Real-Time Environmental Information Network and Analysis System (REINAS)

Wendell A. Nuss
Department Of Meteorology, Code MR/Nu
Naval Postgraduate School
589 Dyer Road, Room 254
Monterey, CA 93943-5100

nuss@arashi.met.nps.navy.mil
408-656-2308 (Office)
408-656-3061 (FAX)

Funding Document Number: N0001498WR30144

LONG-TERM GOALS

The long term goals of the NPS portion of this project, which is joint with UCSC, are to develop a mesoscale coastal analysis system for use in diagnosing and predicting coastal circulations in a topographically complex coastal region and to provide guidance to UCSC for the development of data collection, data management, and visualization tools for mesoscale meteorological problems.

OBJECTIVES

The specific scientific objectives of this project are to develop a coastal mesoscale data assimilation system using multiquadric interpolation and the Navy's NORAPS/COAMPS and NCAR/Penn State MM5 model, diagnose the sensitivity of the diurnally varying winds in the Monterey Bay to synoptic-scale influences using the data assimilation system and other REINAS tools, and to assess the role of the complex coastal topography in modifying the Monterey Bay sea breeze.

APPROACH

The primary approach used in this study is to document the structure of the Monterey Bay sea-breeze using a surface meteorological mesoscale observing network and wind profilers either continuously deployed or deployed for a specific period of investigation (summer 1994). These observing systems are used to develop the REINAS computer software at UCSC as well as to conduct scientific studies. The mesonet is being used to feed the REINAS data collection and data base system in real-time. These observations are also being used to make objective analyses of the meteorological conditions over the Monterey Bay on a routine basis using multiquadric interpolation techniques. These analyses are used to examine the diurnal and spatial variations in the winds for the region. In addition, these observations are being used to design and build a mesoscale modeling and data assimilation system for the region using COAMPS and MM5 with multiquadric interpolation. These model simulations are used to assess related aspects of the sea-breeze circulation.

WORK COMPLETED

The focus of the effort during 1998 has been to expand the REINAS system operationally and port it to

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
1998		**00-00-1998 to 00-00-1998**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Real-Time Environmental Information Network and Analysis System (REINAS)	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Naval Postgraduate School,Department of Meteorology,Monterey,CA,93943-5502**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES
See also ADM002252.

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT **unclassified**	b. ABSTRACT **unclassified**	c. THIS PAGE **unclassified**	**Same as Report (SAR)**	**3**	

NPS or other suitable location to be run operationally. The work completed during 1998 has been to add several standard data feeds to the REINAS system running at UCSC. These have included the standard METAR reports obtained through the NPS UNIDATA feed and the more routine ingestion of California Irrigation Management and Information System (CIMIS) data. Several other data sets have been identified as potential add-ons to the REINAS system but are not being ingested at this point. NPS personnel have begun to be trained in the running of the REINAS system and efforts are underway to port the system to NPS for continued operational use.

The mesoscale data assimilation system has matured considerably during the last year. Three dimensional multiquadric interpolation is now being done routinely for our real-time forecasts using the MM5 model. The code is now fully capable of utilizing a variety of model first guess fields and nearly all the various mesoscale data from REINAS and other sources to perform the mesoscale data assimilation. Data quality of local observations is beginning to be addressed now that routine model forecasts are available.

RESULTS

The primary results from the effort during the past year come from the new analysis capability using the three dimensional multiquadric analysis. A study of a sea breeze day using the MM5 model and the local observations by Taylor (1998) has shown the importance of the local topography in shaping the time evolution of the winds at our Ft. Ord profiler site. This study revealed the role of an initial mountain-valley circulation in initiating the diurnal wind speed increase at Ft. Ord. This was followed several hours later by a more pronounced sea breeze front and a second strong increase in the winds diurnally. Additional studies using the modeling/data assimilation system are underway.

An important result from the data assimilation effort was the discovery that model grids could be represented with a rather small number of scattered points. This resulted from the need to minimize the number of first guess points in the data assimilation. The significance of this result is that is suggests an excellent method for storing and transfering large volumes of model data efficiently. While not implemented, this approach could be used to store model fields in the REINAS system.

IMPACTS

The impact of this study is that it contributes to a more thorough understanding of mesoscale coastal processes that are of interest to the Navy. The most significant aspect is that these results begin to help characterize the nature of coastal flows in complex coastal topography that future generation operational mesoscale models such as COAMPS will try to predict. In addition, our research on the data assimilation using the multiquadric technique is significant in that it may be the most appropriate approach for small shipboard modeling systems, where observations are few and data density is very discontinuous over the model domain.

TRANSITIONS

Although no transitions have occurred with this work as of yet, efforts are underway to test the scattered data representation of the model grids on TAMS-RT fields from San Diego.

REFERENCES

Taylor, Steven, 1998: The Monterey Bay Sea Breeze of August 25, 1997, NPS M.S. Thesis

http://www.met.nps.navy.mil/~nuss/ctd_exp/latest_mry.gif

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