1.3 A FIRST ASSESSMENT OF THE RESPONSE OF A MESOSCALE COASTAL OCEAN MODEL TO FORCING BY A MESOSCALE COASTAL ATMOSPHERIC MODEL

Christopher N.K. Mooers* and Inkweon Bang
Ocean Prediction Experimental Laboratory (OPEL)
RSMAS/University of Miami

Peter Q. Olsson
Alaska Experimental Forecast Facility
University of Alaska-Anchorage
2811 Merrill Field Drive
Anchorage, AK 99775

A prototype, quasi-operational nowcast/forecast system for the coastal ocean and atmosphere has been established in the research mode for Prince William Sound (PWS), Alaska (http://pws-nfs-osri.rsmas.miami.edu) and has been up and running since November, 2000. The coastal ocean model is an implementation of the Princeton Ocean Model (POM) with a resolution of ca. 1 km, and the coastal atmospheric model is an implementation of the Regional Atmospheric Modeling System (RAMS) with a resolution of ca. 4 km (Figure 1).

PWS is a small (diameter ca. 100 km) semi-enclosed sea with two ports and a complex shoreline due to the coastal orography and its consequent multiple subaerial canyons and oceanic fjords. PWS is forced by strong synoptic scale (e.g., extratropical cyclones) and mesoscale winds (e.g., orographic “gap winds” and “barrier winds”), buoyant throughflow forcing from the Alaska Coastal Current, strong precipitation and runoff from snowmelt within the PWS watershed, and strong tides.

Tidal effects were included by fluctuating sea levels at the open boundary with eight major constituents (four diurnal and four semi-diurnal) of which harmonic constants were derived from a finite element model in the Northeast Pacific (Foreman). Daily discharge from the melting of the snow distributed in the mountains around PWS was determined by a simple hydrological model (Simmons 1996) for each of 289 watersheds which were delineated based on digital elevation model. Climatological daily temperature is the key factor in finding the amount of snow melting for every 500 m height increment, and daily precipitation data were added to yield the total discharge.

Two NDBC buoys and three C-MAN coastal meteorological stations, all strategically located, provide the basis for verification of surface winds from PWS-RAMS. Coastal sea levels from two coastal tide gauges at Valdez and Cordova, and SSTs from those tide gauges and the NDBC buoy 46060, provide the basis for verification of PWS-POM.

Synoptic case studies are run to characterize the nature of the wind field and the subsequent coastal ocean response, and to quantify the degree of verification versus observations. A base reference case is provided by hourly wind-forcing from a NDBC buoy in the center of PWS against which the value added by cases with PWS-RAMS-forcing of PWS-POM can be, at least partially, assessed.

PWS-RAMS has been running daily since March, 2003 and produces 36-hour forecast with hourly wind output. At present, only wind data from PWS-RAMS are utilized as a forcing for PWS-POM, but in the future other variables such as heat flux, precipitation, air temperature, sea level pressure, etc will be included in the forcing. As a first measure of its performance, the case of PWS-RAMS winds will be evaluated against the case with spatially uniform winds by comparing the water temperatures at NDBC buoy 46060 and NOS coastal sea level stations and the non-tidal coastal sea levels at Valdez. However, more thorough evaluation is restricted due to the limited observational data available in PWS.

* Christopher N.K. Mooers, Ocean Prediction Experimental Laboratory (OPEL), Rosenstiel School of Marine and Atmospheric Science, University of Miami, 4600 Rickenbacker Causeway, Miami, FL 33149-1098; email:cmooers@rsmas.miami.edu

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Figure. 1 PWS-NFS diagram