dat
-rw-r--r-- 1 rmr rmr 32039294 Oct 1 2005 ppz_20050804.da1
-rw-r--r-- 1 rmr rmr 21708028 Oct 1 2005 ppz_20050805.da1
-rw-r--r-- 1 rmr rmr 23436829 Oct 1 2005 ppz_20050816.da1
-rw-r--r-- 1 rmr rmr 57888497 Oct 1 2005 ppz_20050817.da1
-rw-r--r-- 1 rmr rmr 57888497 Oct 1 2005 ppz_20050818.da1
-rw-r--r-- 1 rmr rmr 55244811 Oct 1 2005 ppz_20050819.da1
-rw-r--r-- 1 rmr rmr 57888564 Oct 1 2005 ppz_20050820.da1
-rw-r--r-- 1 rmr rmr 57888497 Oct 1 2005 ppz_20050821.da1
-rw-r--r-- 1 rmr rmr 57888564 Oct 1 2005 ppz_20050822.da1
-rw-r--r-- 1 rmr rmr 57888363 Oct 1 2005 ppz_20050823.da1
-rw-r--r-- 1 rmr rmr 57888564 Oct 1 2005 ppz_20050824.da1

```
-rw-r--r--   1 rmr  rmr  57888497 Oct  1  2005 ppz_20050825.da1
-rw-r--r--   1 rmr  rmr  57888564 Oct  1  2005 ppz_20050826.da1
-rw-r--r--   1 rmr  rmr  57888564 Oct  1  2005 ppz_20050827.da1
-rw-r--r--   1 rmr  rmr  57810844 Oct  1  2005 ppz_20050828.da1
-rw-r--r--   1 rmr  rmr  57888430 Oct  1  2005 ppz_20050829.da1
-rw-r--r--   1 rmr  rmr  57887626 Oct  1  2005 ppz_20050830.da1
-rw-r--r--   1 rmr  rmr  53208949 Oct  1  2005 ppz_20050831.da1
-rw-r--r--   1 rmr  rmr  57888564 Oct  1  2005 ppz_20050901.da1
-rw-r--r--   1 rmr  rmr  57888497 Oct  1  2005 ppz_20050902.da1
-rw-r--r--   1 rmr  rmr  57888497 Oct  1  2005 ppz_20050903.da1
-rw-r--r--   1 rmr  rmr  57888564 Oct  1  2005 ppz_20050904.da1
-rw-r--r--   1 rmr  rmr  57888430 Oct  1  2005 ppz_20050905.da1
-rw-r--r--   1 rmr  rmr  57888564 Oct  1  2005 ppz_20050906.da1
-rw-r--r--   1 rmr  rmr  57888564 Oct  1  2005 ppz_20050907.da1
-rw-r--r--   1 rmr  rmr  57888497 Oct  1  2005 ppz_20050908.da1
-rw-r--r--   1 rmr  rmr  22391830 Oct  1  2005 ppz_20050909.da1
-rwxrwxrwx   1 rmr  rmr  32038979 Sep 13  2005 ppza_20050804.da1
-rwxrwxrwx   1 rmr  rmr  21707659 Sep 13  2005 ppza_20050805.da1
-rwxrwxrwx   1 rmr  rmr  23436460 Sep 13  2005 ppza_20050816.da1
-rwxrwxrwx   1 rmr  rmr  57888128 Sep 13  2005 ppza_20050817.da1
-rwxrwxrwx   1 rmr  rmr  57888128 Sep 13  2005 ppza_20050818.da1
-rwxrwxrwx   1 rmr  rmr  57598360 Sep 13  2005 ppza_20050819.da1
-rwxrwxrwx   1 rmr  rmr  57888195 Sep 13  2005 ppza_20050820.da1
-rwxrwxrwx   1 rmr  rmr  57888128 Sep 13  2005 ppza_20050821.da1
-rwxrwxrwx   1 rmr  rmr  57888195 Sep 13  2005 ppza_20050822.da1
-rwxrwxrwx   1 rmr  rmr  57887994 Sep 13  2005 ppza_20050823.da1
-rwxrwxrwx   1 rmr  rmr  57888195 Sep 13  2005 ppza_20050824.da1
-rwxrwxrwx   1 rmr  rmr  57888128 Sep 13  2005 ppza_20050825.da1
-rwxrwxrwx   1 rmr  rmr  57888195 Sep 13  2005 ppza_20050826.da1
-rwxrwxrwx   1 rmr  rmr  57888195 Sep 13  2005 ppza_20050827.da1
-rwxrwxrwx   1 rmr  rmr  57884408 Sep 13  2005 ppza_20050828.da1
-rwxrwxrwx   1 rmr  rmr  57888061 Sep 13  2005 ppza_20050829.da1
-rwxrwxrwx   1 rmr  rmr  57887797 Sep 13  2005 ppza_20050830.da1
-rwxrwxrwx   1 rmr  rmr  57082076 Sep 13  2005 ppza_20050831.da1
-rwxrwxrwx   1 rmr  rmr  57888195 Sep 13  2005 ppza_20050901.da1
-rwxrwxrwx   1 rmr  rmr  57888128 Sep 13  2005 ppza_20050902.da1
-rwxrwxrwx   1 rmr  rmr  57888128 Sep 13  2005 ppza_20050903.da1
-rwxrwxrwx   1 rmr  rmr  57888195 Sep 13  2005 ppza_20050904.da1
-rwxrwxrwx   1 rmr  rmr  57888061 Sep 13  2005 ppza_20050905.da1
-rwxrwxrwx   1 rmr  rmr  57888195 Sep 13  2005 ppza_20050906.da1
-rwxrwxrwx   1 rmr  rmr  57888195 Sep 13  2005 ppza_20050907.da1
-rwxrwxrwx   1 rmr  rmr  57888128 Sep 13  2005 ppza_20050908.da1
-rwxrwxrwx   1 rmr  rmr  22391461 Sep 13  2005 ppza_20050909.da1
```

