P5.18 COMPARISON OF 9-KM WIND FORECASTS VERSUS 27-KM WIND FORECASTS DURING THE NORTHERN GULF OF MEXICO LITTORAL INITIATIVE

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1. INTRODUCTION

It is known that an increase in model resolution will generally produce superior forecasts. These improvements can partially be attributed to a reduction in phase speed and amplitude errors, and improved representation of mesoscale phenomena such as precipitation (Weisman et al. 1997; Gallus 1998; Murata et al. 2000). In addition, dramatic wind forecast improvements can be achieved in regions of strong topographical forcing, such as in downslope wind events, and localized circulation patterns.

The purpose of this research is to examine the skill of surface (10-m) wind fields produced by the same mesoscale model (COAMPS) with a different grid spacing of 9- and 27 km. The domain chosen for the comparison covers a Gulf of Mexico littoral zone from Mobile Bay to the Atchafalaya Delta. Six-hour increments of the models are compared with observations from more than twenty surface stations. The results presented here are based on 12 parallel forecasts performed during 12/14/00-12/20/00 and started from 0000 UTC and 1200 UTC. This study parallels the Navy-sponsored Northern Gulf of Mexico Littoral Initiative (NGLI). The goal of NGLI is to provide a broad, state-of-the-art modeling capability to the Mississippi Sound region for the purpose of implementing an ocean circulation-sediment-wave modeling system, with supplemental buoy and CODAR observations.

2. SKILL METHODOLOGY FOR WIND SPEED AND DIRECTION

Frontal passage with vigorous shifting winds is common in the NGLI region in December. During this period of study, 4 cold fronts traversed the region. For this reason, and because wind forcing of ocean models is of primary interest to the Navy, the skill of the higher resolution model is evaluated.

Wind speed observations from CMAN stations and moored buoys are adjusted to 10 m height, using a power-law profile (Arya 1988) with an exponent value equal to 0.2. To account for 2-min averaging applied to moored buoys, the data are additionally multiplied by 1.09 value. The observational accuracy of the wind speed is 1m/s and that of the wind direction is 10 degree.

The quality of the model data is subjectively estimated in three relative grades. A good grade corresponds to the difference between a station and a model wind direction less or equal to 10 deg, a satisfactory which is less or equal to 30 deg, and a bad grade for errors larger than 30 deg. The threshold of 30 degree is intentionally chosen because this value equals to the desired forecast accuracy (Navy recommendations) of the wind direction (Cox et al. 1998). It should be noted that an accuracy of such a subjective evaluation of wind direction is about of 5 degree. Skill scores (Wilks 1995) are also calculated.

The wind direction skill score *AG* for a good grade performance is given by:

$$AG = 100\,(A9 - A27)/(AT - A27), \qquad (1)$$

where *A9* and *A27* are the number of stations with a good grade at a selected forecast hour for the 9-km and the 27-km forecasts correspondingly, *AT* is the total number of stations with observations for a selected forecast hour. Also *AT* should be considered as a measure of a skill for some perfect forecast. Definition of the forecast skill in the form of (1) gives a percentage improvement over the reference forecasts, which represented in our case by the 27-km model. Negative values of skill score means that the 9-km provides inferior results as compare to the 27-km model. The same definition of skill score for wind direction is adopted for a satisfactory grade (*AS*).

To evaluate the wind speed performance of the 9-km and the 27-km models, an absolute error of wind speed is calculated for each station. An average skill score, based on absolute error of wind speed is also computed. Biases are also computed.

3. TENTATIVE RESULTS

The absolute improvement of wind direction performance by the 9-km model was obvious for the period from 12/15-19 Almost all *AG* and *AS* values have substantial positive values for these forecasts. For example, the 12/15 0000 UTC forecast has an average *AG* value of about 30%

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and *AS* values of about 50%. *AS* skill score values that exceed 30% threshold. Lesser improvement is observed for the AG wind direction grade.

With regards to wind speed forecasts, an examination of the spatial distribution of the skill score shows a 40% improvement around the mouth of the Mississippi River. Lesser improvement (20-30%) are observed along the Mississippi Gulf Coast. Most of the improvements are concentrated in the vicinity of shorelines, showing that the 9-km model depicts the frictional transition from land to ocean better.

A comparison of 9-km model 10-m wind speed data against observations clearly reveals clearly a general tendency for wind speed underestimation. Mostly this underestimation for the 9-km resolution occurs during first 12 hours of forecast and thus can be attributed to the limitations of the "cold start" used to start the model. In the future, data assimilation will be incorporated in the runs.

In addition, at most locations a definite tendency for the speed underprediction is observed for both models when wind speed exceeds 6 m/s. At the same time, both models demonstrate persistent overestimation of wind speed for observed weak winds less than 2 m/s. Nearly all calm situations are not reproduced by each model as well.

Case studies, and further analysis, will be shown at the conference.

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