A new Météo-France NWP system over the southwest Indian ocean

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1. CONTEXT

Météo-France regional center based in La Réunion island provides different kinds of meteorological assistances : general weather forecasts focused on La Réunion island, marine weather forecasts over the whole southwest Indian ocean and, as a RSMC[1], tropical cyclone watching, an international duty entrusted by the WMO[2].

To achieve these tasks, Météo-France forecast teams have at their disposal a new weather prediction model since October 2006, called Aladin-Réunion[3] and covering their area of interest (figure 1).

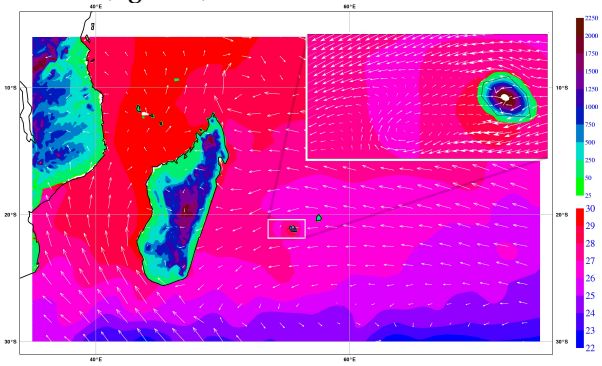

Figure 1 : ALADIN-Réunion domain on which have been plotted its relief (in m) and its sea surface temperature (°C) and 10m wind (arrows) analysis on the 12 december 2006 at 12UTC. A zoom over La Réunion, in the upper right panel, shows the complex effect of the island orography on the wind.

2. MODEL DESCRIPTION

The limited area model run over the south west Indian ocean is the Aladin model (Bubnová et al, 1993 ; Radnóti et al, 1995 ; Horányi et al, 1996) coupled with Météo-France global model Arpege[4] (Courtier et al, 1991) at a uniform resolution. The domain roughly covers the RSMC zone of La Réunion. It has its own assimilation scheme which uses the 3D Var algorithm (Courtier et al, 1998) with a six hour window and a linear beta-plane balance. In the following, the observations dataset is the same as the one from the coupling model which contains in particular a mean sea level pressure bogus. The forecast model is run at the same resolution (10 km) as the analysis. The calculation grid is linear. The background errors covariances have been computed with the analysis ensemble technique (Berre et al, 2006) on warm season meteorological conditions.

3. LIMITED AREA MODEL PERFORMANCES

Aladin-Réunion with its 10km horizontal resolution stands as a significant improvement compared to the global models available over this region, the resolution of which is comprised between 55 and 25km. The better representation of the steep relief of La Réunion, a 2500km^2 island which reachs its highest point above 3000m, enables the model to forecast more realistic interactions between the orography and the atmosphere (figures 1 and 2).

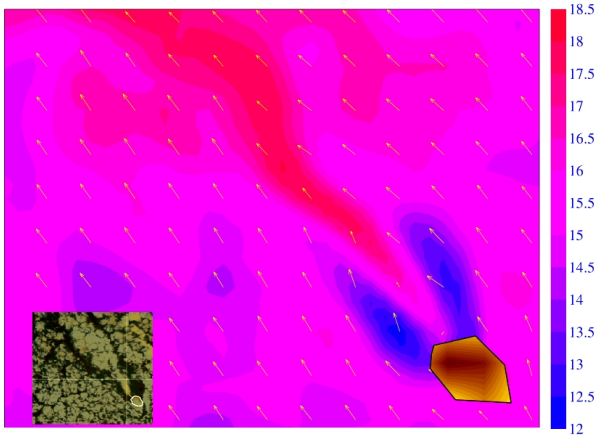

Figure 2 : ALADIN-Réunion forecasts based on the 28 June 2006 at 00UTC valid for the following day at 00UTC. The wet pseudo-adiabatic temperature Θ'_w at 925hPa (colored area in °C) and 10m wind (arrows) are plotted. For comparison, the NOAA18 colour composite on the 28 June 2006 at 23UTC is shown in the bottom left panel. ALADIN-Réunion can remarkably forecast the cloud plume leeward of the island.

This limited area model can also simulate cyclones with a better structure than the global models ones ; on figure 3, the maximum wind radius analysed by Aladin is in better agreement with the reality than Arpege's one. This more realistic analysis has a positive impact on all

1 RSMC : Regional Specialized Meteorological Center
2 WMO : World Meteorological Organization
3 ALADIN-Réunion : Aire Limitée Adaptation Dynamique INternational-Réunion
4 ARPEGE : Action de Recherche Petite Echelle Grande Echelle

ranges of the two day forecast track (figure 4).

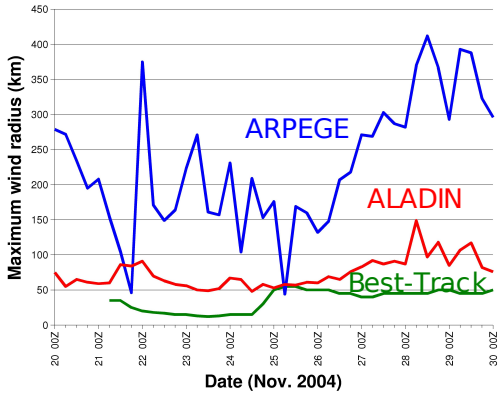

Figure 3 : Radius of maximum wind analysed by the forecasters, Arpege and Aladin on cyclone Bento (November 2004)

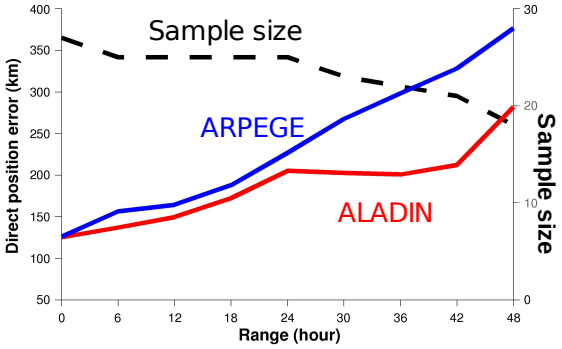

Figure 4 : Evolution of direct position error with range averaged over four cyclone cases : Bento, (november 2004), Juliet (April 2005), Daren and Ernest (January 2006).

4. PERSPECTIVES

Ongoing tests on a three-dimensional wind vortex significantly improve the analyzed position of cyclones, and by consequence their forecast position. Non linear and omega balances (Fisher, 2003), that make the background covariance model dependent on the flow, i.e. forcing the background errors to be spatially heterogeneous, have been experimented and lead to a very positive signal for cyclone analyses. These new releases should be operational for the next cyclonic season. Efforts are also gathered on the humidity field initialization by assimilating SSM/I[5] radiances in cloudy and rainy conditions. In regard to intensity forecasts, the impact of a high resolution sea surface temperature analysis is being tested.

5 SSM/I : Special Sensor Microwave Imager

5. REFERENCES

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