FOLDER: /Volumes/hd1/mid_level0/s1:
total 367728

```
-rwxrwxrwx   1 rmr  rmr       856 Sep 21  2005 CleanSummary.dat
-rwxrwxrwx   1 rmr  rmr  13259664 Aug  8  2005 UDP06$20050808.dat
-rwxrwxrwx   1 rmr  rmr  16891072 Aug 12  2005 UDP06$20050812.dat
-rwxrwxrwx   1 rmr  rmr  13667672 Aug 14  2005 UDP06$20050814.dat
-rwxrwxrwx   1 rmr  rmr  16564199 Aug 18  2005 UDP06$20050818.dat
-rwxrwxrwx   1 rmr  rmr  16727656 Aug 20  2005 UDP06$20050820.dat
-rwxrwxrwx   1 rmr  rmr  17012970 Aug 24  2005 UDP06$20050824.dat
-rwxrwxrwx   1 rmr  rmr  13258912 Sep 21  2005 s1_20050808.da1
-rwxrwxrwx   1 rmr  rmr  16890716 Sep 21  2005 s1_20050812.da1
-rwxrwxrwx   1 rmr  rmr  13666776 Sep 21  2005 s1_20050814.da1
-rwxrwxrwx   1 rmr  rmr  16562760 Sep 21  2005 s1_20050818.da1
-rwxrwxrwx   1 rmr  rmr  16726912 Sep 21  2005 s1_20050820.da1
-rwxrwxrwx   1 rmr  rmr  17012104 Sep 21  2005 s1_20050824.da1
```

FOLDER: /Volumes/hd1/mid_level0/s10:

```
total 349088
-rw-r--r--   1 rmr  rmr       401 Sep 28  2005 CleanSummary.dat
-rwxrwxrwx   1 rmr  rmr  13341514 Aug  9  2005 UDP17$20050808.dat
-rwxrwxrwx   1 rmr  rmr  10852730 Aug 12  2005 UDP17$20050812.dat
-rwxrwxrwx   1 rmr  rmr  15463153 Aug 14  2005 UDP17$20050814.dat
-rwxrwxrwx   1 rmr  rmr  16646341 Aug 18  2005 UDP17$20050818.dat
-rwxrwxrwx   1 rmr  rmr  15871194 Aug 20  2005 UDP17$20050820.dat
-rwxrwxrwx   1 rmr  rmr  17829413 Aug 24  2005 UDP17$20050824.dat
-rw-r--r--   1 rmr  rmr  13144998 Sep 28  2005 s10_20050808.da1
-rw-r--r--   1 rmr  rmr  10689649 Sep 28  2005 s10_20050812.da1
-rw-r--r--   1 rmr  rmr  15233184 Sep 28  2005 s10_20050814.da1
-rw-r--r--   1 rmr  rmr  16400796 Sep 28  2005 s10_20050818.da1
-rw-r--r--   1 rmr  rmr  15636795 Sep 28  2005 s10_20050820.da1
-rw-r--r--   1 rmr  rmr  17566261 Sep 28  2005 s10_20050824.da1
```

FOLDER: /Volumes/hd1/mid_level0/s11:

```
total 189744
-rw-r--r--   1 rmr  rmr       200 Sep 28  2005 CleanSummary.dat
-rwxrwxrwx   1 rmr  rmr  15503898 Aug 18  2005 UDP11$20050818.dat
-rwxrwxrwx   1 rmr  rmr  16482717 Aug 20  2005 UDP11$20050820.dat
-rwxrwxrwx   1 rmr  rmr  16931692 Aug 24  2005 UDP11$20050824.dat
-rw-r--r--   1 rmr  rmr  15275330 Sep 28  2005 s11_20050818.da1
-rw-r--r--   1 rmr  rmr  16236911 Sep 28  2005 s11_20050820.da1
-rw-r--r--   1 rmr  rmr  16682464 Sep 28  2005 s11_20050824.da1
```

FOLDER: /Volumes/hd1/mid_level0/s12:

```
total 191968
-rw-r--r--   1 rmr  rmr       199 Sep 28  2005 CleanSummary.dat
-rwxrwxrwx   1 rmr  rmr  16075148 Aug 18  2005 UDP15$20050818.dat
-rwxrwxrwx   1 rmr  rmr  15503767 Aug 20  2005 UDP15$20050820.dat
-rwxrwxrwx   1 rmr  rmr  17910924 Aug 24  2005 UDP15$20050824.dat
```

```
-rw-r--r--   1 rmr  rmr  15838532 Sep 28  2005 s12_20050818.da1
-rw-r--r--   1 rmr  rmr  15275594 Sep 28  2005 s12_20050820.da1
-rw-r--r--   1 rmr  rmr  17646728 Sep 28  2005 s12_20050824.da1
```

FOLDER: /Volumes/hd1/mid_level0/s2:

```
total 181360
-rwxrwxrwx   1 rmr  rmr       198 Sep 21  2005 CleanSummary.dat
-rwxrwxrwx   1 rmr  rmr  12989596 Aug 12  2005 UDP13$20050812.dat
-rwxrwxrwx   1 rmr  rmr  16727851 Aug  8  2005 UDP15$20050808.dat
-rwxrwxrwx   1 rmr  rmr  16727825 Aug 14  2005 UDP15$20050814.dat
-rwxrwxrwx   1 rmr  rmr  16727319 Sep 21  2005 s2_20050808.da1
-rwxrwxrwx   1 rmr  rmr  12937602 Sep 21  2005 s2_20050812.da1
-rwxrwxrwx   1 rmr  rmr  16727590 Sep 21  2005 s2_20050814.da1
```

FOLDER: /Volumes/hd1/mid_level0/s3:

```
total 368608
-rwxrwxrwx   1 rmr  rmr       397 Sep 21  2005 CleanSummary.dat
-rwxrwxrwx   1 rmr  rmr     32643 Aug  8  2005 UDP03$20050808.av1
-rwxrwxrwx   1 rmr  rmr  14238080 Aug  8  2005 UDP03$20050808.dat
-rwxrwxrwx   1 rmr  rmr  15339464 Aug 12  2005 UDP03$20050812.dat
-rwxrwxrwx   1 rmr  rmr  16115272 Aug 14  2005 UDP03$20050814.dat
-rwxrwxrwx   1 rmr  rmr  16643872 Aug 18  2005 UDP03$20050818.dat
-rwxrwxrwx   1 rmr  rmr  15624554 Aug 20  2005 UDP03$20050820.dat
-rwxrwxrwx   1 rmr  rmr  16359768 Aug 24  2005 UDP03$20050824.dat
-rwxrwxrwx   1 rmr  rmr  14236208 Sep 21  2005 s3_20050808.da1
-rwxrwxrwx   1 rmr  rmr  15337128 Sep 21  2005 s3_20050812.da1
-rwxrwxrwx   1 rmr  rmr  16113892 Sep 21  2005 s3_20050814.da1
-rwxrwxrwx   1 rmr  rmr  16639328 Sep 21  2005 s3_20050818.da1
-rwxrwxrwx   1 rmr  rmr  15621300 Sep 21  2005 s3_20050820.da1
-rwxrwxrwx   1 rmr  rmr  16358284 Sep 21  2005 s3_20050824.da1
```

