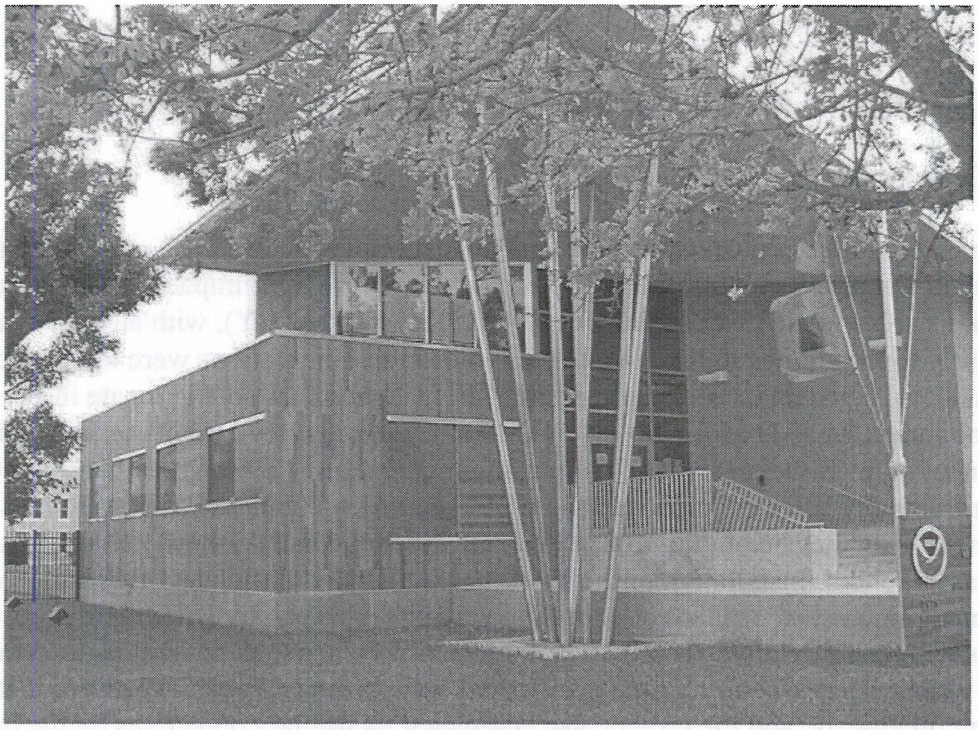

Final Project Report

to the

COMET Partners Program

Boulder, Colorado

15 October 2007

Submitted by

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Project Title:

Impact Of Local Analysis And Prediction System On Coastal/Marine Forecasts from NWS Key West[1]

UCAR Project No. S06-58381

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[1] Cover photo of NWS Key West Weather Forecast Office as it prepares for Hurricane Wilma in 2005; courtesy, NWS Key West, from http://www.srh.noaa.gov/key/HTML/galleries/whitestreet/Pre-Wilma%2010232005/images/DSCF0003_JPG.jpg.

1. PROJECT OBJECTIVES AND ACCOMPLISHMENTS

1.1 – Description

The objective of the project was to site, install, calibrate, and establish communications with five Davis Vantage Pro 2 weather stations, and to analyze their impacts on nowcast operations at National Weather Service (NWS) Key West (KEY), with an eye towards portability to techniques for use in other NWS offices. The stations were to be placed in the Florida Keys, between Ocean Reef and Key West. It was desirable to locate these stations in data poor areas, outside of Key West and Marathon. Sites were sought that were ideal to site instrumentation, possessed stable Internet communications (either broad band or dial up), and most importantly, sites which possessed willing partners. Finally chosen were two private residences, two sites belonging to the Florida Keys Aqueduct Authority (FKAA), and a Montessori school. Installation of the sites, which included design and fabrication of instrument mounts, as well as collaboration with site partners, took approximately three months with completion in January. Communication issues took some time to get resolved, which will be addressed in section 5.2. Overall, our six-month objectives were met, as reported previously, and the project also completed its primary objectives by the time of completion. The sites installed are illustrated in Figures 1-1 and 1-2 on the next page, and are more fully described in the Appendix in Table A-1.

1.2 – Division of Labor

The effort has consisted of effective collaboration between the two entities, Florida State University (FSU) and NWS Key West (KEY). At FSU, Prof. Paul Ruscher, Associate Professor and Associate Chair of the Department of Meteorology leads the project. A senior undergraduate student, Holly Anderson, and a NOAA student intern, John Turner, who is located at NWS Tallahassee (TAE), assist him. At KEY, Andrew Devanas (SOO) and Thomas Tarlton (ESA) are the principals involved. In August 2006, Ruscher visited NWS Key West and worked with Devanas and Tarlton in a comprehensive site survey of the entire length of the Florida Keys, to establish the needs of the project. On a return trip to the Florida Keys in August 2007, we once again completed site survey updates for each of the five new weather stations, and also installed a local version of NOAA/ESRL LAPS software to enable us to carry out some data denial experiments to evaluate impacts of the stations. We were able to complete preliminary and final site surveys for all five new weather stations during the course of the project. It was agreed that NWS would then work towards getting the five stations up and running, and FSU would begin to collect quality control data from NOAA MADIS (NOAA cited 2007) feeds as soon as stations were up and running

We have created the server computer and domain on which all data will be collected and have started collected all the quality control data (daily) and begun initial analysis of it. Due to communications problems at the remote sites, the data are available at MADIS and APRS web sites only (NOAA cited 2007; CWOP cited 2007). We will continue to work with the KEY mesonet partners as we do with our REALM partners (Ruscher 2005) to facilitate use of the data in their own operations – this is not critical to the success of our COMET project, however, so is not deemed that important to its success.

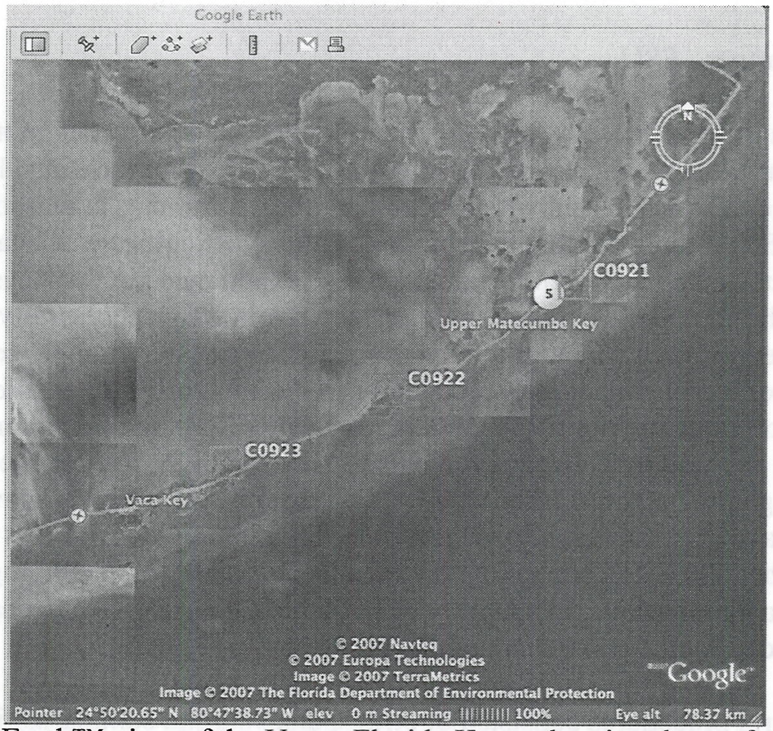


Figure 1-1. Google Earth™ view of the Upper Florida Keys, showing three of our station locations (C0921, C0922, and C0923; Islamorada, Long Key, and Burnt Point, respectively) and surroundings.

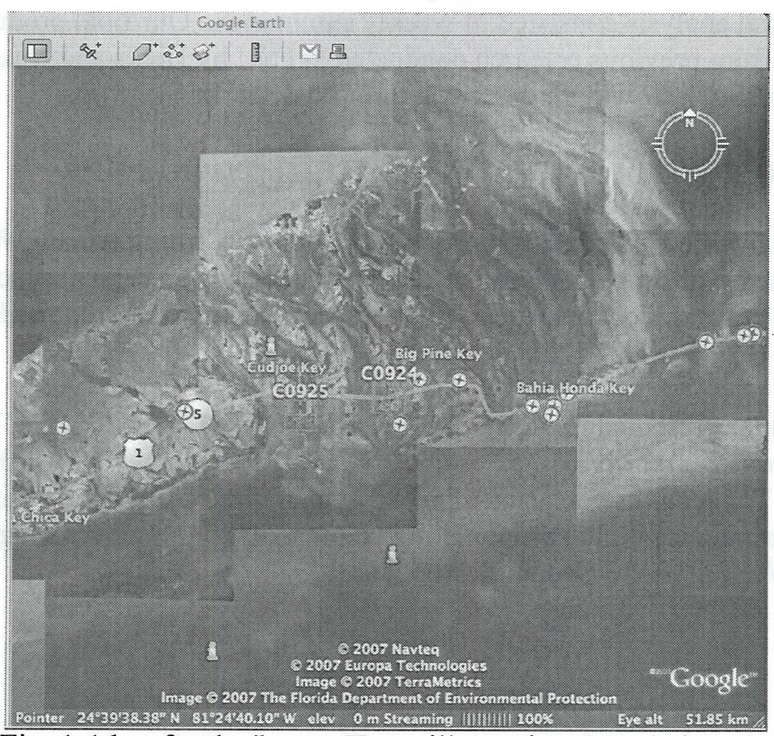


Figure 1-2. As in Fig. 1-1 but for the Lower Keys, illustrating the relative placement of C0924 and C0925. Other automated stations are present at Cudjoe Key and Ramrod Key.

2. MAJOR ACCOMPLISHMENTS

2.1 Academic Partner - FSU

We worked with the AWIPS QCMS program to monitor stations' throughput at the TAE office with help from Irv Watson and his staff (NOAA cited 2007). We have also learned much about some of the difficulties associated with maintaining the instruments at our other mesonet sites by working with KEY; it turns out that the communications difficulties we began experiencing in our panhandle sites in the fall were identical to those experienced in the Keys. Thanks to the good efforts of the KEY office and our partners, the errors were successfully diagnosed and feedback provided to Davis. In addition, we were able to transfer knowledge of and implementation of our quality control procedures to the TAE office to enable them to successfully incorporate previously ignored mesonet sites into their operations. The mesonet stations selected are built by Davis Instruments of Hayward, CA, and are their Wireless Fan-Aspirated Vantage Pro2 stations (model #6153), an example of which is shown in Figure 2.1 These stations have been successfully deployed by FSU in previous projects (REALM and REALM^2; Ruscher 2005) and are among the most popular in the CWOP program. Their virtues include a good radiation shield, availability of fan aspiration and NIST-traceability, and stability, performance, and reliability (Ruscher and Hicks 2008).

The quality control procedures consisted of critical analysis and summarization of NOAA ESRL provided mesonet data, which is accessible by email, ftp, and through AWIPS. Hourly, daily, monthly and other frequencies of quality control data (compared to operational analyses run at ESRL) are provided for all stations, including ASOS and most of the mesonets that are also reporting. Our initial analysis consisted of weekly summaries. Our final product is illustrated in Table 1 and stems from previous research conducted at FSU by Hicks and Ruscher (Hicks 2006; Ruscher and Hicks 2008). It will be described in more detail in §4.

2.2 Forecast Partner – KEY

The installation of five new mesonet stations in our County Warning Area (CWA) and incorporation of their real-time data into our operations has been a critical success. In addition, we present several cases of documented positive impact; these will be reported more fully in the next sections.

The forecaster partner presented two guest lectures at two MET 4400C/5403C "*Meteorological Instrumentation and Observations*" classes at Florida State University (FSU) during the week of March 19th – 23rd. The lectures consisted of an overview of the COMET Partners project, with an emphasis on the importance on the proper siting and installation of meteorological sensors. Meetings with NWS TAE were also held at this time.

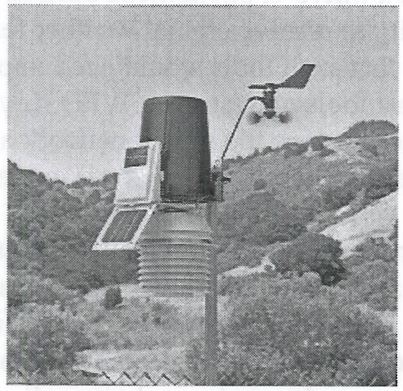


Figure 2.1. Davis Vantage Pro2 wireless fan-aspirated automated weather station, courtesy of Davis Instruments (retrieved from their online catalog at http://www.davisnet.com/weather/products/weather_product.asp?pnum=06153).

3. Benefits and Lessons Learned: Operational Partner Perspective (NWS KEY)

Background

The Florida Keys is a string of islands at the southern tip of Florida. These islands are oriented northeast to southwest, and connected from Ocean Reef to Key West by forty-two bridges along the Overseas Highway. The largest of these islands is Key Largo, followed by Big Pine Key. The island of Key West, which is the most populous of the Florida Keys with approximately twenty five thousand residents, is only two miles by four miles.

The meteorological relevancy of this island configuration lies in the scale of meteorological phenomenon affecting the Keys. For six months of the year, outside of tropical systems, most weather can be directly attributed to local mesoscale interactions. The scale of these interactions can be anywhere from several hundred kilometers to just a few meters. An example of a meso-α (200-2000 km) scale phenomenon affecting the Keys is the daily sea-breeze convection occurring on mainland Florida. The mainland sea-breeze can directly affect the Keys with outflow boundaries or convection advecting southward, or indirectly by affecting boundary layer circulation over the islands. At the meso-γ scale (2-20 km), and even at the micro-α scale (200-2000 m), the islands themselves are the catalyst for convective events, and other phenomenon such as island shadows in the near surface wind fields. The most well known example of meso-γ phenomenon is the cumulus line created when near surface winds run parallel to the island chain (Golden 1974a). This cumulus line serves as the impetus for waterspout development, and the waterspout frequency in the Keys is widely considered the highest known on earth (Golden 1974b). In the winter months, even when under synoptic scale influence, the islands will create downstream mesoscale circulations impacting local weather. Overall, because of the orientation and size of the islands, as well as the coastal-marine interface, mesoscale forcing dominates local weather regimes.

Available numerical guidance at WFO Key West, as well as local analysis models such as LAPS and ADAS are not of sufficient horizontal resolution to resolve many of the meteorological features found in the Keys. In fact, micro-α phenomena such as waterspouts fall below WSR-88D resolution. Given the inability to resolve crucial weather features with available forecast and analysis tools, it became evident that such tools would need improvement, and local development of additional forecast tools on station at WFO Key West is required. An integral part of the on station effort was to increase the sensor network along the island chain, which would serve as the foundation for high-resolution analysis and modeling.

