1. Introduction

This work is the start-up of development and testing of the ability to assimilate cloudy radiances from GOES-R with NCEP regional data assimilation system and model. NCEP’s mesoscale data assimilation systems are based on Gridpoint Statistical Interpolation (GSI) and the Nonhydrostatic Multiscale Model on B-grid (NMMB) and their combined use in systems like the North American Mesoscale (NAM) and its NAM Data Assimilation System (NDAS). Since GOES-R has not yet launched, radiances data from Meteosat Second Generation (MSG) SEVIRI will be treated as a proxy for the GOES-R ABI – the primary difference being SEVIRI having a ~3 km footprint whereas GOES-R will have a ~2 km footprint and a more rapid scanning capability. Clear sky radiances from two water vapor channels from SEVIRI has been assimilated in NCEP’s global data assimilation system (GDAS/GSI).

In order to use SEVIRI as a proxy for GOES-R before it launch and to perform this work in a regional and severe weather context, we built a regional, hourly-updated, NAM/NDAS-like data assimilation system placed over Europe and Africa where the maximum SEVIRI coverage is located. The positioning of this test system will also allow research to be done on the high impact weather over Lake Victoria where it is likely other observational assets will be deployed in a future field program. Lake Victoria is Africa’s largest and the world’s second largest freshwater lake, with an area of 69,000 km² spanning Tanzania, Uganda, and Kenya. It supports over 30 million people. Boating accidents associated with the marine industry cause more than 5000 deaths every year. Many of these accidents have been attributed to hazardous weather conditions from the frequent occurrence of nocturnal thunderstorms.

2. Model Description

Investigation of the impact of SEVIRI clear sky radiance adopts the NCEP’s newly developed NAM-Rapid Refresh (Fig. 2; NAMRR) system, but move the operational domain to Europe and Africa (Fig. 1). The NAMRR is an hourly updated forecast-analysis system which cycles both 12 km and 4 km nest domains (Fig. 1) and the model configuration is listed in Table 1.

3. Cases and Experiment Setup

The storm case of 0600 UTC, 4 March 2012 was selected for the initial study. During this storm, a fishing boat was lost in the Bukoba region of Tanzania in the western part of the lake, resulting in the deaths of two fishermen. From satellite images (Fig. 4), the storm grew over Kampala from approximately 0000 UTC (0300LT) and moved southwards towards the Bukoba region by 0300 UTC (0600LT). It is assumed the boat experienced dangerous weather conditions around 10.8 µm Infrared images taken by Meteosat for (a) 0000 UTC, (b) 0300 UTC and (c) 0600 UTC (From: J.M. Chamberlain et al. (2013))

4. Assimilated SEVIRI

SEVIRI clear sky radiance was thinned to 120km following the default thinning mesh in operational NDAS. Quality control rejected most of data over the south of Africa. Two experiments with NAMRR are conducted for:

- CONV: Conventional Observation only
- SEVI: Conv. + SEVIRI Clear Sky Radiance (6.26&7.36 um)

Fig.3 Evolution of the storm on 4 March 2012. 10.8 µm Infrared images taken by Meteosat for (a) 0000 UTC, (b) 0300UTC and (c) 0600 UTC (From: J.M. Chamberlain et al. (2013))

5. Model Forecast

<table>
<thead>
<tr>
<th>Wind Gusts</th>
<th>850Pa Wind</th>
<th>6h Precip.</th>
</tr>
</thead>
<tbody>
<tr>
<td>GFS</td>
<td>CONV</td>
<td>SEVI</td>
</tr>
<tr>
<td>O-B without Bias Correction</td>
<td>O-B with Bias Correction</td>
<td>O-B with Bias Correction</td>
</tr>
</tbody>
</table>

5.1 Model Forecast

- Wind Gusts
- 850Pa Wind
- 6h Accumulate precipitation

Fig.4 The brightness temperature difference (k) of observation and mode first guess (GFS 6h forecast) before bias correction and after bias correction.

7. Discussion and Future Plan

The NCEP/EMC hourly-updated NAM system (NAMRR) (Fig. 1) was built over Europe and Africa centered with Lake Victoria, where the maximum SEVIRI coverage is located. The initial configuration at this moment includes a 12-km coarse (aka parent) domain and 4-km fine (aka child) nested domain. From current tests, both the data assimilation and model forecast are performing properly and producing reliable results. With high resolution, model is able to produce the small scale storm features, like the maximum gust wind and precipitation comparing with global model. The future plan is to do more test for assimilating SEVIRI clear sky radiance to get the best performance. Then we will focus on the SEVIRI cloudy radiance assimilation and high impact weather forecast.

Acknowledgements: Steve Goodman from GOES-R program is acknowledged for providing funding. Haisia Lai is thanked for the SEVIRI data. and Eric Rogers, Matthew Pyle, and George Guayno is thanked for the model setup.