FOLDER: /Volumes/hd1/mid_level0/s4:

```
total 363536
-rwxrwxrwx   1 rmr  rmr       395 Sep 21  2005 CleanSummary.dat
-rwxrwxrwx   1 rmr  rmr     36549 Aug  8  2005 UDP08$20050808.av1
-rwxrwxrwx   1 rmr  rmr  15789148 Aug  9  2005 UDP08$20050808.dat
-rwxrwxrwx   1 rmr  rmr  16482816 Aug 12  2005 UDP08$20050812.dat
-rwxrwxrwx   1 rmr  rmr  13015099 Aug 14  2005 UDP08$20050814.dat
-rwxrwxrwx   1 rmr  rmr  13545331 Aug 18  2005 UDP08$20050818.dat
-rwxrwxrwx   1 rmr  rmr  16727736 Aug 20  2005 UDP08$20050820.dat
-rwxrwxrwx   1 rmr  rmr  17461950 Aug 24  2005 UDP08$20050824.dat
-rwxrwxrwx   1 rmr  rmr  15788240 Sep 21  2005 s4_20050808.da1
-rwxrwxrwx   1 rmr  rmr  16481908 Sep 21  2005 s4_20050812.da1
-rwxrwxrwx   1 rmr  rmr  13014724 Sep 21  2005 s4_20050814.da1
-rwxrwxrwx   1 rmr  rmr  13544648 Sep 21  2005 s4_20050818.da1
-rwxrwxrwx   1 rmr  rmr  16727116 Sep 21  2005 s4_20050820.da1
```

```
-rwxrwxrwx   1 rmr  rmr  17460700 Sep 21  2005 s4_20050824.da1
```

FOLDER: /Volumes/hd1/mid_level0/s5:

```
total 367104
-rwxrwxrwx   1 rmr  rmr       394 Sep 21  2005 CleanSummary.dat
-rwxrwxrwx   1 rmr  rmr     36921 Aug  8  2005 UDP04$20050808.av1
-rwxrwxrwx   1 rmr  rmr  16197364 Aug  9  2005 UDP04$20050808.dat
-rwxrwxrwx   1 rmr  rmr  16279011 Aug 12  2005 UDP04$20050812.dat
-rwxrwxrwx   1 rmr  rmr  13382248 Aug 14  2005 UDP04$20050814.dat
-rwxrwxrwx   1 rmr  rmr  16115554 Aug 18  2005 UDP04$20050818.dat
-rwxrwxrwx   1 rmr  rmr  15707802 Aug 20  2005 UDP04$20050820.dat
-rwxrwxrwx   1 rmr  rmr  16238161 Aug 24  2005 UDP04$20050824.dat
-rwxrwxrwx   1 rmr  rmr  16197056 Sep 21  2005 s5_20050808.da1
-rwxrwxrwx   1 rmr  rmr  16278452 Sep 21  2005 s5_20050812.da1
-rwxrwxrwx   1 rmr  rmr  13381856 Sep 21  2005 s5_20050814.da1
-rwxrwxrwx   1 rmr  rmr  16114368 Sep 21  2005 s5_20050818.da1
-rwxrwxrwx   1 rmr  rmr  15707320 Sep 21  2005 s5_20050820.da1
-rwxrwxrwx   1 rmr  rmr  16237584 Sep 21  2005 s5_20050824.da1
```

FOLDER: /Volumes/hd1/mid_level0/s6:

```
total 152496
-rwxrwxrwx   1 rmr  rmr       198 Sep 21  2005 CleanSummary.dat
-rwxrwxrwx   1 rmr  rmr  17095168 Aug 12  2005 UDP11$20050812.dat
-rwxrwxrwx   1 rmr  rmr  13830979 Aug 14  2005 UDP11$20050814.dat
-rwxrwxrwx   1 rmr  rmr       651 Aug  6  2005 UDP20$20050806.av1
-rwxrwxrwx   1 rmr  rmr     34596 Aug  8  2005 UDP20$20050808.av1
-rwxrwxrwx   1 rmr  rmr   8076751 Aug  8  2005 UDP20$20050808.dat
-rwxrwxrwx   1 rmr  rmr   8074924 Sep 21  2005 s6_20050808.da1
-rwxrwxrwx   1 rmr  rmr  17094520 Sep 21  2005 s6_20050812.da1
-rwxrwxrwx   1 rmr  rmr  13829424 Sep 21  2005 s6_20050814.da1
```

FOLDER: /Volumes/hd1/mid_level0/s7:

```
total 364608
-rwxrwxrwx   1 rmr  rmr       651 Aug  4  2005 UDP12$20050804.av1
-rwxrwxrwx   1 rmr  rmr  15789384 Aug  8  2005 UDP12$20050808.dat
-rwxrwxrwx   1 rmr  rmr  14687608 Aug 12  2005 UDP12$20050812.dat
-rwxrwxrwx   1 rmr  rmr  16645967 Aug 14  2005 UDP12$20050814.dat
-rwxrwxrwx   1 rmr  rmr  15952580 Aug 18  2005 UDP12$20050818.dat
-rwxrwxrwx   1 rmr  rmr  13627072 Aug 20  2005 UDP12$20050820.dat
-rwxrwxrwx   1 rmr  rmr  17299032 Aug 24  2005 UDP12$20050824.dat
-rwxrwxrwx   1 rmr  rmr  15557227 Oct  6  2005 s7_20050808.da1
-rwxrwxrwx   1 rmr  rmr  14471223 Oct  6  2005 s7_20050812.da1
-rwxrwxrwx   1 rmr  rmr  16400684 Oct  6  2005 s7_20050814.da1
-rwxrwxrwx   1 rmr  rmr  15718094 Oct  6  2005 s7_20050818.da1
-rwxrwxrwx   1 rmr  rmr  13426962 Oct  6  2005 s7_20050820.da1
-rwxrwxrwx   1 rmr  rmr  17044761 Oct  6  2005 s7_20050824.da1
```