At the time of project proposal, only a handful of widely separated remotely accessible terrestrial sensor stations were in existence; which included two ASOS stations (Key West and Marathon), one HANDAR station (Big Pine Key), and a station at Boca Chica Naval Air Station. This meant that several large data gaps existed along the island chain, including a gap from Marathon Florida to Homestead Florida, some eighty miles including all of the upper Keys.

Benefits to WFO Key West

The increase in surface sensors had an immediate impact on forecast practices at the WFO, not only because of the placement of the sensors in data poor areas, but also because of the increased temporal resolution of the new sites. Eventually, all five sites were programmed to send data every ten minutes, whereas data from the CMAN, HANDAR, and ASOS sites were available once an hour (ASOS could be dialed into for instantaneous observations). The increased temporal resolution proved useful soon after the installation of the Florida Keys Aqueduct Authority site at Long Key. On February 12th, 2007 a stationary thunderstorm complex developed in the vicinity of Long Key. The rainfall rates measured by the tipping bucket (near 9"/hour at times) led to the issuance of a flood advisory early in the event (Fig 3-1). The final total for the event was an impressive 9.36", most of which fell within a three hour period and led to significant flooding in Long Key. The rainfall measured at the Long Key gauge became a national news story that evening. Forecasters may not have issued a flood advisory that early in the event without the ground truth provided by the site.

Forecasters also maintain a wind matrix throughout their shift that contains information on wind speed, direction, and gusts (fig 3-2). The lines highlighted in red in the figure are new mesonet stations at Cudjoe Key and Ramrod Key. The bottom row is Long Key, the site mentioned above. This matrix is a valuable tool used in tropical analysis. Among many other features, this matrix is helpful in detecting wind surges and lulls, poorly defined tropical waves, outflow boundaries, density currents, and island effects.

One objective of the project was to analyze the impact of the new stations on the Local Analysis and Prediction System (LAPS) analysis run locally at the WFO within the Automated Weather Information Processing System (AWIPS). LAPS is currently run at 10 km horizontal resolution at WFO Key West, but can be configured to run at higher resolutions.

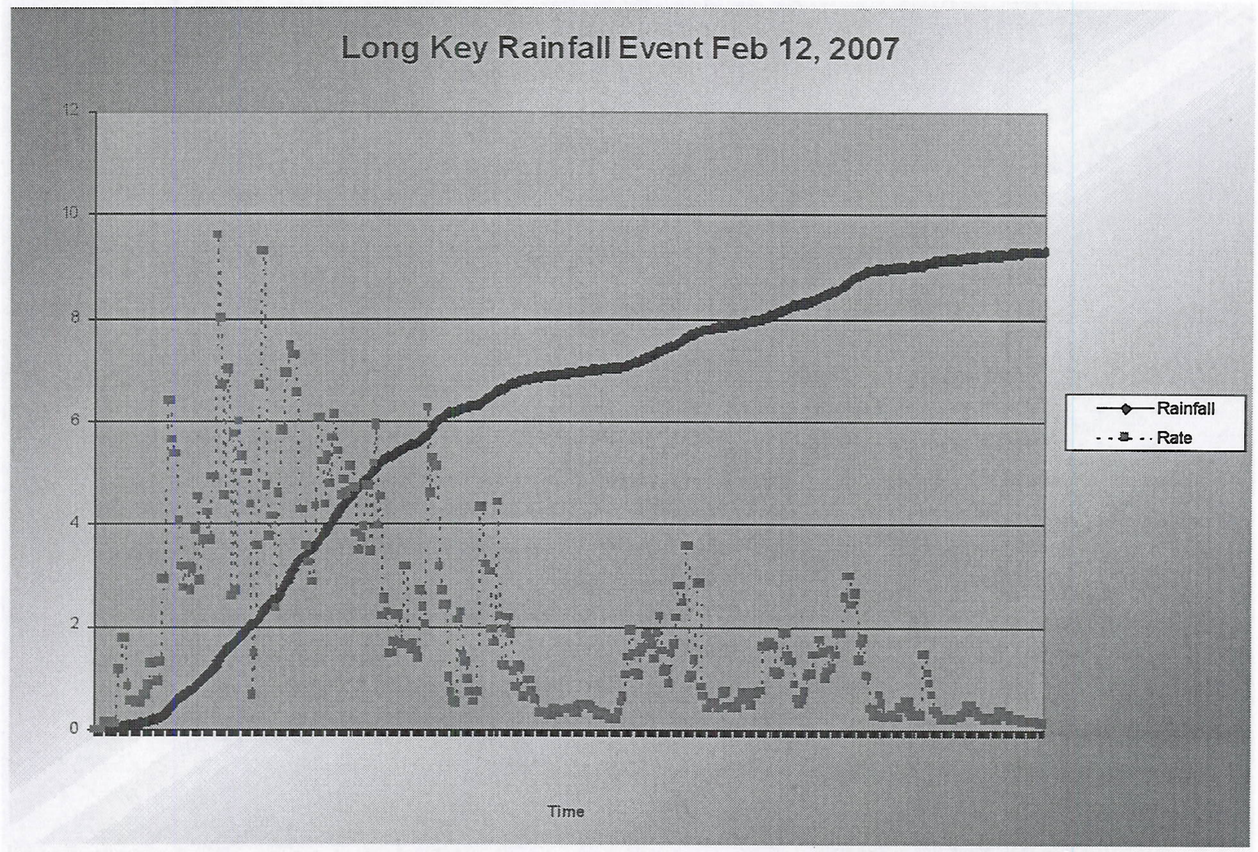


Figure 3-1. Accumulated rainfall (blue line, inches) and rain rate (magenta, in hr^{-1}) at Long Key mesonet station on 12 February 2007. This station was instrumental in the early issuance of a flood warning for this part of Monroe County.

What was found with the inclusion of the new stations in LAPS was that they did indeed improve the LAPS analysis on a limited basis, isolated spatially, but LAPS is very sensitive to observations and may produce erroneous analysis even with valid observations. The root cause of these erroneous analyses is the paucity of data over the waters surrounding the Florida Keys, and the linear configuration of surface stations (along the island chain). Therefore, available Coastal-Marine Automated Network (CMAN) stations have a large sphere of influence on the analysis, and CMANs affected by convection have a detrimental impact on the analysis even though the observation is correct. An example of this is shown in figure 3-3. The CMAN station at Molasses Reef (blue arrow) is affected by a convective event, and measuring southwesterly winds at near 15 knots. The island stations (remaining observations) all have northeasterly winds between 5 and 10 knots. Radar and satellite observations confirm that the observation at Molasses Reef is valid. The influence of the CMAN station creates a southeast to northwest elongated divergent zone in the LAPS analysis (blue in filled contour analysis) stretching from the Atlantic into Florida Bay. On-station subjective analysis found this divergent zone to be erroneous. In fact, further analysis done near the time of the observation found Florida Bay to be a confluent area.

Date	20z – (4pm)	21z – (5pm)	22z – (6pm)	23z – (7pm)	00z – (8pm)	01z – (9pm)	02z – (10pm)	03z – (11pm)
KYWF1	0806 / 13	0804 / 16	1006 / 16	0907 / 14	1006 / 16	1205 / 11	0804 / 13	1004 / 13
RWF VCAF1	1012 / 20	0716 / 24	0914 / 21	1014 / 22	0912 / 16	0812 / 17	0809 / 15	1009 / 15
MLR	0919 / 25	0920 / 24	1117 / 27	1018 / 27	0919 / 21	0921 / 26	0920 / 29	0922 / 27
LON	0820 / 23	0920 / 24	0918 / 25	0920 / 28	0819 / 24	0916 / 22	1018 / 23	0819 / 22
SMK	0822 / 29	0822 / 28	0923 / 29	0922 / 29	0918 / 26	0921 / 27	1021 / 27	0919 / 27
SAN	0823 / 33	0822 / 33	0823 / 33	0821 / 33	0924 / 31	1122 / 32	0920 / 32	0921 / 31
PLS	0921 / 27	0920 / 26	0924 / 27	0821 / 27	0923 / 30	0923 / 28	0921 / 30	0822 / 28
42003	0919 / 25	0919 / 23	0819 / 23	0918 / 21	0918 / 21	0818 / 23	0818 / 19	0818 / 19
0925 (Cudjoe)	0911 / 20	1012 / 20	0715 / 24	0613 / 21	0911 / 19	0910 / 17	1010 / 22	0910 / 18
0924 (Ramrod)	1017 / 24	0916 / 24	0518 / 26	0918 / 24	1013 / 22	0911 / 19	0914 / 21	0813 / 20
0828 42023	1010	1008	0908		1112	1012	1114	
0922 (Long Key)	1122 / 23	1119 / 20	1118 / 19	1118 / 19	1117 / 18	1014 / 15	1215 / 16	1117 / 18

Figure 3-2. Forecaster matrix of wind observations for reporting stations for KEY CWA. Mesonet sites installed for this project are given as station number 092x (where x is 1, …, 5). This matrix is used by forecasters to provide a time history of surface winds, allowing for the analysis of trough and wind shift line locations and other mesoscale wind features. The additional five mesonet sites have added critical landside stations to the matrix. This table was created by forecasters for daily operational use at NWS KEY.

The LAPS analysis with the inclusion of the new stations does have some utility. Figures 3-4 and 3-5 show a morning LAPS analysis where a density current was moving off the mainland into Florida Bay. The red arrow denotes the station located at the Montessori School in Islamorada Florida. Station observations are in black, while the wind barbs from the LAPS analysis are purple. Figure 3-4 includes the Islamorada station in the analysis, while figure 3-5 excludes this observation. Note the LAPS wind barb adjacent to the station is northwest in figure 4 and east northeast in figure 3-5. Winds over Florida Bay during this observation period were likely light

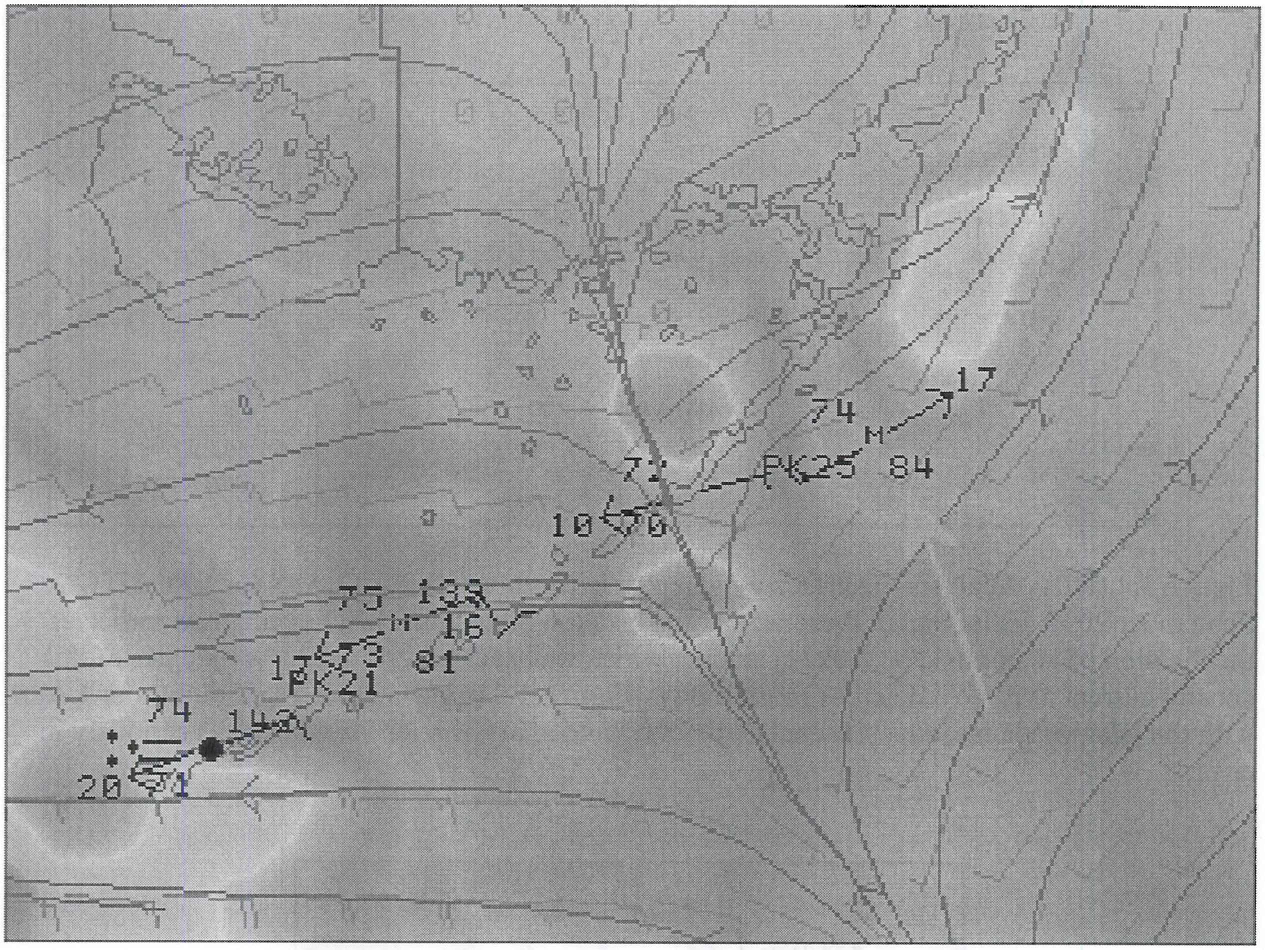
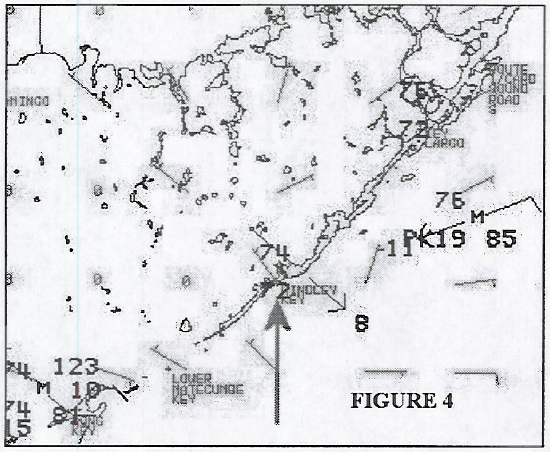


Figure 3.3 Example of an erroneous objective analysis of a surface divergence zone created when one local scale observation is used by the operational LAPS to extrapolate flow features over a larger domain. Subjective analysis created using all available data indicated a convergent boundary at nearly the same location. The objective analysis was dominated by one CMAN station experiencing convection, a non-representative feature for the rest of the domain.

from the north to northwest, as observed at the station. The analysis that includes the station is superior. Also note the influence of the CMAN station at Molasses Reef (red arrowhead in figure 5). Without the Islamorada station the CMAN influence extends into Florida Bay and the density current is missed. Analysis from the next hour shows the density current clearly (figure 3-6). However, most likely the current does not extend very far into the Atlantic waters as depicted by the analysis (note the Molasses Reef observation). During this morning the confluence in the upper keys resulting from easterly winds meeting this density current resulted in a heavy precipitation event with Key Largo receiving over three and one half inches of rain.



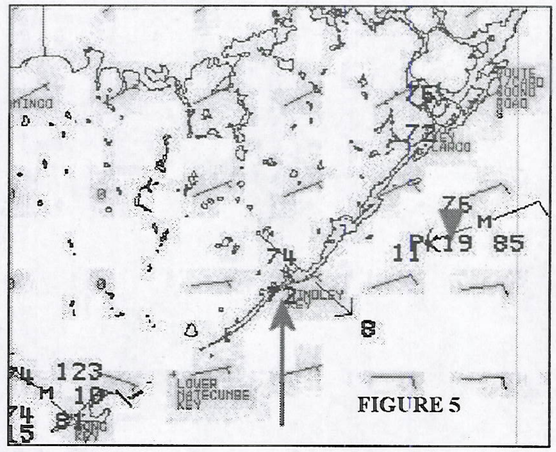


Figure 3.4 (left). Analysis of surface winds (purple wind barbs) from LAPS for 1000 UTC 26 September 2007, including all mesonet stations (station plots, black). The red arrow indicates the location of Islamorada (CW0921) station, which was deemed critical in the analysis of this density current as it moved across Florida Bay. **Figure 3-5** (right). As in Fig. 3-4, but for LAPS with the Islamorada mesonet site excluded. The wind analysis over Florida Bay is seriously in error.

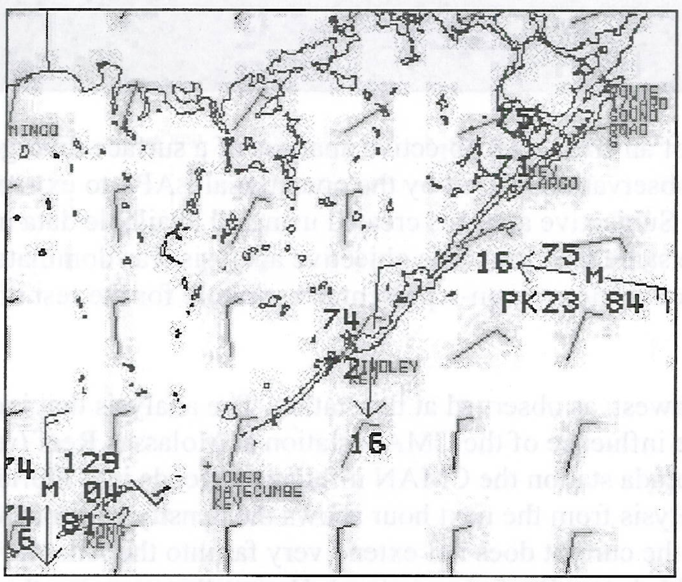


Figure 3.6. As in Figure 3.4 but for 1100 UTC.

It may be possible that the LAPS configuration may be adjusted to help mitigate the observation paucity problem, and further investigation is needed. However, given the coastal-marine environment and the scale of phenomenon such as the mainland density current, it is unlikely that the overall LAPS performance will increase consistently without the inclusion of more sensors, both marine and terrestrial. The addition of the five COMET project stations does improve the LAPS analysis in limited areas as shown, and it can be of use when combined with other on-station subjective analysis. A more complete side-by-side comparison of LAPS analyses with and without CW0921's report are provided in the Appendix in Figure A-1.

One other example of positive impacts is for a strong wind event that occurred on 18 Feburary 2007 as a strong cold front moved through the Keys. This event was well documented by existing ASOS stations, but the mesonet sites helped to document the extent of the strong winds across the entire CWA. Table 1 illustrates the strong winds (with peak gusts reported) providing confidence that our sites are well-sited, as the data appear to be very representative of standard ASOS installations. Mesonet sites installed as part of this COMET project are indicated by CWOP.

Table 1. Public Information Statement from KEY, 18 February 2007

```
NOUS42 KKEY 182149
PNSKEY FLZ076-077-078-190300

PUBLIC INFORMATION STATEMENT
NATIONAL WEATHER SERVICE KEY WEST FL
450 PM EST SUN FEB 18 2007

...PEAK WIND GUSTS MEASURED SUNDAY IN THE FLORIDA KEYS...

A ROBUST COLD FRONT MOVED SOUTHEAST THROUGH THE KEYS THIS MORNING...BRINGING
GALE FORCE WIND GUSTS TO PORTIONS OF THE ISLAND CHAIN. THE FOLLOWING IS A
LISTING OF NOTABLE GUSTS THROUGHOUT THE FLORIDA KEYS AND THE SURROUNDING
WATERS.

ISLAND STATION NAME                                    PEAK WIND GUST
BURNT POINT ON VACA KEY (CWOP)                              49 MPH
CUDJOE KEY (CWOP)                                           46 MPH
KEY WEST INTERNATIONAL AIRPORT (ASOS)                       45 MPH
LONG KEY FKAA PUMPING STATION (CWOP)                        42 MPH
RAMROD KEY FKAA PUMPING STATION (CWOP)                      38 MPH
KEY WEST NATIONAL WEATHER SERVICE (RSOIS)                   35 MPH
MARATHON AIRPORT (ASOS)                                     35 MPH

COASTAL (OVERSEA) STATION NAME

PULASKI SHOAL LIGHT NEAR DRY TORTUGAS (CMAN)                53 MPH
MOLASSES REEF LIGHT (CMAN)                                  52 MPH
SOMBRERO KEY LIGHT (CMAN)                                   52 MPH
SAND KEY LIGHT (CMAN)                                       51 MPH
LONG KEY LIGHT (CMAN)                                       47 MPH

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JR
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Other less tangible benefits to the WFO were realized in ad-hoc on station training opportunities and the partnerships formed with those involved in the project. The temporal and spatial resolution of the new stations has provided a data set not previously available at the WFO. This has led to many operational discussions of the nature of mesoscale phenomenon, which in turn has aided in forecaster recognition of mesoscale features, and the application of such to short range forecasting.

The relationship between the WFO and the partners involved in the project has exceeded all expectations. The Florida Keys Aqueduct Authority (FKAA), which hosts two sites located at

Ramrod Key and Long Key, not only allowed the use of their land and towers, but they also provided workstations at both sites, access to their network, and provided information technology support to help diagnose communication problems and maintain the network and workstation communications. The other partners involved have been equally as involved and generous with their time and resources. These relationships will most likely endure well past the life of this project.

Problems Encountered

About forty man-hours were budgeted for installation of the Davis stations. The actual hours used was near 160. This did curtail the time available for other aspects of the project, but the management of the WFO valued this project and was able to budget additional time. The knowledge and experience gained in this stage of the project far outweighed the additional time necessary to complete the installations.

The greatest problem encountered was the communication dropout problem described in the six-month progress report. These dropouts resulted in many days of missing data, as well as several on site visits needed to diagnose the problem and restart hardware and software. The switch from USB communications to serial port communication between the Davis console and companion has resolved this problem. There are still intermittent outages resulting from power outages and Internet or phone line connectivity. All workstations are now on UPS backup, but occasionally power outages have extended past the protection of the UPS. Power outages of this nature are relatively rare but have occurred during this project.

4. BENEFITS AND LESSONS LEARNED: OPERATIONAL PARTNER PERSPECTIVE (FSU)

Working with students Holly Anderson and John Turner, we devised a method for collecting and analyzing the quality control (QC) data available from the NOAA ESRL MADIS tracking system. In order to carry out our project objectives, the method was developed first for the KEY CWA and then extended into the TAE domain. QC data are available each hour out to monthly for all mesonet (and first order) stations both within AWIPS as well as by ftp access to MADIS, and email bulletins. This makes data collection quite easy, but it is still somewhat time consuming to analyze the data from an operational perspective. Miller et al. (2005) provide full details of the data available within and outside AWIPS.

For our project, we decided to summarize the weekly data and come up with a quantitative assessment strategy. The basis for this is to examine the five parameters, potential temperature (which can track elevation and pressure errors as well as temperature), altimeter setting, relative humidity, wind direction, and wind speed, and "score" the network and compare it to other available data networks. Among the other networks available in Florida are ASOS, RAWS, FAWN, AWS, and xyz (Miller et al. 2005).

An example from a recent summary is shown in Table 2, and a subset example of the quality control reports is shown in Table 3 (the full table for this particular period is shown in Appendix Table A-2. Although raw statistics are available for wind direction and speed, we have already indicated how unreliable the automated analyses can be, or how they can be biased by single observations. Although wind is the critical (vector) parameter of interest in the Keys, all parameters are generally of critical importance in most CWAs. We decided to develop a QC

Table 2. Sample Daily Quality Control Data from CWOP

```
Station C0922 from 25 September 2007
DATE       UTC   *   ALT     * POT TEMP *  DEW PNT *      DD      *     FF
                 *   (MB)    *  (DEG F) *  (DEG F) *    (DEG)     *   (KNT)
25-SEP-2007 1930  *1014.(0.36)* 79(3.25)*75.5(-3.4)*140.(-28.)*24.3(-13.)
25-SEP-2007 1950  *1014.(   -0)* 79(3.25)*75.5(-3.4)*135.(-23.)*26.1(-15.)
25-SEP-2007 1959  *1014.(0.09)* 78(-0.8)*74.8(-2.8)*140.(-15.)*24.3(-11.)
25-SEP-2007 2019  *1014.(0.29)* 78(-0.8)*75.5(-3.4)*135.(-10.)*24.3(-11.)
25-SEP-2007 Errs  *   0/17    *   0/17   *   0/17   *    4/17    *   4/17
25-SEP-2007 Smry  *0.32(0.37)*-0.4(1.53)*-2.8(0.57)*-30.(11.9)*-5.6(5.06)

Station C0924 from 26 September 2007
DATE       UTC   *   ALT     * POT TEMP *  DEW PNT *      DD      *     FF
                 *   (MB)    *  (DEG F) *  (DEG F) *    (DEG)     *   (KNT)
26-SEP-2007 Errs  *   1/94    *   0/94   *   0/94   *    2/94    *   2/94