FOLDER: /Volumes/hd1/mid_level0/s8:

```
total 363520
-rwxrwxrwx   1 rmr  rmr    122361 Aug 12  2005 (lab)UDP16$20050812.dat
-rw-r--r--   1 rmr  rmr       453 Sep 28  2005 CleanSummary.dat
-rwxrwxrwx   1 rmr  rmr       837 Aug  4  2005 UDP16$20050804.av1
-rwxrwxrwx   1 rmr  rmr     36270 Aug  8  2005 UDP16$20050808.av1
-rwxrwxrwx   1 rmr  rmr  15136656 Aug  8  2005 UDP16$20050808.dat
-rwxrwxrwx   1 rmr  rmr  13911718 Aug 14  2005 UDP16$20050814.dat
-rwxrwxrwx   1 rmr  rmr  16687124 Aug 18  2005 UDP16$20050818.dat
-rwxrwxrwx   1 rmr  rmr  16034242 Aug 20  2005 UDP16$20050820.dat
-rwxrwxrwx   1 rmr  rmr  17299080 Aug 24  2005 UDP16$20050824.dat
-rwxrwxrwx   1 rmr  rmr  14565332 Aug 12  2005 UDP21$20050812.dat
-rw-r--r--   1 rmr  rmr  14913798 Sep 28  2005 s8_20050808.da1
-rw-r--r--   1 rmr  rmr  14350245 Sep 28  2005 s8_20050812.da1
-rw-r--r--   1 rmr  rmr  13705706 Sep 28  2005 s8_20050814.da1
-rw-r--r--   1 rmr  rmr  16441599 Sep 28  2005 s8_20050818.da1
-rw-r--r--   1 rmr  rmr  15798196 Sep 28  2005 s8_20050820.da1
-rw-r--r--   1 rmr  rmr  17044398 Sep 28  2005 s8_20050824.da1
```

FOLDER: /Volumes/hd1/mid_level0/s9:

```
total 324720
-rw-r--r--   1 rmr  rmr       393 Sep 28  2005 CleanSummary.dat
-rwxrwxrwx   1 rmr  rmr   5180728 Aug  8  2005 UDP13$20050808.dat
-rwxrwxrwx   1 rmr  rmr  13830916 Aug 14  2005 UDP13$20050814.dat
-rwxrwxrwx   1 rmr  rmr  15299488 Aug 18  2005 UDP13$20050818.dat
-rwxrwxrwx   1 rmr  rmr  15870864 Aug 20  2005 UDP13$20050820.dat
-rwxrwxrwx   1 rmr  rmr  16319753 Aug 24  2005 UDP13$20050824.dat
-rwxrwxrwx   1 rmr  rmr  17217466 Aug 12  2005 UDP15$20050812.dat
-rw-r--r--   1 rmr  rmr   5102452 Sep 28  2005 s9_20050808.da1
-rw-r--r--   1 rmr  rmr  16964065 Sep 28  2005 s9_20050812.da1
-rw-r--r--   1 rmr  rmr  13626795 Sep 28  2005 s9_20050814.da1
-rw-r--r--   1 rmr  rmr  15073392 Sep 28  2005 s9_20050818.da1
-rw-r--r--   1 rmr  rmr  15636594 Sep 28  2005 s9_20050820.da1
-rw-r--r--   1 rmr  rmr  16078928 Sep 28  2005 s9_20050824.da1
```

FOLDER: /Volumes/hd1/mid_level0/sit_Stevens_HoweCenter:

```
total 416
-rwxrwxrwx   1 rmr  rmr  206580 Sep 12  2005 sit_HoweCenter.txt
```

Appendix B: Listing of All Folders and Files for Level 1 Data

DESCRIPTION OF THE LEVEL 1 DATA FOLDERS AND FILES

The level 1 data are located in the level1 folder on a path ~/data/mid/level1. A listing of the level 1 folder is given below.

```
drwxr-xr-x    7 rmr  rmr  238 Apr 18 13:25 field
drwxrwxrwx   15 rmr  rmr  510 Apr  6 21:41 iop1
drwxrwxrwx   15 rmr  rmr  510 Apr  6 20:42 iop2
drwxrwxrwx   15 rmr  rmr  510 Apr  6 22:42 iop3
drwxrwxrwx   15 rmr  rmr  510 Apr  6 22:46 iop4
drwxrwxrwx   15 rmr  rmr  510 Apr  6 22:47 iop5
drwxrwxrwx   15 rmr  rmr  510 Apr  6 22:48 iop6
drwxrwxrwx   22 rmr  rmr  748 Apr  6 23:42 meso
```

where the folders hold data from the field calibrations, the six IOPs and the mesonet array that was in operation most of the month of August.

Field Data files

The field data are divided into four directories gp1, gp2, gp3, and gp4. Each directory contains a data set from is a different time when a different set of sonic anemometers were compared.

```
/Users/rmr/data/mid/level1/field:
total 0
drwxrwxr-x   23 rmr  rmr  782 Apr 18 13:25 gp1
drwxrwxr-x    9 rmr  rmr  306 Apr 18 16:31 gp2
drwxrwxr-x   17 rmr  rmr  578 Apr 18 16:31 gp3
drwxrwxr-x   15 rmr  rmr  510 Apr 18 16:31 gp4
```

Each of the folders contain avg files for the instruments in that group. As an example, the contents of gp1 is

```
-rw-r--r--   1 rmr  rmr   7862 Apr 18 13:18:35 2006 mid_field_z366_rmy3d_av300.mat
-rw-r--r--   1 rmr  rmr   7895 Apr 18 13:18:35 2006 mid_field_z367_rmy3d_av300.mat
-rw-r--r--   1 rmr  rmr   7823 Apr 18 13:18:35 2006 mid_field_z597_rmy3d_av300.mat
-rw-r--r--   1 rmr  rmr   7888 Apr 18 13:18:35 2006 mid_field_z607_rmy3d_av300.mat
-rw-r--r--   1 rmr  rmr   7838 Apr 18 13:18:34 2006 mid_field_z320_rmy3d_av300.mat
-rw-r--r--   1 rmr  rmr   7843 Apr 18 13:18:34 2006 mid_field_z358_rmy3d_av300.mat
-rw-r--r--   1 rmr  rmr   7892 Apr 18 13:18:34 2006 mid_field_z362_rmy3d_av300.mat
-rw-r--r--   1 rmr  rmr   7856 Apr 18 13:18:34 2006 mid_field_z363_rmy3d_av300.mat
```

```
-rw-r--r--   1 rmr  rmr   7636 Apr 18 13:18:34 2006 mid_field_z364_rmy3d_av300.mat
-rw-r--r--   1 rmr  rmr   7793 Apr 18 13:18:34 2006 mid_field_z365_rmy3d_av300.mat
-rw-r--r--   1 rmr  rmr  37202 Apr 17 15:04:40 2006 mid_field_z607_rmy3d_av300.dat
-rw-r--r--   1 rmr  rmr  36864 Apr 17 15:04:39 2006 mid_field_z320_rmy3d_av300.dat
-rw-r--r--   1 rmr  rmr  37202 Apr 17 15:04:39 2006 mid_field_z358_rmy3d_av300.dat
-rw-r--r--   1 rmr  rmr  37202 Apr 17 15:04:39 2006 mid_field_z362_rmy3d_av300.dat
-rw-r--r--   1 rmr  rmr  37202 Apr 17 15:04:39 2006 mid_field_z363_rmy3d_av300.dat
-rw-r--r--   1 rmr  rmr  37202 Apr 17 15:04:39 2006 mid_field_z364_rmy3d_av300.dat
-rw-r--r--   1 rmr  rmr  36864 Apr 17 15:04:39 2006 mid_field_z365_rmy3d_av300.dat
-rw-r--r--   1 rmr  rmr  37202 Apr 17 15:04:39 2006 mid_field_z366_rmy3d_av300.dat
-rw-r--r--   1 rmr  rmr  37202 Apr 17 15:04:39 2006 mid_field_z367_rmy3d_av300.dat
-rw-r--r--   1 rmr  rmr  37202 Apr 17 15:04:39 2006 mid_field_z597_rmy3d_av300.dat
```