Note that times are in UTC. The values displayed are 'Observed (error)'
The error value is 'analysis - observed'. I.e. if your observed value is higher
than the computed value, then the error will be negative. You have to pick out
the reading that is in error. The row with the time of 'Smry' is a daily summary
and the data is  'mean(standard deviation)' for each observation during that day.
```

Table 3. Subset of FSU QC Data for last week of September 2007 for entire Florida mesonet station set, for stations reporting to CWOP/APRS/NOAA. Only stations reporting during this period are shown. The only KEY area station missing (from our network) is C0921. FSU's network typically has a much higher score (upper 70s to lower 80s) compared to other state mesonetwork sites evaluated; ASOS stations typically grade out in the lower to mid 80s.

Station	Location	Grade	Mb	mb SD	24 hr temp	24 hr SD	day temp	day SD	night temp	night SD
							FSUMET Stations		**Overall Grade: 79.2**	
C0900	Tallahassee	79.5	-0.3	0.2	-1.9	1.6	-0.8	1.5	-2.7	1.1
CW3951	Tallahassee	76.8	-0.5	0.3	-1.5	1.7	-2.5	1.9	-0.9	1.1
CW3952	Tallahassee	75	-0.3	0.3	-1.3	1.8	0.2	1	-2.7	1.4
CW3961	Panama City	82.1	0.8	0.2	-1.2	1.4	-1.1	1.8	-1.3	1
CW3962	Bristol	?	?	?	?	?	?	?	?	?
CW3963	Blountstown	78.5	0.7	0.3	-0.9	2.4	0.4	2.8	-1.9	1.6
CW3966	Marianna	79.1	-0.6	0.3	0.3	2.1	-1.3	1.7	1.6	1.4
CW4103	St. Teresa	67.9	-0.4	0.4	1.3	2.3	3.1	1.6	-0.4	1.6
CW3964	Cantonment	89.3	0.1	0.2	0.5	1.1	0.2	1.1	0.7	0.9
CW3964	Milton	?	?	?	?	?	?	?	?	?
CW0922	Long Key	?	0.2	0.2	x	x	-1.4	1.7	x	x
CW0923	Burnt Point	83.7	1.4	0.2	0	1.1	0.6	1.1	-0.6	0.7
CW0924	Ramrod Key	80.4	0.8	0.2	1.1	1.2	0.6	1.1	1.4	1.1
CW0925	Cudjoe Key	78.9	0.4	0.2	0.2	1.2	0.9	1.2	-0.4	0.9

system not so dependent on wind siting statistics (we found many poorly sited instruments in the KEY CWA by both site surveys and also by analyzing the QC data). Rather, our methodology here concentrates on using pressure, temperature, and dew point temperature data to score the stations. Our scoring system is based on an academic grading scale, with a numerical scale similar to that used to assign letter grades (e.g., 90 or higher is A, grades in the 80s correspond to a B, etc.). In addition, QC statistics reported from MADIS and external partners are more robust for T, p, and T_d than they are for wind. A longer-term objective for this work would be to extend the analysis to u- and v-wind components to avoid the complication of analyzing a circular function (wind direction), separate from wind speed.

The QC data from MADIS separately evaluate temperature and dew point errors for daytime and nighttime as well as the entire 24 hr period, which is useful for the identification of potential radiation errors, in particular (e.g., Hicks 2006). Each of these elements of the FSU QC scoring system is described more fully in Appendix 3. Stations illustrated in Tables 2 and 3 generally report at 5- (Big Bend/Panhandle) or 15-minute intervals (Keys). For 15-minute interval data, a total of 96 reports are available each day. Table 2 shows that both stations illustrated do not report for all times, indicating some latent communications issues are occasionally interfering with data throughput to NOAA. Table 3 shows a subset of the data in Table A-2, which is a full accounting of the data for one week. This table illustrates the relatively high performance of the FSU network compared to other, and it is the only one that is typically ranked "green", scoring at or above 80% (rounded) in weekly quality control results.

5. PRESENTATIONS AND PUBLICATIONS

No presentations at scientific meetings were scheduled other than presentations to partners to describe the project, meetings and interviews between the PI (Ruscher), Co-PI (Devanas), and forecasters at KEY, and seminars and class lectures by Devanas at FSU. We have had an abstract accepted for presentation at the 88th AMS Annual Meeting in New Orleans (Ruscher et al. 2008) to describe the project, in a presentation for January, which may also result in a paper being submitted to an American Meteorological Society journal such as the *Journal of Atmospheric and Oceanic Technology* or *Weather and Forecasting*.

6. SUMMARY OF ACCOMPLISHMENTS

This project has led to the following accomplishments:

- 5 new mesonet stations have been installed in NWS KEY area, Monroe County, Florida
- Data are received in real-time at NWS KEY and have made positive impacts on routine daily mesoscale analysis of wind events, and in several notable meteorological events described herein
- Data denial experiments using LAPS have been carried out to demonstrate the importance of these stations in mesoscale wind events
- FSU has developed a quality control algorithm that has demonstrated its ability to identify stations that are both good and suspect, enabling WFOs to more dynamically allow or deny access to stations in their automated analyses, such as LAPS.
- QC has been extended to one other WFO (TAE) to enable the acquisition of mesonet data that had been heretofore "blacklisted" – providing potential benefits in mesoscale analysis for the TAE office as well
- Paper has been accepted for presentation at the 88th AMS Annual Meeting in New Orleans in January 2008. This work will form the basis of a journal manuscript.

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Appendix 1: Supplemental Primary Data and Analyses Referred to in the Report