where the file names show the experiment (mid), the data segment (field), the sonic serial number (z366), the instrument type (rmy3d), and the averaging time in seconds (av300). The format of these files is explained below in Appendix B.1 that describes level 1 data formats. Twenty instruments were compared during gp1 time period.

IOP Data Files

Each of the six IOP data folders is organized in the same way. The iop1 folder contains one ASCII file named INFO_mid_iop1.txt is an information file that provides details about that particular IOP. Any information that is general to the IOP and applies to all measurement systems is recorded in this file. It also contains folders for each street level anemometer used during the IOP. The directory is shown below:

```
-rwxrwxrwx   1 rmr  rmr  1064 Sep 21  2005 INFO_mid_iop1.txt
drwxrwxrwx   5 rmr  rmr   170 Apr  6 21:39 s1
drwxrwxrwx   5 rmr  rmr   170 Apr  6 21:39 s2
drwxrwxrwx   5 rmr  rmr   170 Apr  6 21:39 s3
drwxrwxrwx   5 rmr  rmr   170 Apr  6 21:39 s4
drwxrwxrwx   5 rmr  rmr   170 Apr  6 21:39 s5
drwxrwxrwx   5 rmr  rmr   170 Apr  6 21:39 s6
drwxrwxrwx   5 rmr  rmr   170 Apr  6 21:39 s7
drwxrwxrwx   5 rmr  rmr   170 Apr  6 21:39 s8
drwxrwxrwx   5 rmr  rmr   170 Apr  6 21:39 s9
drwxrwxrwx   5 rmr  rmr   170 Apr  6 21:41 s10
```

The folders s1, s2, …, s10 hold all level 1 data for the particular station. One example of this folder, s1, is given below:

```
-rwxrwxrwx   1 rmr  rmr   610 Apr  6 22:38 INFO_mid_iop1_s1.txt
-rwxrwxrwx   1 rmr  rmr  9224 Apr  9 07:17 mid_iop1_s1_rmy3d_av300.dat
```

where the file INFO_mid_iop1_s1.txt is an information ASCII file that provides specific information about the station, s1, during IOP 1. Instrument failures, alignment issues, wind blockage from truck, etc are entered to this file. The averaged wind data are listed in the ASCII data file with a name of mid_iop1_s1_rmy3d_av300.dat which includes the experiment (mid), IOP (iop1), station (s1), instrument (rmy3d), and averaging time in seconds (av300).

Meso Data Files

The level 1 folder called "meso" holds the mesoscale wind network data for the experiment. The instruments and data collected here cover the entire month of August as continuous time series. The meso folder is as follows:

```
-rwxrwxrwx    1 rmr  rmr   591 Oct  1  2005 INFO_mid_meso.txt
drwxr-xr-x    4 rmr  rmr   136 Apr  6 23:05 ccny_roof_met
drwxrwxrwx    6 rmr  rmr   204 Apr  6 23:25 cpk_CentralPark_asos
drwxr-xr-x    5 rmr  rmr   170 Apr  6 23:07 eml_EnvironMeasLab_DCnet
drwxr-xr-x    6 rmr  rmr   204 Apr  6 23:25 ewr_Newark_asos
drwxrwxrwx    7 rmr  rmr   238 Apr 14 06:25 gm1_GeneralMotors_met
drwxrwxrwx   42 rmr  rmr  1428 Apr 14 06:26 gm2_GMBldg_sodar
drwxr-xr-x    6 rmr  rmr   204 Apr  6 23:26 jfk_Kennedy_asos
drwxrwxrwx    4 rmr  rmr   136 Apr  6 23:28 lbr1_LhrBros_roof_noaa
drwxrwxrwx    5 rmr  rmr   170 Oct  6  2005 lbr2_LehmanBros_setback
drwxrwxrwx    6 rmr  rmr   204 Apr  6 23:29 lga_LaguardiaAP_asos
drwxrwxrwx    7 rmr  rmr   238 Apr 14 06:26 met1_MetLife_met
drwxrwxrwx   42 rmr  rmr  1428 Apr 14 06:27 met2_MetLife_sodar
drwxrwxrwx    5 rmr  rmr   170 Oct  4  2005 mgh1_McGraw-Hill_roof
drwxrwxrwx    5 rmr  rmr   170 Oct  5  2005 mgh2_McGraw-Hill_setback
drwxrwxrwx    5 rmr  rmr   170 Oct  6  2005 opp
drwxrwxrwx    5 rmr  rmr   170 Oct  6  2005 ppz_ParkPlaza_roof
drwxr-xr-x    7 rmr  rmr   238 Apr  6 23:53 sit1_met
```

where the ASCII information file, **INFO_mid_meso.txt** provides general information about mesonet data. Data specific to a particular station are not in this file.

The different mesonet stations are discussed in the Appendix that describes Level 0 file organization. The following types of stations are included here:

gm1,lbr2,met1,mgh1,mgh2,opp,ppz: UDP rooftop or setback wind stations. These are all RMY 3D sonic anemometers.

gm2,met2: mini Sodar installations.

cpk,ewr,jfk,lga: NOAA NWS ASOS stations.

ccny: The rooftop station from CCNY. This is an important site at the north end of Manhattan.

eml: The NOAA DCnet station on the roof of the DHS's EML building in west Greenwich Village.

lbr1: The NOAA Dcnet station on the roof of Building 'A'

sit1: The meteorological system deployed by the Stevens Institute of Technology in Hoboken New Jersey.

ASOS Data Files

The Automated Observing Systems (ASOS) weather stations are deployed by NOAA around the country. The ASOS data are collected over the internet (see http://www.ncdc.noaa.gov/oa/climate/stationlocator.html) in a standard format. The raw files from the internet have a format shown below:

```
Month:, 06/2005
Station Name:, "JOHN F KENNEDY INTERNATIONAL AIRPORT" Call Sign:, JFK
Day,Time,StationType,Maint Indic,SkyConditions,Visibility,Weather Type,Dry Bulb Faren,Dry Bulb
Cel,Wet Bulb Faren,Wet Bulb Cel,Dew Point Faren,Dew Point Cel,Rel Humd,Wind Speed,Wind Dir,Wind
Char Gusts,Val. for Wind Char,Station Pressure,Press Tend,Sea Level Pressure,Report Type,Precip
Total
01,0051,AO2 ,-,FEW008                                             ,10SM   ,-,56   ,   13.3,54   ,
12.4,53   ,  11.7, 90 , 5   ,090,-,0  ,30.14,0,216,AA,-
01,0151,AO2 ,-,SCT008                                             ,8SM    ,-,56   ,   13.3,54   ,
12.1,52   ,  11.1, 87 , 6   ,090,-,0  ,30.15,-,218,AA,-
01,0251,AO2 ,-,BKN008                                             ,7SM    ,-,56   ,   13.3,54   ,
12.4,53   ,  11.7, 90 , 5   ,090,-,0  ,30.14,-,217,AA,-
01,0351,AO2 ,-,OVC008                                             ,10SM   ,-,56   ,   13.3,54   ,
12.1,52   ,  11.1, 87 , 8   ,090,-,0  ,30.16,3,221,AA,-
```

where the lines are wrapped for convenience. We have ASOS data from 2000 to present day. A PERL program named **ReadNwsAsos.pl** reads the raw files and the level 1 files. Level 1 files with names such as **jfk2005.dat** where the station identifier (jfk) and the year (2005) define the data set. An example of the first lines of this file is given below.

```
PROGRAM: ReadNwsAsos.pl
Version: v1.01,  Editdate: 2005/09/12
Station: jfk
Year: 2005
Time correction: 0
DATE (JD) TIME   Npts  wspd(m/s)  wdir(degT)  tair(C)  tdew(C)  rh(%)  slp(hPa)   ppt(mm)
2005-02-28 (059) 23:51:00,    5.7,     10,   -0.6,   -1.7,     92,  996.8, 0.8
2005-03-01 (060) 00:51:00,    5.1,    360,   -0.6,   -2.2,     89,  996.5, 0.0
2005-03-01 (060) 01:51:00,    5.7,     10,   -0.6,   -2.8,     85,  995.8, 1.0
2005-03-01 (060) 02:51:00,    3.6,    350,   -1.1,   -2.2,     92,  995.8, 0.3
```

Note that the ASOS data are reported once each hour at 51 minutes after the hour. Each record gives averages for a five-minute sampling period. The data here are taken directly from the raw files, possibly with a change of units.

CCNY Data File Formats

The CCNY data are available from the BNL mesonet data base.

```
Timestamp, tempC, relHumidity, windSpeedMs, windDir, baroMb
2005-08-26 12:36:00, 26.9, 34,2.850, 234, 999.9
2005-08-26 12:37:00, 26.7, 35,0.900, 275, 999.9
2005-08-26 12:38:00, 26.8, 35,1.840, 202, 999.9
2005-08-26 12:39:00, 26.9, 36,2.920, 192, 999.9
2005-08-26 12:40:00, 27.0, 34,3.500, 213, 999.9
2005-08-26 12:41:00, 26.9, 33,2.720, 218, 999.9
```

```
2005-08-26 12:42:00, 26.7, 33,2.060, 224, 999.9
```

The CCNY data are reported each minute. Units are in metric, relative to true north. The internet files are averaged and converted to level 1 files with a PERL program, **wx1_web_avg.pl** which is used on all files that are derived from the BNL data base.

The output of the program is a level 1 averaged file with a name such as mid_meso_lbr1_web_av300.dat where the name includes the experiment name (mid), the data segment (meso), the station ID (lbr1), and the averaging time, in seconds (300). An example of the first lines of data follows:

```
Program: wx1_web_avg.pl.pl   Version: 2.2 (mid lbr1)    EditDate: 060613
RUN PROGRAM at 2006-06-13 (164) 16:28:59
EXPNAME: mid
SEGMENT: meso
STATION: lbr1
SENSOR: web
START TIME:   2005,08,01,0,0,0
END TIME:   2005,09,04,23,59,59
RAW SAMPLE PERIOD (sec): 900
AVG TIME (secs): 1800
  Sample time is centered on the averaging interval.
Instrument heading (degT): 0
  Note: rotation correction is applied to raw samples before vector averaging.
Percent good points required for an average:  49 (1 points)
Raw data path: /Users/mike/data/urban/mid-05/mid_level0/lbr1_BldgA_roof
Out data path: /Users/mike/data/urban/mid-05/mid/level1/meso/lbr1_LhrBros_roof_noaa
Time is in standard time, timezone: -5
Missing data value: -999
COMMENTS:
 Add comments here.  Indent > 1 space.
   DATE (local std)          WSPD    VSPD      WDIR       SIGMA-THETA       TAIR (DEGC)        RH (%)           BARO (hPa)
   date    jd        time    m/s     m/s       degT     Yamartino Vector   av      stdev    av      stdev       av       stdev
2005-08-01 (213) 01:00:00,    2.37,   2.37,   124.0,    0.00,    0.00,   20.20,    0.00,   89.00,    0.00,     -999.00,   -999.00
2005-08-01 (213) 01:30:00,    2.33,   2.32,   122.3,    3.50,    0.15,   20.50,    0.14,   88.50,    0.71,     -999.00,   -999.00
2005-08-01 (213) 02:00:00,    2.31,   2.29,   125.7,    7.50,    0.68,   20.60,    0.00,   85.50,    0.71,     -999.00,   -999.00
```

The header lines are wrapped for convenience. The format of the files here is exactly the same for all data sets that are generated from the BNL mesonet web site.