Table A-1. Observational Sites Deployed by the Project, Fall 2006 to Winter 2007

Site ID	Name	Lat	Long	Elev[2] (m)
C0921[3]	Islamorada	24.95809°N	80.57163°W	12
C0922	Long Key	24.83978°N	80.79163°W	5
C0923	Burnt Point	24.76006°N	80.98588°W	5
C0924	Ramrod Key	24.66066°N	81.41114°W	5
C0925	Cudjoe Key	24.64775°N	81.48120°W	5

Table A-2. Full FSU Quality Control data for the last week of September 2007. These tables are now placed online in a folder at http://yankee.met.fsu.edu/~paul/COMET-KEY/QC/. Data table on next pages.

Figures A-1 to A-6. On the pages following Table A-2, a sequence of LAPS analyses for 0900, 1000, and 1100 UTC on 26 September 2007 is shown. These are analyses from data denial experiments in which analyses are identical except for the withholding of one station (Islamorada Montessori School, C0921). Figs. A1-3 are shown for the operational LAPS; Figs. A4-6 show the sequence with C0921 withheld. The evolution of the wind surge associated with the density current moving across Florida Bay is evident on the first image sequence, but is completely missed in the second. Without the mesonet (KEY operations prior to the COMET project) there would have been no advance notice about this wind surge, which has important consequences for recreational and transportation forecasts, as well as possible relationships to convective weather forecasts for other similar wind events.

[2] Elevation reported is approximate elevation (within tolerance of handheld 12 channel Garmin GPS unit) of temperature and relative humidity sensor; wind sensor is higher, particularly at FKAA sites (C0922 and C0924).

[3]May also be identified in APRS or CWOP databases as CW0921; similar multiple names exist in databases inside and outside NWS for other CWOP sites (with C or CW prefixes).

Table A-2. Full FSU Quality Control data for the last week of September 2007 for all stations reporting to CWOP/NOAA. Data source from MADIS (NOAA cited 2007).

Station	Location	Grade	mb	mb SD	24 hr temp	24 hr SD	day temp	day SD	nigl
							FSUMET Stations (Wednesday)		**Ove**
C0900	Tallahassee	79.5	-0.3	0.2	-1.9	1.6	-0.8	1.5	
CW3951	Tallahassee	76.8	-0.5	0.3	-1.5	1.7	-2.5	1.9	
CW3952	Tallahassee	75	-0.3	0.3	-1.3	1.8	0.2	1	
CW3961	Panama City	82.1	0.8	0.2	-1.2	1.4	-1.1	1.8	
CW3962	Bristol	?	?	?	?	?	?	?	
CW3963	Blountstown	78.5	0.7	0.3	-0.9	2.4	0.4	2.8	
CW3966	Marianna	79.1	-0.6	0.3	0.3	2.1	-1.3	1.7	
CW4103	St. Teresa	67.9	-0.4	0.4	1.3	2.3	3.1	1.6	
CW3964	Cantonment	89.3	0.1	0.2	0.5	1.1	0.2	1.1	
CW3964	Milton	?	?	?	?	?	?	?	
CW0922	Long Key	?	0.2	0.2	x	x	-1.4	1.7	
CW0923	Burnt Point	83.7	1.4	0.2	0	1.1	0.6	1.1	
CW0924	Ramrod Key	80.4	0.8	0.2	1.1	1.2	0.6	1.1	
CW0925	Cudjoe Key	78.9	0.4	0.2	0.2	1.2	0.9	1.2	
							Panhandle (Thursday)		**Ove**
W4RL-3	Barrineau Park	67.6	0.6	0.3	0	3.7	-3.4	2.2	
CW1141	Pensacola	67.5	1.5	0.2	-1.3	3.8	-5	2.5	
N9OSQ-7	Pensacola	85.1	-0.3	1	-0.9	0.9	-0.7	1.1	
KI4FCY-4	Pensacola	71.7	0.1	0.2	0.1	2	-1.8	1.5	
W4RL-6	Pensacola	20	x	x	4.4	29.6	5.4	37.6	
CW2227	Gulf Breeze	69.6	3.4	0.2	-1.5	1.1	-0.7	1	
CW4163	Gulf Breeze	80.1	0.3	0.3	-1.2	1.2	-2.2	1	
CW7062	Fort Walton Beach	66.7	0.4	0.3	-0.9	3.5	-4.5	1.7	
KG4SEY	Niceville	74.1	2	0.3	-1.3	1.6	-1.6	2	
N4GXX	Crestview	71.7	-1.2	0.3	-0.4	1.8	-1.3	2	
KI4PEQ	Crestview	56.8	0.4	0.4	0.6	2.9	-1.6	2.6	
CW7152	Panama City	54.4	-5.3	0.3	-3.6	4.7	-8.5	3.8	
N1HQ	Panama City	78.5	-1.6	0.2	-1.7	2	-3.3	1.8	
KQ4YD	White City	78	0.3	0.3	1.3	2.4	-0.7	1.9	
							Big Bend (Thursday)		**Ove**

CW8302	Carrabelle	59.3	0.7	0.3	-0.8	2.1	0.7	1.2
KA4EOC	Tallahassee	44.8	-0.1	0.3	2.4	2.4	2.5	2.9
CW1758	Lake City	85.1	0.1	0.3	-0.5	1.7	-1.1	1.4
CW1450	Trenton	84.7	0.4	0.3	0	1.7	0	2
CW6650	Bird Island	77.3	0.8	0.2	-2.8	1.2	-1.5	1.2
							North Florida (Thursday)	**Ove**
WK1F-2	Yulee	82	0.1	0.4	0.8	1.6	0.3	2.2
CW2050	Fernandina Beach	79.1	0.3	0.4	0.5	1.6	1.5	1.8
CW0777	Jacksonville	68	-2	0.5	-1	2.9	-3.3	2.7
CW2098	Jacksonville	84.7	0.2	0.3	-0.6	1.4	-0.5	1.6
CW0569	Jacksonville	77.6	-0.1	0.3	0.2	1.5	0.1	1.5
CW4840	Jacksonville	67.7	0.8	0.4	-1.9	1.6	-2.3	1.8
CW2703	Jacksonville	83.3	1.2	0.3	-0.3	1.6	-1	2
K4GDX	Jacksonville Beach	77.3	0.7	0.3	1	1.5	1.3	1.7
CW7781	Jacksonville	82	0.1	0.4	0.3	1.7	1.7	1.5
N6EIV	West Jacksonville	50.3	0.9	0.4	1.1	2.9	-0.5	3
CW4952	Jacksonville	83.1	0.5	0.3	-0.3	1.4	0	1.5
CW0639	Jacksonville	87.9	0	0.2	0.3	1.1	0.7	1.4
CW3837	Macclenny	70.4	-0.9	0.4	-0.3	1.8	-1.3	2.1
W4EDP	Jacksonville	74.7	0.7	0.3	-0.9	3	-3.1	3.5
CW4561	St. Augustine	66.4	0.8	0.4	1.2	2.8	-0.4	2.4
KS4KP	Keystone Heights	43.9	7	0.5	1.3	3.8	1.2	5.6
KD4QOF-1	St. Augustine	76.3	-0.7	0.4	-1.2	1.6	-0.8	1.8
W4DFU	Gainesville	64	1.8	0.3	-0.9	2.4	1.2	1.5
CW4992	Gainesville	58.3	-0.6	0.3	0.3	2	-0.5	2.7
CW3666	Palm Coast	68.1	0.8	0.4	2.8	2.2	2	2.9
CW1544	Palm Coast	49.2	-1.7	0.4	-0.8	3	-2.8	2.9
CW6469	Ocala	78.7	0.2	0.2	0.8	2.7	-1.1	3.2
CW2755	Ormond Beach	60	1.7	0.2	-3.7	2	-5.2	2
							Central Florida (Thursday)	**Ove**
CW1327	Holder	72.8	0.3	0.2	0.1	2.6	-1.8	2.5
K4MG	Ocala	47.1	2.1	0.2	-0.9	4.9	3	3.6
CW1118	Candler	75.9	-0.3	0.3	2.2	1.4	1.9	1.8
CW8204	The Villages	78.7	-0.1	0.2	-1.4	2.4	-3.1	2.8
CW1913	The Villages	84.8	1.4	0.2	-0.4	1.9	-0.8	2.5
CW2067	Lady Lakes	x	x	x	x	x	x	x
CW4828	Tavares	82.1	0.7	0.2	-0.8	1.9	-1	2.6
CW7784	Sorrento	69.7	0.7	0.4	-0.7	2.6	-3.2	2.2
CW8133	New Smyrna Beach	84.3	-0.5	0.3	0	1.4	0.4	2.1

N4PLT	Edgewater	82.8	1.7	0.2	-0.3	1.4	-1.3	1.6