B.1 FILES CONTAINED IN THE LEVEL 1 FOLDERS

Folder: /Users/rmr/data/mid/level1/field:
total 0
drwxrwxr-x 23 rmr rmr 782 Apr 18 13:25 gp1
drwxrwxr-x 9 rmr rmr 306 Apr 18 16:31 gp2
drwxrwxr-x 17 rmr rmr 578 Apr 18 16:31 gp3
drwxrwxr-x 15 rmr rmr 510 Apr 18 16:31 gp4

FOLDER /Users/rmr/data/mid/level1/iop1:
total 16
-rw-r--r-- 1 rmr rmr 635 Apr 6 22:38 INFO.tmp
-rwxrwxrwx 1 rmr rmr 1064 Sep 21 2005 INFO_mid_iop1.txt
drwxrwxrwx 5 rmr rmr 170 Apr 6 21:39 s1
drwxrwxrwx 5 rmr rmr 170 Apr 6 21:41 s10
drwxrwxrwx 5 rmr rmr 170 Apr 6 21:39 s2
drwxrwxrwx 5 rmr rmr 170 Apr 6 21:39 s3
drwxrwxrwx 5 rmr rmr 170 Apr 6 21:39 s4
drwxrwxrwx 5 rmr rmr 170 Apr 6 21:39 s5
drwxrwxrwx 5 rmr rmr 170 Apr 6 21:39 s6
drwxrwxrwx 5 rmr rmr 170 Apr 6 21:39 s7
drwxrwxrwx 5 rmr rmr 170 Apr 6 21:39 s8
drwxrwxrwx 5 rmr rmr 170 Apr 6 21:39 s9

FOLDER /Users/rmr/data/mid/level1/iop2:
total 16
-rw-r--r-- 1 rmr rmr 635 Apr 6 22:42 INFO.tmp
-rwxrwxrwx 1 rmr rmr 689 Sep 21 2005 INFO_mid_iop2.txt
drwxrwxrwx 4 rmr rmr 136 Oct 6 2005 s1
drwxrwxrwx 5 rmr rmr 170 Oct 6 2005 s10
drwxrwxrwx 5 rmr rmr 170 Oct 6 2005 s2
drwxrwxrwx 4 rmr rmr 136 Oct 6 2005 s3
drwxrwxrwx 4 rmr rmr 136 Oct 6 2005 s4
drwxrwxrwx 4 rmr rmr 136 Oct 6 2005 s5
drwxrwxrwx 5 rmr rmr 170 Apr 6 22:43 s6
drwxrwxrwx 5 rmr rmr 170 Oct 6 2005 s7
drwxrwxrwx 5 rmr rmr 170 Oct 6 2005 s8
drwxrwxrwx 4 rmr rmr 136 Oct 6 2005 s9

FOLDER /Users/rmr/data/mid/level1/iop3:
total 16
-rw-r--r-- 1 rmr rmr 724 Apr 6 22:45 INFO.tmp
-rwxrwxrwx 1 rmr rmr 595 Apr 9 06:14 INFO_mid_iop3.txt
drwxrwxrwx 5 rmr rmr 170 Apr 6 22:46 s1

drwxrwxrwx   4 rmr rmr 136 Oct 6 2005 s10
drwxrwxrwx   5 rmr rmr 170 Apr 6 22:50 s2
drwxrwxrwx   5 rmr rmr 170 Oct 6 2005 s3
drwxrwxrwx   5 rmr rmr 170 Oct 6 2005 s4
drwxrwxrwx   4 rmr rmr 136 Oct 6 2005 s5
drwxrwxrwx   5 rmr rmr 170 Dec 30 07:17 s6
drwxrwxrwx   4 rmr rmr 136 Oct 6 2005 s7
drwxrwxrwx   5 rmr rmr 170 Oct 6 2005 s8
drwxrwxrwx   4 rmr rmr 136 Oct 6 2005 s9

FOLDER /Users/rmr/data/mid/level1/iop4:
total 16
-rw-r--r--   1 rmr rmr 542 Apr 6 22:47 INFO.tmp
-rwxrwxrwx   1 rmr rmr 775 Sep 21 2005 INFO_mid_iop4.txt
drwxrwxrwx   5 rmr rmr 170 Oct 6 2005 s1
drwxrwxrwx   4 rmr rmr 136 Oct 6 2005 s10
drwxrwxrwx   5 rmr rmr 170 Oct 6 2005 s11
drwxrwxrwx   5 rmr rmr 170 Oct 6 2005 s12
drwxrwxrwx   4 rmr rmr 136 Oct 6 2005 s3
drwxrwxrwx   4 rmr rmr 136 Oct 6 2005 s4
drwxrwxrwx   4 rmr rmr 136 Oct 6 2005 s5
drwxrwxrwx   4 rmr rmr 136 Oct 6 2005 s7
drwxrwxrwx   5 rmr rmr 170 Oct 6 2005 s8
drwxrwxrwx   4 rmr rmr 136 Oct 6 2005 s9

FOLDER /Users/rmr/data/mid/level1/iop5:
total 16
-rw-r--r--   1 rmr rmr 539 Apr 6 22:48 INFO.tmp
-rwxrwxrwx   1 rmr rmr 541 Sep 21 2005 INFO_mid_iop5.txt
drwxrwxrwx   5 rmr rmr 170 Oct 6 20:02 s1
drwxrwxrwx   4 rmr rmr 136 Oct 6 2005 s10
drwxrwxrwx   4 rmr rmr 136 Oct 6 2005 s11
drwxrwxrwx   5 rmr rmr 170 Oct 6 2005 s12
drwxrwxrwx   4 rmr rmr 136 Oct 6 2005 s3
drwxrwxrwx   4 rmr rmr 136 Oct 6 2005 s4
drwxrwxrwx   4 rmr rmr 136 Oct 6 2005 s5
drwxrwxrwx   5 rmr rmr 170 Oct 6 2005 s7
drwxrwxrwx   5 rmr rmr 170 Oct 6 2005 s8
drwxrwxrwx   4 rmr rmr 136 Oct 6 2005 s9

FOLDER /Users/rmr/data/mid/level1/iop6:
total 16
-rw-r--r--   1 rmr rmr 539 Apr 6 22:49 INFO.tmp
-rwxrwxrwx   1 rmr rmr 785 Sep 21 2005 INFO_mid_iop6.txt
drwxrwxrwx   5 rmr rmr 170 Oct 6 2005 s1
drwxrwxrwx   4 rmr rmr 136 Oct 6 2005 s10

```
drwxrwxrwx   4 rmr  rmr  136 Oct  6  2005 s11
drwxrwxrwx   5 rmr  rmr  170 Oct  6  2005 s12
drwxrwxrwx   4 rmr  rmr  136 Oct  6  2005 s3
drwxrwxrwx   4 rmr  rmr  136 Oct  6  2005 s4
drwxrwxrwx   4 rmr  rmr  136 Oct  6  2005 s5
drwxrwxrwx   4 rmr  rmr  136 Oct  6  2005 s7
drwxrwxrwx   5 rmr  rmr  170 Oct  6  2005 s8
drwxrwxrwx   4 rmr  rmr  136 Oct  6  2005 s9
```

FOLDER /Users/rmr/data/mid/level1/meso:

```
total 16
-rw-r--r--    1 rmr  rmr   695 Apr  7 00:07 INFO.tmp
-rwxrwxrwx    1 rmr  rmr   591 Oct  1  2005 INFO_mid_meso.txt
drwxr-xr-x    4 rmr  rmr   136 Apr  6 23:05 ccny_roof_met
drwxrwxrwx    6 rmr  rmr   204 Apr  6 23:25 cpk_CentralPark_asos
drwxr-xr-x    5 rmr  rmr   170 Apr  6 23:07 eml_EnvironMeasLab_DCnet
drwxr-xr-x    6 rmr  rmr   204 Apr  6 23:25 ewr_Newark_asos
drwxrwxrwx    7 rmr  rmr   238 Apr 14 06:25 gm1_GeneralMotors_met
drwxrwxrwx   42 rmr  rmr  1428 Apr 14 06:26 gm2_GMBldg_sodar
drwxr-xr-x    6 rmr  rmr   204 Apr  6 23:26 jfk_Kennedy_asos
drwxrwxrwx    4 rmr  rmr   136 Apr  6 23:28 lbr1_LhrBros_roof_noaa
drwxrwxrwx    5 rmr  rmr   170 Oct  6  2005 lbr2_LehmanBros_setback
drwxrwxrwx    6 rmr  rmr   204 Apr  6 23:29 lga_LaguardiaAP_asos
drwxrwxrwx    7 rmr  rmr   238 Apr 14 06:26 met1_MetLife_met
drwxrwxrwx   42 rmr  rmr  1428 Apr 14 06:27 met2_MetLife_sodar
drwxrwxrwx    5 rmr  rmr   170 Oct  4  2005 mgh1_McGraw-Hill_roof
drwxrwxrwx    5 rmr  rmr   170 Oct  5  2005 mgh2_McGraw-Hill_setback
drwxrwxrwx    5 rmr  rmr   170 Oct  6  2005 opp
drwxrwxrwx    5 rmr  rmr   170 Oct  6  2005 ppz_ParkPlaza_roof
drwxr-xr-x    7 rmr  rmr   238 Apr  6 23:53 sit1_met
```

Appendix C: RM Young 81000 UltraSonic Anemometer

YOUNG Model 81000 **Ultrasonic Anemometer**

The YOUNG Model 81000 Ultrasonic Anemometer is a 3-axis, no moving parts wind sensor. It is perfectly suited for applications requiring fast response, high resolution and three-dimensional wind measurement.

The sensor features durable, corrosion-resistant construction with 3 opposing pairs of ultrasonic transducers supported by stainless steel members. The transducers are arranged so that measurements are made through a common volume. A fast, 160 Hz internal sampling rate ensures superior measurement resolution. Output rates from 4 to 32 Hz may be selected. Each 81000 is individually wind-tunnel tested and calibrated to compensate for wind shadow effects of the support structure.

Model 81000 features four voltage ouput channels. Serial RS-232 and RS-485 outputs are available as well. For applications requiring synchronized analog measurements, **Model 81000V** includes four voltage input channels instead of voltage outputs. Wind, sonic temperature and voltage input data are transmitted serially. For each model, a variety of preset or custom output format options may be selected by the user.

Both models install on standard 1 inch pipe. Wiring connections are housed in a convenient weatherproof junction box.

Specifications

Wind Speed: 0 to 40 m/s (0 to 90 mph)
Resolution: 0.01 m/s
Threshold: 0.01 m/s
Accuracy: ± 1% rms ±0.05 m/s (0 to 30 m/s)
± 3% rms (30 to 40 m/s)

Wind Direction: 0 to 360 degrees
Elevation Range: ± 60 degrees
Resolution: 0.1 degree
Accuracy: ± 2 degrees (1 to 30 m/s)
± 5 degrees (30 to 40 m/s)

Speed of Sound: 300 to 360 m/s
Resolution: 0.01 m/s
Accuracy: ± 0.1% rms ± 0.05 m/s (0 to 30 m/s)

Sonic Temperature: -50 to +50 °C
Resolution: 0.01 °C
Accuracy: ± 2 °C (0 to 30 m/s)

Serial Output:
RS-232 or RS-485
1200 to 38400 baud
4 to 32 Hz (user-selected)
User Programmable ASCII output configuration (select from U, V, W, Speed of sound, Sonic temperature, 2D speed, 3D speed, Azimuth, Elevation)
Preset outputs:
NMEA- Marine Standard
RMYT- Young Wind Tracker
Units: m/s, cm/s, MPH, Knots, Km/hr

Analog Voltage Outputs (81000):
4 voltage outputs, 0 to 5000 mV
(select from U, V, W, Sonic temperature or Speed, Azimuth, Elevation, Sonic temperature)

Voltage Input (81000V):
Range: 0 to 5000 mV, V1 & V2
0 to 1000 mV, V3 & V4
Resolution: 1 part in 4000
Accuracy: ± 0.1% of full scale

Power Requirement:
12 to 24 VDC, 110 mA

Operating Temperature:
-50 to +50 °C

Dimensions:
56cm high x 17cm radius (3 support arms)
Weight: 1.7 kg (3.8 lb)
Shipping Weight: 4.5 kg (10 lb)

Ordering Information

	MODEL
ULTRASONIC ANEMOMETER- *VOLTAGE & SERIAL OUTPUTS*	**81000**
ULTRASONIC ANEMOMETER- *VOLTAGE INPUTS, SERIAL OUTPUTS ONLY*	**81000V**

CE *Complies with applicable CE Directives*

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