K4NBR	Mims	59.1	x	x	0.4	3.6	-2.4	3.7
CW5909	Port St. John	81.2	0.2	0.3	-0.4	1.3	-0.6	1.5
KG4ZVW	Merritt Island	79.3	1	0.2	0.1	2.1	-0.3	3.1
KB2RC	Orlando	61.3	-0.9	0.3	-2.4	1.4	-1.9	2.1
CW4262	Orlando	75.6	1.2	0.3	1.7	1.7	0.7	1.8
KD4MRL	Orlando	61.6	-1.2	0.3	-1.4	2.1	-2.8	2.4
KE4LOJ	Casselberry	84.3	0.1	0.3	-0.5	1.9	1.2	1.7
WA4IKQ	Winter Park	82.7	-0.2	0.3	-0.5	1.4	-0.4	1.8
CW0572	Orlando	55.1	0.4	0.4	-0.1	2	-1.8	1.9
N4JCV	Orlando	86	0	0.3	0.9	1.3	0.5	1.8
CW2502	Casselberry	84	0.9	0.3	0.1	1.7	-0.9	1.9
CW3924	Orlando	76.1	-0.2	0.4	-2.2	2	-3.8	1.7
WA4LZC	Orlando	68.2	-0.4	0.4	0	1.6	0	1.6
KD4WLI	Orlando	58.9	-0.1	0.3	-0.9	1.9	-2.3	1.9
CW2611	Apopka	58.9	-0.1	0.3	-3.7	1.9	-4.5	1.7
CW0927	Apopka	75.2	0.4	0.3	0.1	1.9	-1	1.9
KC2BRB-1	Clermont	72.9	0.2	0.3	-1	2.2	-1.5	2.8
CW1921	Clermont	84.4	0.3	0.2	0.4	1.4	0.5	2
CW8067	Bushnell	78.5	0	0.3	-0.5	1.7	-1	2.1
CW7082	Floral City	75.7	0.1	0.3	-0.2	2.5	0.3	2.8
CW4074	Homosassa Springs	78.8	0.6	0.3	-0.6	2	-1.6	2.7
							Lakes Region (Friday)	**Ove**
N4ZIQ	St. Cloud	83.5	-0.7	0.3	-0.4	2	-0.9	2.2
KG4FZO-7	Kissimmee	65.1	1.2	0.3	-0.5	1.5	0.4	1.4
K9YAP	Kissimmee	54.9	6.4	0.4	-0.6	1.6	-1.2	2
WC4PEM-14	Davenport	66	1.8	0.2	-0.6	1.7	-0.7	2.1
KG4JSZ	Haines City	67.5	1.4	0.7	-1.3	2.4	-2.8	2.7
WC4PEM-9	Polk City	68.5	-1	0.3	0.7	1.7	0.2	1.8
WC4PEM-15	Dundee	76.5	2.1	1.2	-0.7	1.2	-0.5	1.5
WC4PEM	Bartow	78	-0.5	0.2	1.1	1.1	1.7	1
WC4PEM-10	Bartow	70.7	-0.4	0.3	-0.5	1.7	-1.5	1.6
CW3842	Homeland	79.1	1.4	0.3	0.9	1.6	0.7	1.8
WC4PEM-11	Welcome	77.5	1	0.4	-0.9	1.5	-0.1	1.6

WC4PEM-13	Indian Lakes Estate	74.1	-0.3	0.3	-1	1.9	-1.5	2.4
WC4PEM-12	Frostproof	81.7	0.7	0.3	-0.2	1.8	-0.7	2.1
KQ4KX	Lakeland	82	0	0.3	-0.8	1.4	-1.3	1.7
KN4LF	Lakeland	86.9	0	0.2	0	1.2	0.2	1.3
CW7718	Lakeland	83.6	0	0.2	0.3	1.6	0.6	2.1
CW6582	Lakeland	72.3	1.1	0.3	-0.5	2.8	-2.8	2.8
CW4013	Plant City	82.9	0.5	0.3	0.6	1.8	0.2	2.4
							Tampa Bay (Friday)	**Ove**
KG4JPL	Hudson	68.1	1.1	0.2	1.3	1.9	0.5	2.1
CW8274	Hudson	63.6	3.1	0.6	-2.6	3.5	-1.4	3.2
K4NUT	New Port Richey	61.5	0.2	0.3	-0.1	1.6	-1	1.1
KG4YZY-10	Port Richey	77.9	0.1	0.2	-0.9	1.7	-0.2	1.4
KG4YZY	New Port Richey	81.2	0.1	0.2	0.9	1.7	0.5	1.3
N9EE-1	New Port Richey	68.3	x	x	1.8	2.4	0.2	2
N4WDH	Wesley Chapel	44.3	x	x	-0.9	2.6	-1.8	3
CW4037	New Port Richey	58.7	0.5	0.4	-1.4	4.2	-3	6
CW3793	Tarpon Springs	66.7	-0.9	0.3	1.7	3.1	0.7	3.7
CW3771	Palm Harbor	79.7	-0.1	0.2	-1.3	1.6	-1.7	1.6
CW2574	Crystal Beach	62.3	1.2	0.3	1.2	3.7	4.5	2.3
CW5072	Palm Harbor	77.9	0.8	0.3	0.1	2.1	-1.5	1.6
CW2932	Oldsmar	68.4	2.6	0.2	-1.4	2.4	-3.6	1.9
AB4EZ-1	Clearwater	74	2.1	0.2	0.7	1.7	-0.2	1.3
CW2947	Clearwater	69.1	0	0.2	-1.5	3.4	-4.8	2
W8RD	Dunedin	62.1	1.1	0.2	-0.5	2.5	0.8	1.9
CW3235	Clearwater	73.6	3.9	0.2	-1.5	1.3	-1.2	1.3
N4BSA	Clearwater	63.7	-1.3	0.3	0	2.3	-2.2	1.6
CW5360	Clearwater	76.3	1.5	0.2	-0.7	1.7	0.6	1.3
KF4YYH	Largo	82.7	0.2	0.2	0.3	1.4	-0.6	1.5
WA4ROX	Largo	77.7	1.6	0.2	-0.3	1	-0.3	1.1
NA4AR	Seminole	50.5	-0.9	0.3	-1	3.1	-4.2	2.2
N4GD	Pinellas Park	65.2	-0.1	0.4	-3	3.3	-6	2.4
CW4628	Seminole	70	0.9	0.3	-1	2.7	-3.5	2.1
CW7163	St. Petersburg	64.4	-4.4	0.3	-1.6	2.7	-4.4	1.7
NP3R	St. Petersburg	78.5	0.5	0.3	0.2	2.1	-1.5	1.7
CW1721	St. Petersburg	66.8	-0.1	0.2	0.1	2.8	-2.5	2.2
CW7616	Treasure Island	77.7	1	0.2	-0.2	2.4	1.9	1.5

CW4224	Lutz	78.1	-0.5	0.3	0.7	1.7	0.6	2.3
N4WEB	Tampa	75.3	0.3	0.3	0.4	1.9	-0.5	2.4
CW1018	Tampa	72	-1.4	1.1	0.4	1.9	1.1	2.4
CW2672	Tampa	51.7	-0.3	0.3	-4.3	6	-8.9	5.4
CW2979	Valrico	39.6	-32.5	1.7	-0.9	2.6	-3.3	2.2
N9RLR	Tampa	83.7	0.2	0.3	-0.7	1.7	0.5	1.5
CW4703	Brandon	80.5	1.5	0.2	0.4	1.4	0.9	1.7
CW6730	Tampa	88	1.6	0.2	x	x	x	x
CW3367	Valrico	85.1	-0.8	0.2	0.5	1.5	1.3	1.8
CW1912	Valrico	82.7	0.6	0.2	1	1.5	1.4	1.9
WX4DAN	Valrico	64.5	-0.4	0.2	-1.7	5.7	-5.1	6.9
CW3502	Valrico	80.8	-0.1	0.2	1.4	1.7	1	2.2
CW3302	Lithia	66.8	2.9	0.3	-0.1	2.4	-1.7	2.7
NI4CE-11	Riverview	74.6	x	x	-0.8	2.4	-0.5	2.9
N3FU	Apollo Beach	72	-0.3	0.3	-1.9	2.1	-2	2.5
CW6511	Wimauma	67.7	0.7	0.3	1.7	2.8	1.3	3.6
CW3358	Sun City	80.9	2.3	0.2	1.2	1.8	1.5	2.2
N1ZK	Ruskin	53.9	-0.8	0.7	-0.3	2.9	-0.4	3.1
							Southwest Florida (Monday)	**Ove**
KI4FH	Ellenton	55.3	1.3	0.5	1.3	1.4	0.6	1.4
CW4416	Bradenton	77.6	-0.3	0.3	-1.5	1.5	-0.7	1.5
CW3320	Bradenton	83.3	0.9	0.2	-0.9	0.9	-0.6	0.8
KB4SYV	Bradenton	78.3	0.3	0.3	0.7	2.5	-1.4	2
NI4CE-10	Verna	57.4	x	x	-0.3	3.8	-3.5	2.6
CW7986	Sarasota	67.6	-0.1	0.5	-2.4	2.5	-4.4	2.1
CW4382	Sarasota	71.2	0.9	0.2	1.1	2.4	-0.3	3
CW2562	Venice	59.5	1.3	0.2	-1.4	1.1	-1.4	1.2
CW2763	North Port	74.1	-3	0.2	0.6	1.4	0.1	1.7
CW3032	North Port	62	-0.3	0.4	-0.6	2.2	-2.4	2.1
CW5740	Port Charlotte	75.5	-0.9	0.4	-3	2.8	-4.4	2.8
CW4903	Cape Coral	45.7	0	0.2	-1	3.1	0.5	2.2
CW4265	Fort Myers	80.7	1.1	0.2	0.1	1.8	-0.7	2
CW5863	Lehigh Acres	70.1	1.5	0.3	1.1	2.3	0.8	3.2
CW4679	Lehigh Acres	56.5	0.2	0.3	-5	2.5	-5	3.1
N4CRO	Cape Coral	45.5	6.2	0.3	-2.4	5.9	-5.1	7.8
CW6925	Cape Coral	51.9	-1.3	0.4	-1.5	3	-3.3	3.1
CW3609	Cape Coral	82.7	0.9	0.2	-0.2	1.4	-0.7	1.6
CW5277	Fort Myers	83.7	0.6	0.3	0.3	1.5	-0.7	1.4
CW3181	St. James City	76.4	0.5	0.3	-1.9	1.6	-2.5	1.9

CW2514	Naples	77.2	3.6	0.3	0.1	1.7	-0.1	2.3	
CW5898	Naples	x	x	x	x	x	x	x	
CW5783	Naples	76	0.8	0.3	1.1	2.4	0	3	
WB2WPA-4	Naples	88.3	x	x	0	0.8	-0.6	1.5	
N3ISH	Naples	67.7	x	x	-3.3	1.7	-4.4	1.7	
							South Central Florida (Monday)		**Ove**
KG4INU	Sebring	68.8	-0.2	0.3	-2	2.1	-1.7	2.9	
N8JE	Arcadia	58.4	0.2	0.4	-2.3	1.7	-2.7	2.1	
W4MIN	Arcadia	54.9	-0.3	0.2	1.2	1.9	1.7	2.4	
CW7827	Venus	71.1	-0.3	0.3	0.4	2.6	-0.7	3.3	
K4JHI	Okeechobee	73.7	1	0.3	0.3	3.2	-0.3	4.3	
							Space Coast (Monday)		**Ove**
CW6107	Rockledge	78.8	0.3	0.4	-0.4	2.6	-1.7	3.6	
CW8055	Rockledge	76.3	-0.1	0.4	-1.1	2.2	-2.1	2.7	
CW2306	Rockledge	75.2	0.9	0.3	-0.2	2	-0.8	2.7	
KE4OZD-1	Cocoa Beach	70.9	0.7	0.2	0.1	1.7	1.2	1.8	
CW1819	Satellite Beach	80.9	-0.8	0.4	-0.4	1.4	-0.4	2	
CW4018	Melbourne	85.3	-0.2	0.3	0.2	1.9	-0.2	2.6	
CW4083	Melbourne	82	0.3	0.3	-0.4	1.8	-1.4	2	
CW4149	Melbourne	80.9	-0.2	0.3	0.3	1.8	-0.8	2.1	
W4RP	Palm Bay	78.7	0.5	0.3	0.3	1.9	-0.2	2.2	
CW2791	Palm Bay	80.7	0.7	0.3	0.4	1.7	0.1	2	
AG4OX	Palm Bay	53.2	0.6	0.4	0.2	2.1	-0.4	3	
CW7841	Sebastian	56.4	1.7	0.3	-1.9	2.3	-3.1	3	
CW5924	Vero Beach	57.3	0	0.3	1.2	5.7	-0.6	7.7	
WA4ASJ	Vero Beach	65.5	0.4	0.4	-1.1	1.8	-1.2	2.6	
CW1407	Vero Beach	53.6	0.4	0.3	-3.6	6.7	-7.5	5.5	
CW7883	Port St. Lucie	74.3	0.3	0.2	-0.5	1.9	-0.4	2.4	
CW5990	Port St. Lucie	73.3	1.2	0.3	-1.2	2.2	-1	2.3	
CW0262	Port St. Lucie	68.1	0	0.4	-1.3	3.1	-3	3	
KC8NZJ-1	Port St. Lucie	73.1	1.5	0.3	-1.1	2.2	-2.2	2.5	
CW6502	Palm City	84.4	0.6	0.3	-0.2	1.8	-0.8	2.4	
CW2613	Palm City	81.1	-0.5	0.3	0.4	1.6	1.2	2	
CW8019	Jupiter	86.9	-0.7	0.2	-0.2	1.4	-0.7	1.9	
CW4392	Jupiter	81.9	0.8	0.3	0.6	2	-0.9	1.8	
W4JKJ-2	Jupiter	68.9	-0.9	0.4	-3.8	1.6	-4.3	1.8	
NS4E	Palm Beach Gardens	60	0.5	0.3	-4.1	3.5	-7.1	3.1	

CW6851	Loxahatchee	72.4	0.2	0.4	1.8	2.2	1.6	2.8
							Southeast Florida (Tuesday)		**Ove**
CW4557	Palm Springs	76.1	1	0.3	1.6	1.8	1.5	2.2
CW4042	Lantana	78	0.3	0.2	-0.9	1.4	-0.6	1.5
WA2MOY	Boynton Beach	85.5	0	0.2	0.4	1.9	1.1	2.3
KD4LXB-3	Boynton Beach	47.1	0.9	0.6	-3.3	2.2	-5.2	1.9
CW4740	Boynton Beach	86.8	0.1	0.2	-0.4	1.4	-0.3	1.6
CW5156	Delray Beach	81.5	1.1	0.3	0.5	2	-0.5	2.2
CW4957	Boca Raton	76.3	1.8	0.2	-1.1	1.7	-2.2	1.5
AB4YB	Parkland	67.3	0	0.4	-0.4	3	-2.4	3.2
KA4EPS	Deerfield Beach	81.9	1.3	0.2	-1.1	1.1	-1.6	1.4
W4AKE	Fort Lauderdale	84.9	0.2	0.2	-0.8	1.8	-1.8	1.8
CW0294	Weston	77.9	1.7	0.2	-1.5	1.9	-2.5	2.2
CW2571	Weston	76.8	1.4	0.3	-1	1.6	-1.5	2.1
KC4VFP	Davie	85.2	0.4	0.3	1.1	2	0	2.5
CW6345	Davie	73.3	0.6	0.2	0.7	1.6	0.1	1.9
WD4CLZ	Hollywood	79.2	0.5	0.2	-0.9	2	-1.9	1.8
N4HHP-3	Hallandale Beach	38.6	x	x	7.2	3	10	1.5
CW6519	Coral Gables	80.3	0.2	0.2	-0.8	1.9	-2.4	1.3
K4TCV-1	Miami	70.9	x	x	-0.4	2.5	1.8	2
CW3829	Miami	60.7	0.7	0.4	-2.5	3.9	-5.1	3.1
K4JRG	Miami	73.3	0.1	0.8	-0.9	2.4	-2.6	2.7
CW1733	South Miami	54.3	1.9	0.2	0.5	1.9	-0.5	2
CW5385	Pinecrest	77.7	0.1	0.2	-0.9	1.8	-2.3	1.3
CW4495	The Hammocks	83.5	-0.2	0.2	-1.3	1.5	-1.8	1.8
KG4LXH-2	Miami	53.2	3.2	0.4	-3.8	2	-5	2.3
							The Keys (Tuesday)		**Sin**
CW1719	Key Largo	60.5	0	0.3	-4.4	4.6	-7.5	3.4

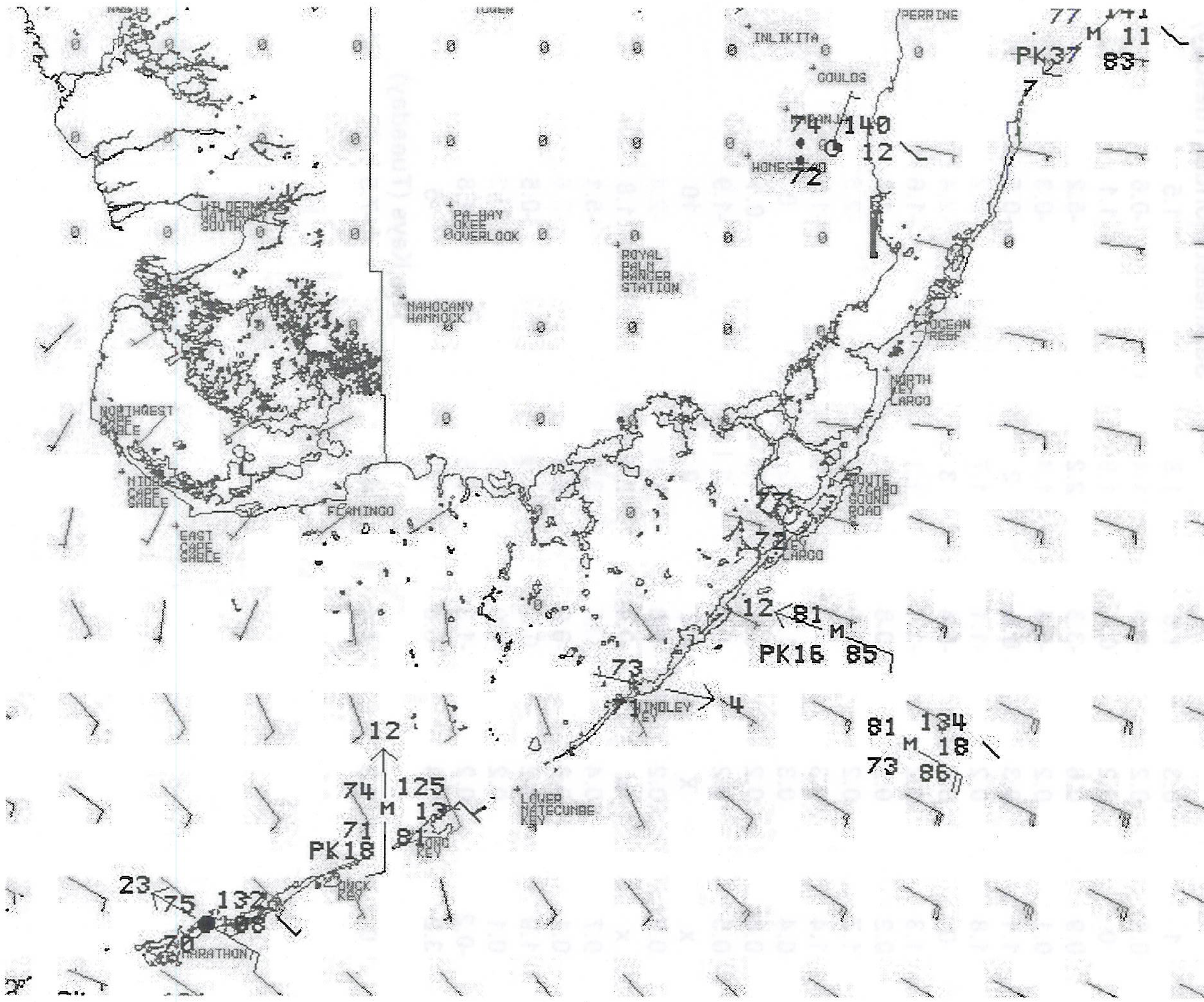


Figure A-1. LAPS analysis for the Upper Florida Keys for 0900 UTC 26 September 2007. Analyzed wind barbs are shown in purple, station plots are in black. Station names are indicated in red.

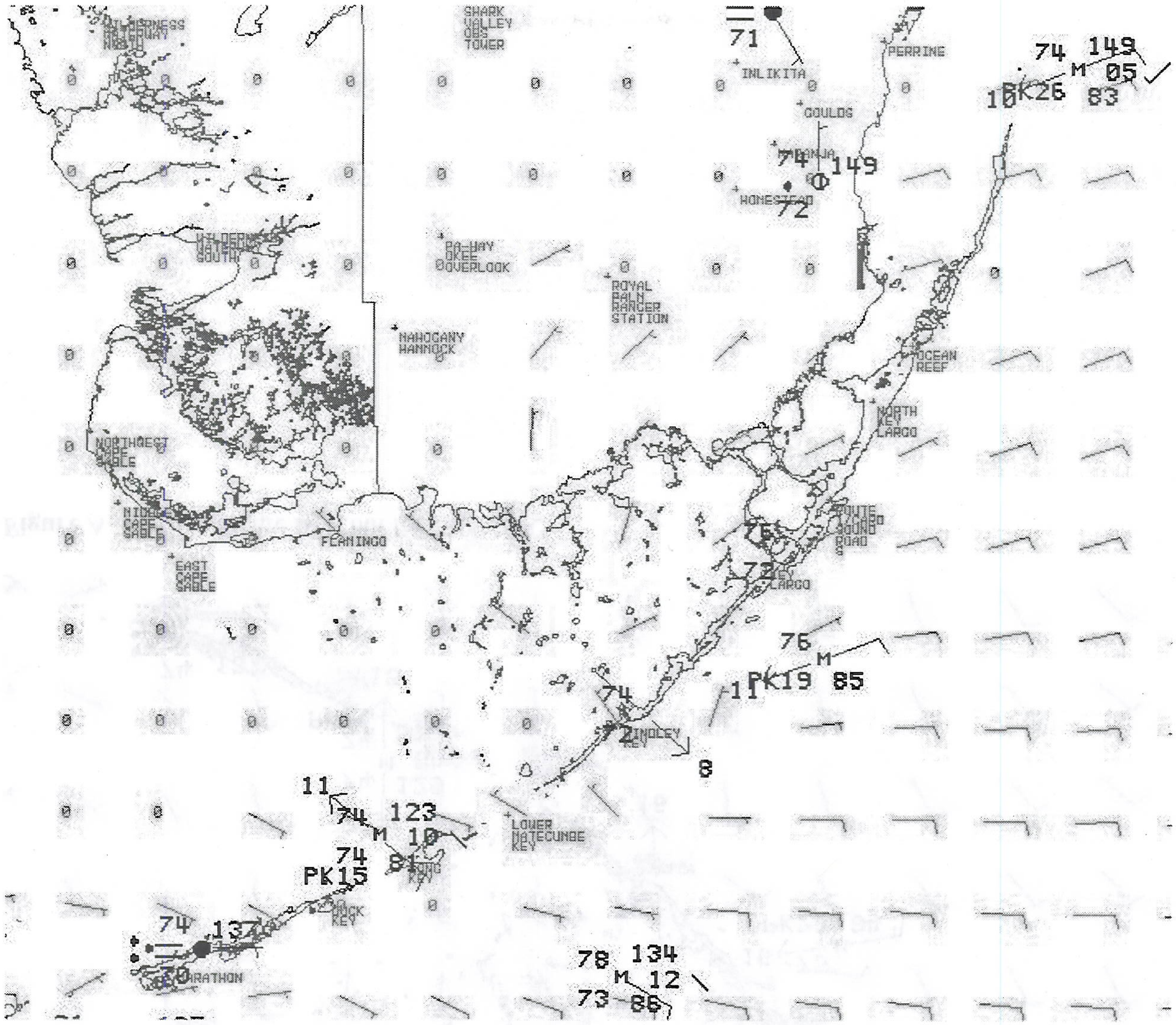


Figure A-2. As in Figure A-1, but for 1000 UTC.

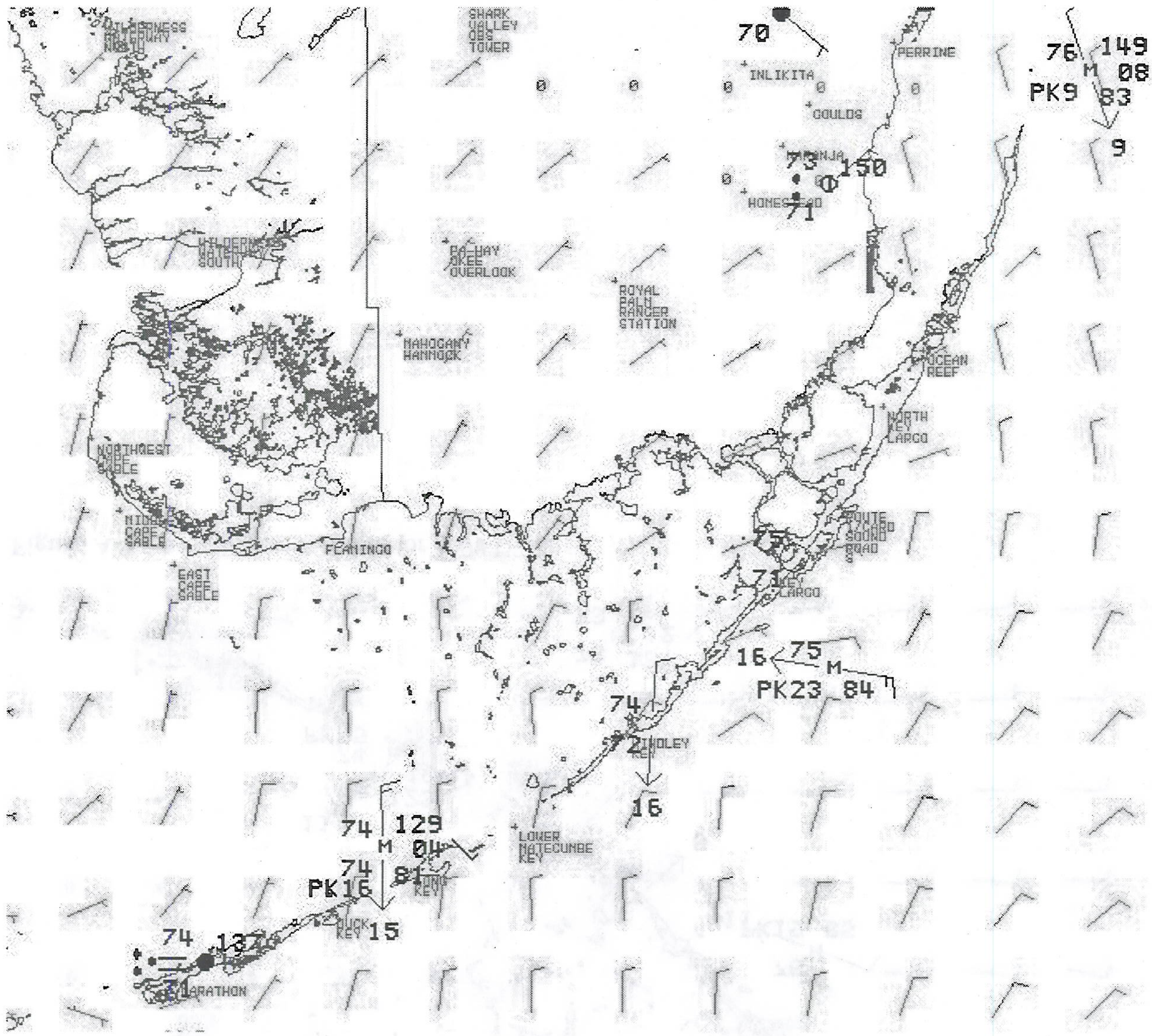


Figure A-3. As in Figure A-1, but for 1100 UTC.

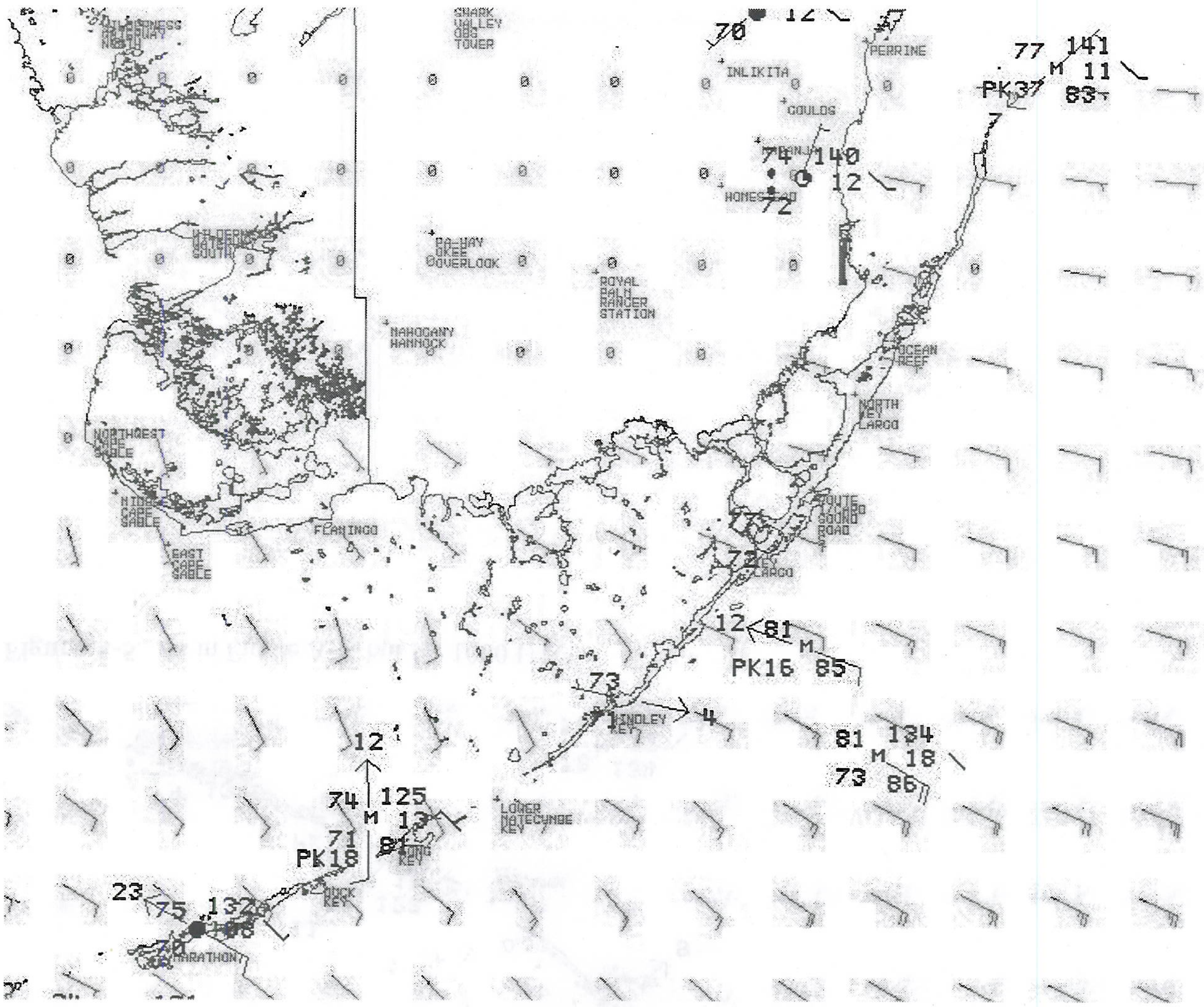


Figure A-4. As in Figure A-1, but for the LAPS data denial experiment, with C0921 withheld.

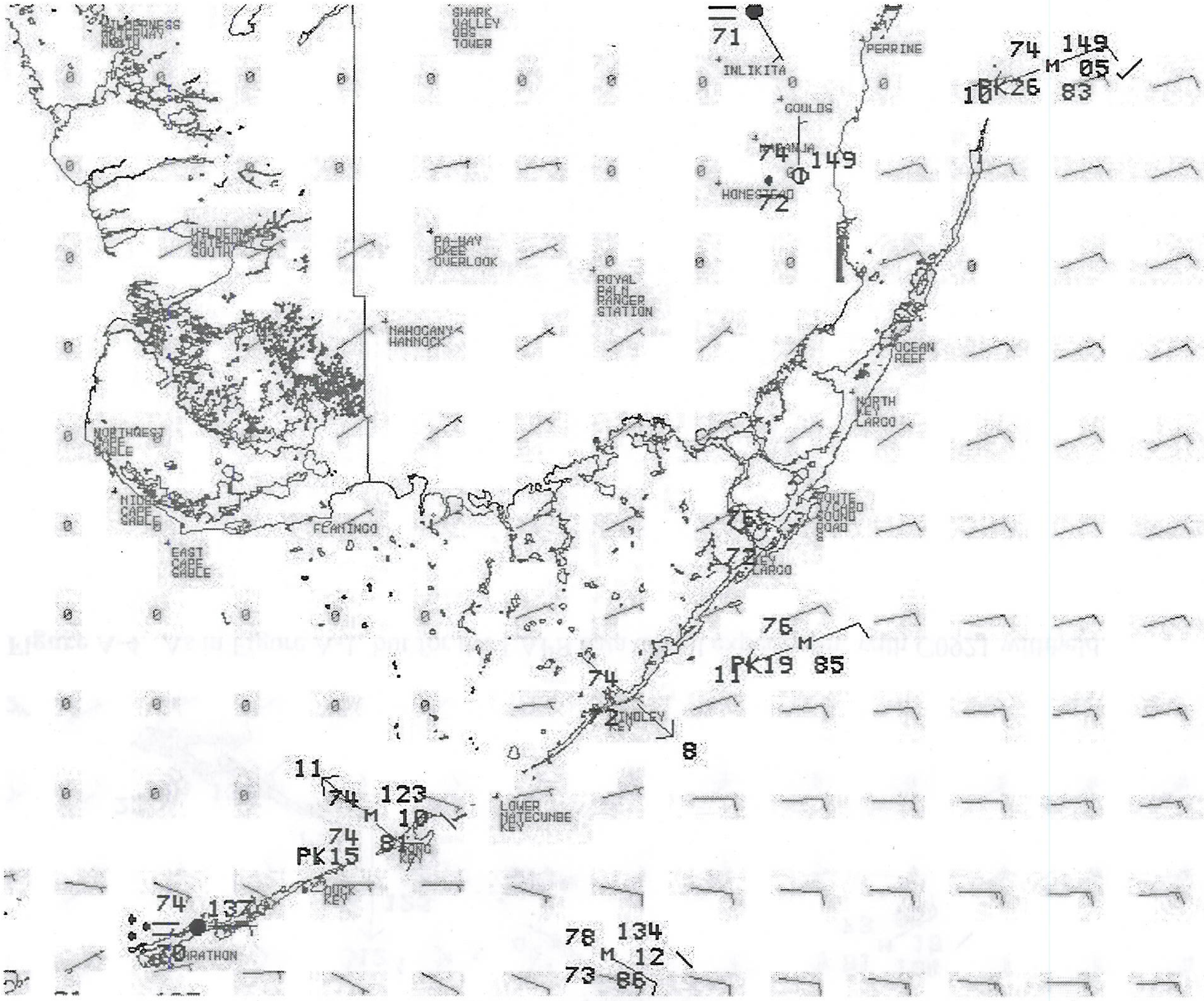


Figure A-5. As in Figure A-4, but for 1000 UTC.

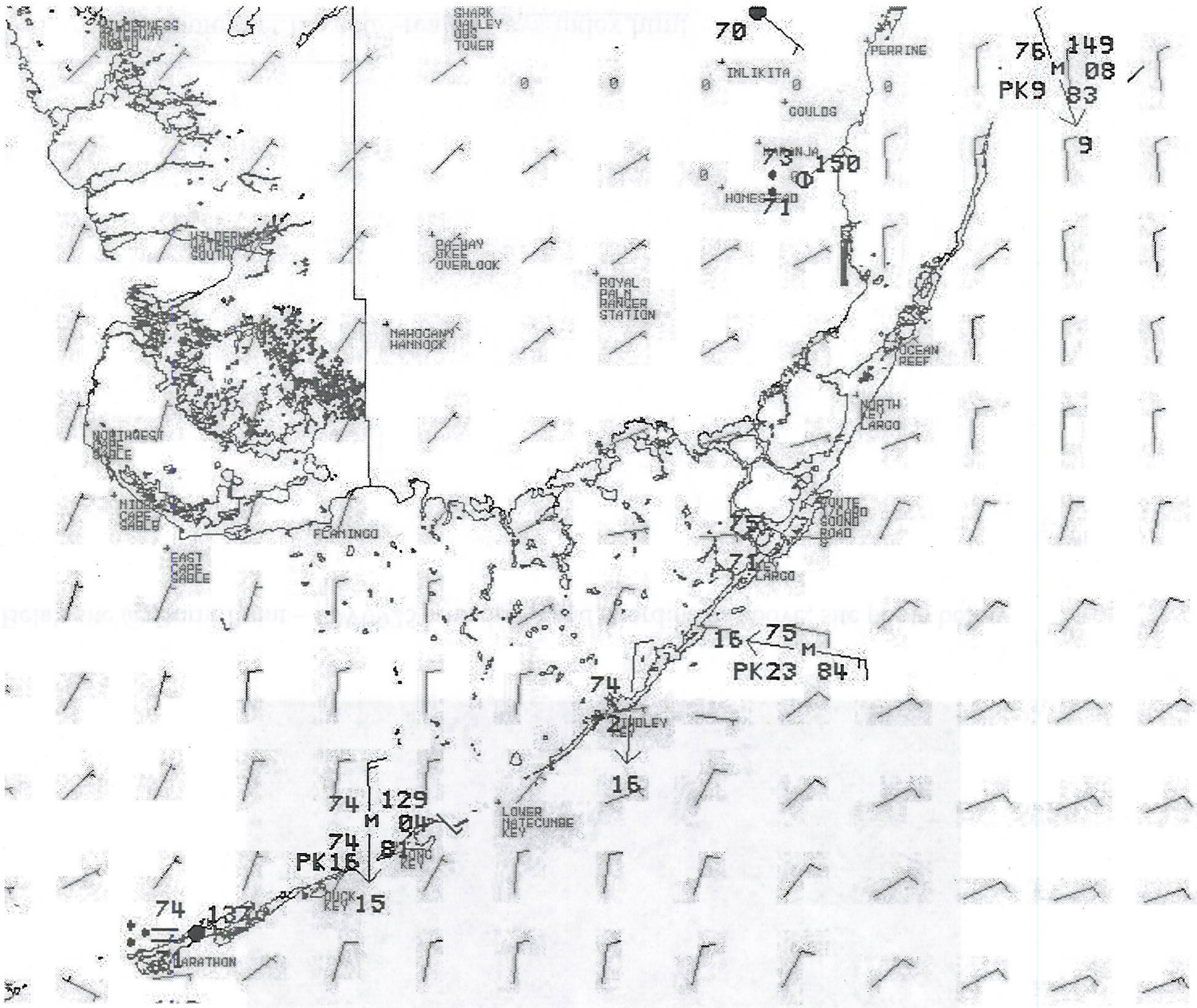
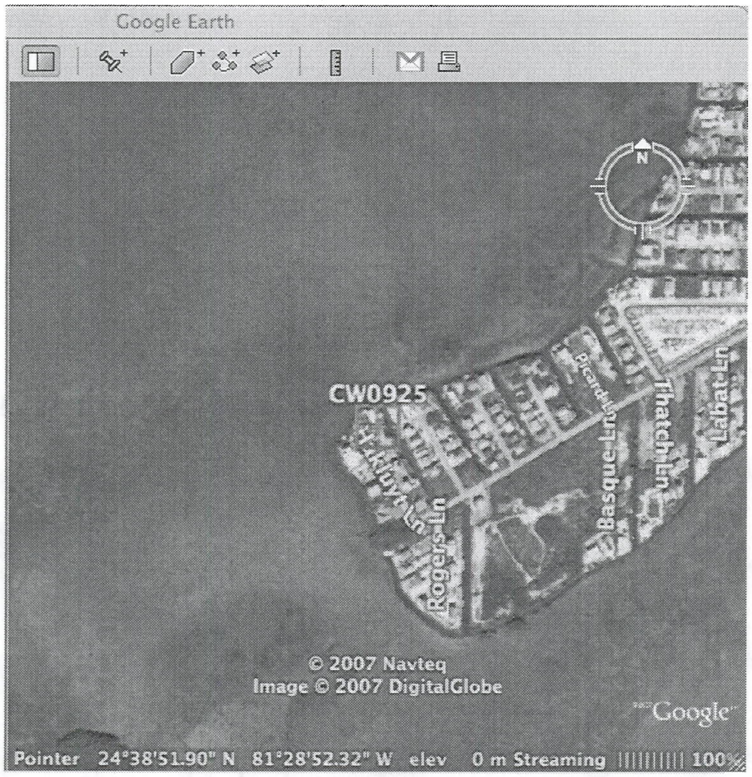


Figure A-6. As in Figure A-4, but for 1100 UTC.

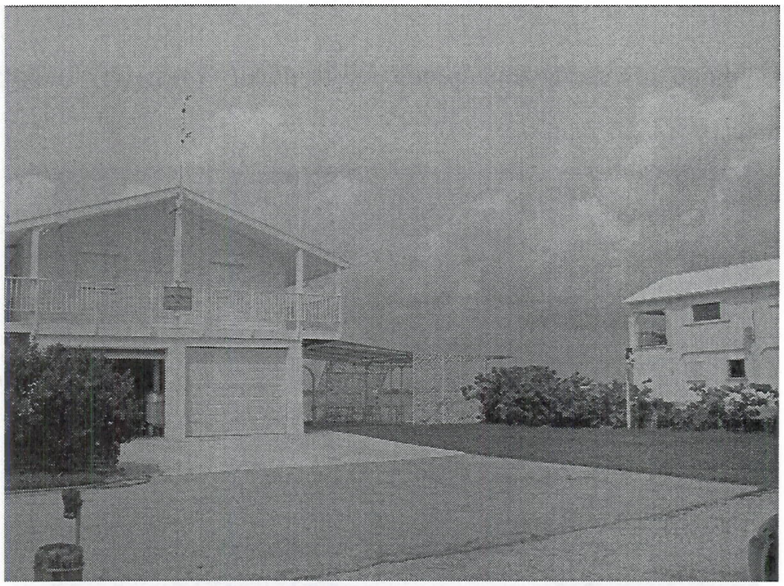
Appendix 2. Site Metdata

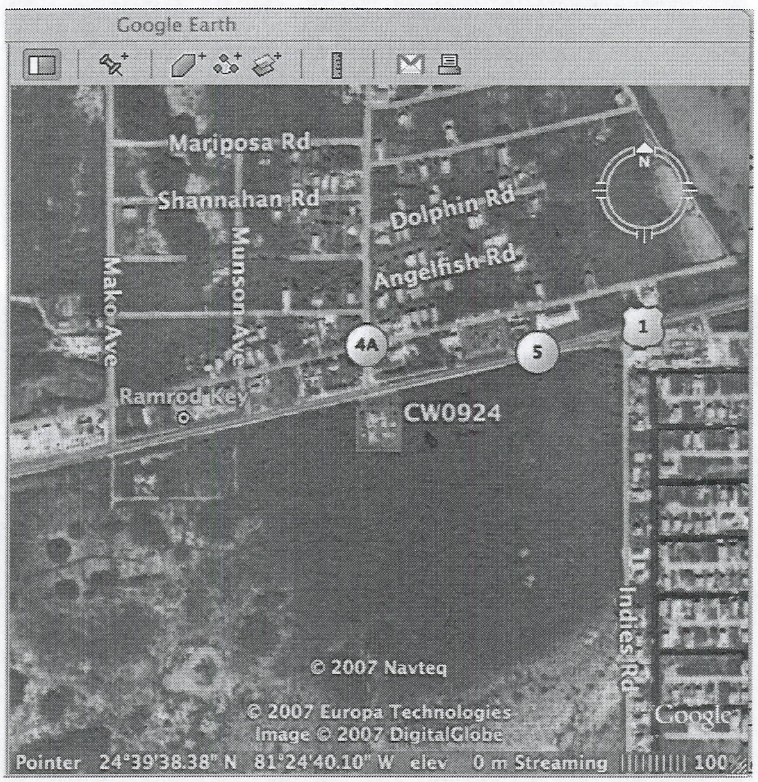
these figures contain site maps (from Google Earth™ and site photos taken by either FSU or NWS employees during our site survey trip in August 2006. Site photos from C0921, our northernmost site are also shown in the report that reveal all exposure directions. Comprehensive site photos are part of the metadata being assembled for the project WWW site[4].



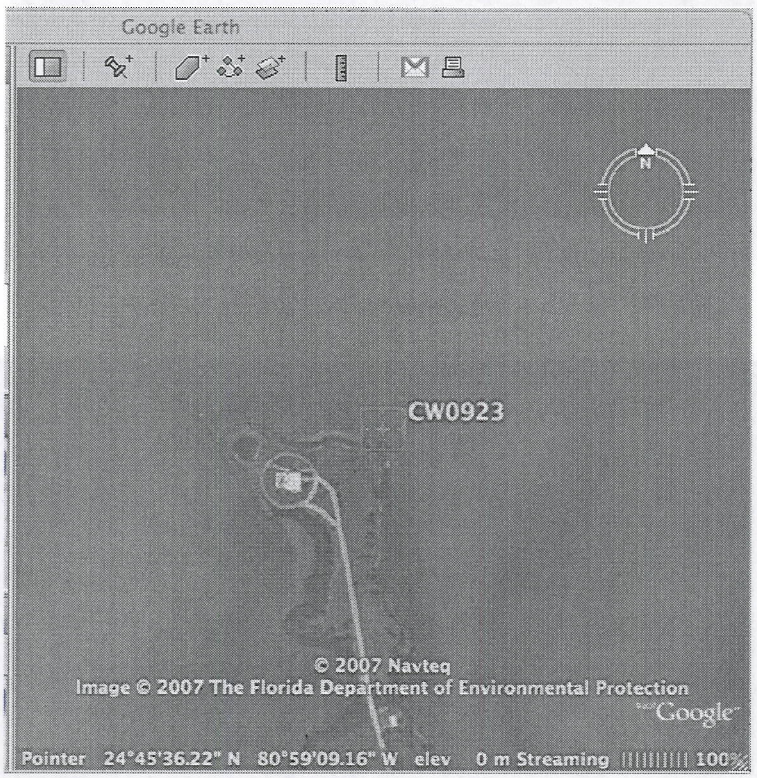
Bela's site @ Burnt Point – CW0925 – mapping and coordinates above; site photo below

4 http://opie.met.fsu.edu/~realm/Keys/index.html

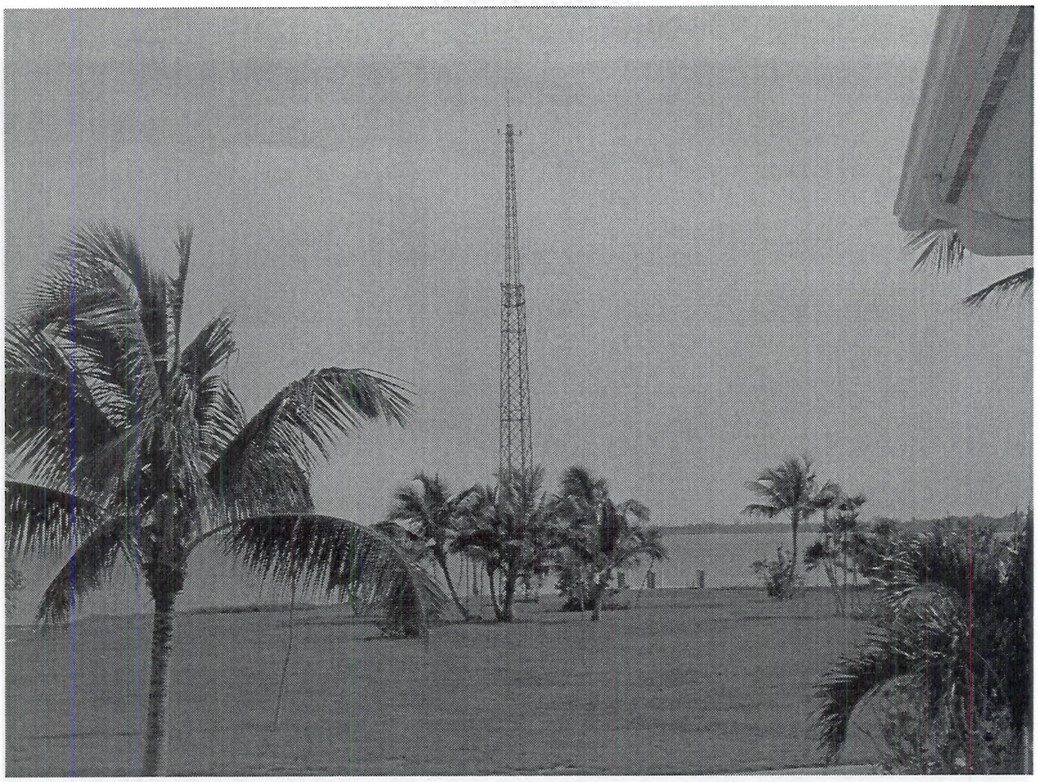


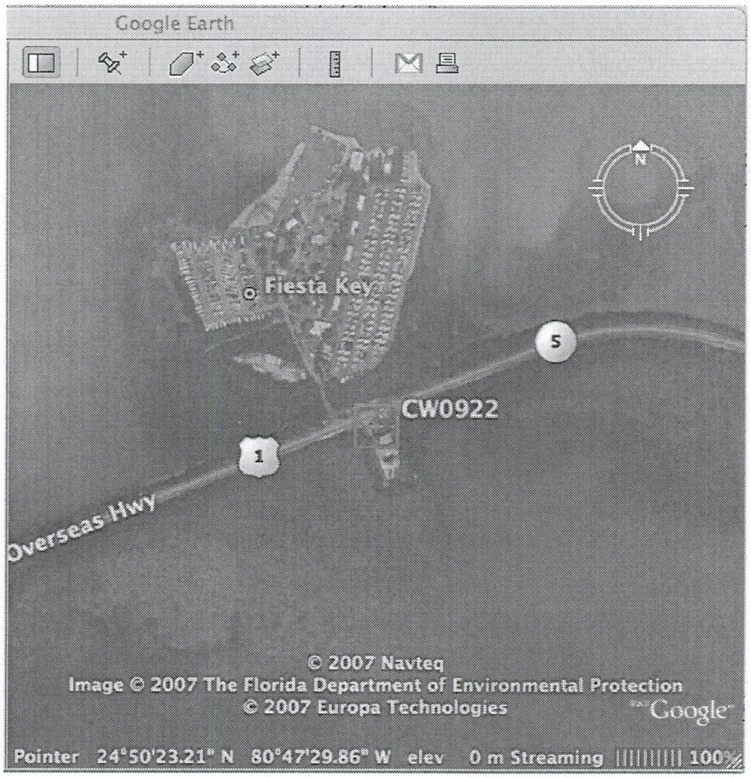


FKAA Ramrod Key site – CW0924 - mapping and coordinates above; site photo below

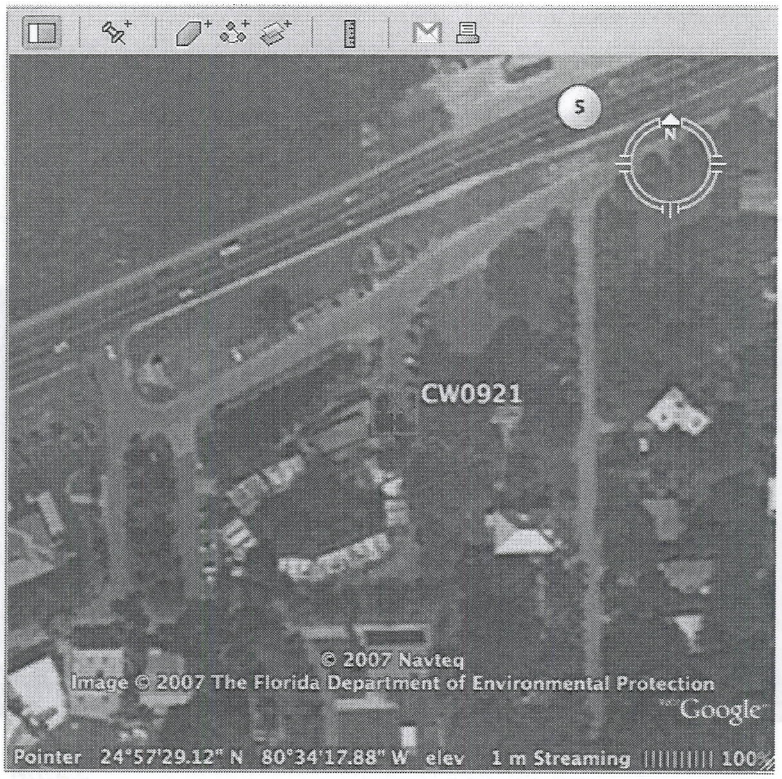


Switlik site on Burnt Point – CW0923 - mapping and coordinates above; site photo below forthcoming



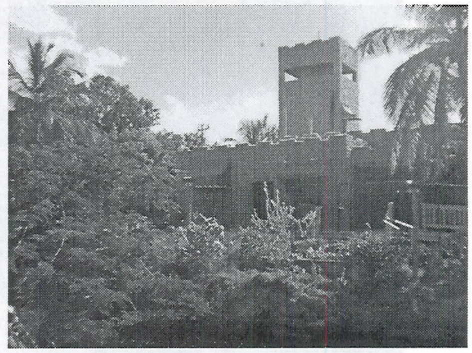


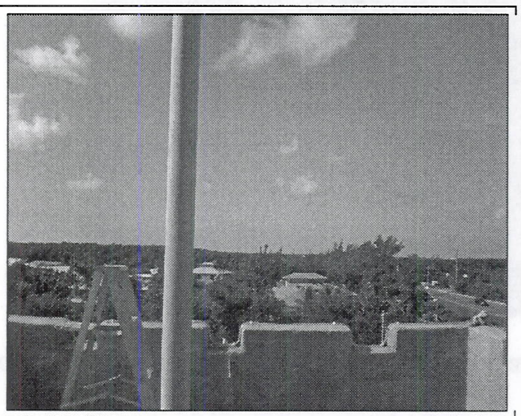
FKAA Long Key site – CW0922 - mapping and coordinates above; site photo below



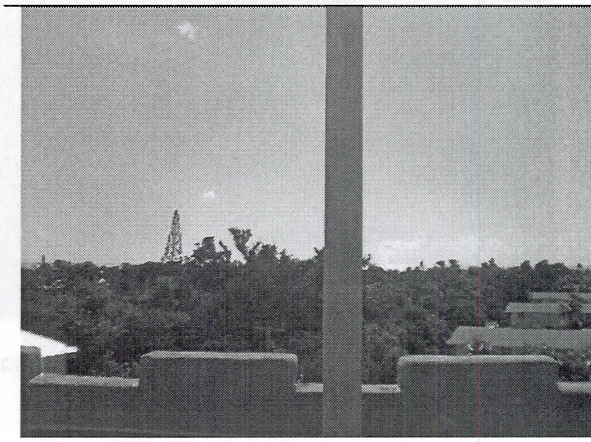
Montessori school site – CW0921 - mapping and coordinates above; site photo below

Montessori School
Islamorada, Florida
CW0921

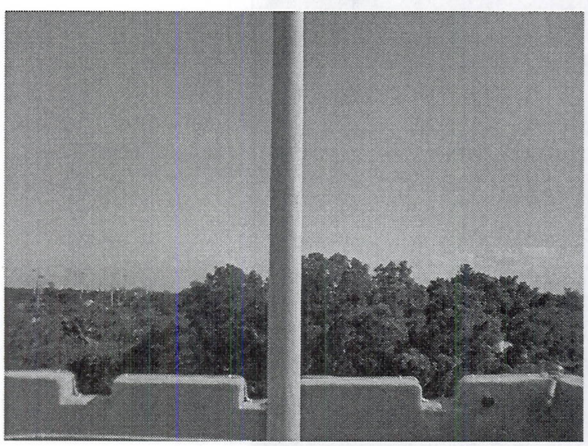




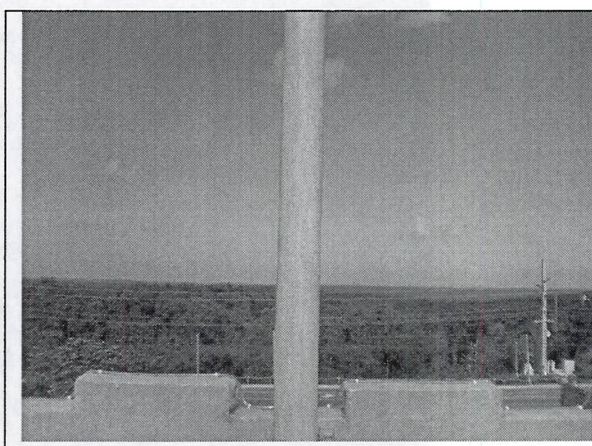
WEST



SOUTH



EAST



NORTH

Appendix 3. Methodology for FSU Quality Control Evaluation of Mesonet Sites

Extracting the QC data from MADIS, we invoke the procedure described below. This document also resides online within the QC directory cited earlier, and is available in the document by Turner and Ruscher (cited 2007).

Quality Control Methodology
FSU COMET KEY Project
Summer 2007
John Turner for Paul Ruscher

Here's some information on the methodology that was used in creating this grading system for mesonet stations, in particular, those operated as an outreach program by Florida State University. I have also included an excel file that lists all of the operating sites in Florida and the corresponding grades that were assigned to these locations based on quality control data supplied by MADIS. This was more or less a test to judge the accuracy of the grading algorithm that was created, not so much a comparison of other sites to those operated by FSU. However, it must be noted that FSU collectively received by far the highest rating when compared to the other regions of the state. I also need to be sure to mention that this 'test' was performed approximately 1.5 – 2 weeks ago, so some of the stations have dropped in and others out in the time period between then and now. This is why it is going to be extremely important to monitor our sites on a regular basis in order to track their status and to identify any trends or bias that exists due to location or function.

Before I get in depth into explaining the process that went into creating this grading scale, let me first stress that currently it does not include wind data. At this point, only raw wind data is available via MesoWest and MADIS status check emails. Therefore, one of the goals I have in the upcoming days, after my leave next week, is to find a way to effectively incorporate wind data into this grading system. This will of course be the largest benefit to the Keys sites since wind direction and speed is such an important factor to the weather of that region.

For the most part, this grading scale is fairly simplistic and is based solely on quality control data provided through MADIS. However, I feel that it also provides a quick and easy, but more importantly, an accurate way in which to check the status of our stations. The excel file that I am sending you uses a 28 day period of quality control data, however, since our sites will be monitored on a much more regular basis, a 3 day period will be sufficient. This means that an updated list of data and grades will be issued every 4 days. The process begins by recording the average error and standard deviation (as determined by MADIS) for each of the following data categories: 24 hr pressure; 24 hr, daytime, and nighttime temperature; and 24 hr, daytime, and nighttime dew point (which is, of course, a function of the two). In addition, data is recorded on the number of days that a station is offline, which also accounted into the reliability of the system. The raw data, alone, is assigned one of three colors (standing for three levels of confidence) based on their value: green = satisfactory, yellow = suspect, and red = problematic. Since pressure is not as variable as temperature, which can be influenced by structures and location, it has a smaller threshold between colors, as does standard deviation when compared to standard error. While these colors, and their representations, are not included in the algorithm per say, they do allow the observer to easily pinpoint potential issues with the data.

As for the actual grading system, it involves a process that combines all of the data mentioned above into a single numerical value based upon the traditional grading scale of an A = 90+, B = 80+, etc. Scaling factors described below were arrived at after some experimentation. First, the quality control data from MADIS is multiplied by a factor of ten in order to elevate it to the scale that is used (i.e. 0.2 becomes 2). Then, all of the QC data is summed together and multiplied by .2. In other words, this means that for every tenth a number varies from 0 (whether positive or negative), two tenths of a point will be subtracted from a perfect score of 100. This process is undergone by all of the QC data since a smaller standard deviation represents greater consistency, just as a smaller standard error represents greater accuracy. Meanwhile, the number of days offline is divided by the total number of days in the grading period (i.e. 1 day offline is divided by 28 days in the period), which is then halved and multiplied by a factor of ten in order to bring it to the same scale as the rest of the data. Once the QC data and the reporting data (days offline) is summed, it is divided by the total number of data, then subtracted from 100 in order to give us the final grade. Each grade is also assigned one of the three colors mentioned before: As and Bs are marked green, Cs are yellow, and Ds and Fs are red. You will notice in the excel file I present to you that there is not a single A, although some stations come close. I do not, however, believe this to be a flaw with the system as the average for the entire data set remains a C. An A is simply a very difficult grade to achieve, at least for the long term, and therefore a B is also viewed as a properly operating site. More important than the letter grade, is the numerical grade which should aid in understanding how well a station is operating.

A sample matrix of data for one week in September 2007 is shown as Example.xls (an Excel spreadsheet file).

I hope that this is of some help to you, and if you have any questions or suggestions, please feel free to mention them. It is my hope that within the next couple of weeks, I will have a final product that is able give an accurate portrayal of each station as a whole and benefit us in monitoring the data they exhume.

Posted by Paul Ruscher, ruscher@met.fsu.edu.