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High resolution numerical simulation (WRF V3) of an extreme rainy event over the Guadeloupe archipelago: Case of 3-5 january 2011.

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During the dry season, the Guadeloupe archipelago may be affected by extreme rainy disturbances which may induce floods in a very short time. C. Brévignon (2003) considered a heavy rain event for rainfall upper 100 mm per day (out of mountainous areas) for this tropical region. During a cold front passage (3-5 January 2011), torrential rainfalls caused floods, major damages, landslides and five deaths. This phenomenon has put into question the current warning system based on large scale numerical models. This low-resolution forecasting (around 50-km scale) has been unsuitable for small tropical island like Guadeloupe (1600 km2).

The most affected area was the middle of Grande-Terre island which is the main flat island of the archipelago (area of 587 km2, peak at 136 m). It is the most populated sector of Guadeloupe. In this area, observed rainfall have reached to 100-160 mm in 24 hours (this amount is equivalent to two months of rain for January (C. Brévignon, 2003)), in less 2 hours drainage systems have been saturated, and five people died in a ravine.

Since two years, the atmospheric model WRF ARW V3 (Skamarock et al., 2008) has been used to modeling meteorological variables fields observed over the Guadeloupe archipelago at high resolution 1-km scale (Cécé et al., 2011). The model error estimators show that meteorological variables seem to be properly simulated for standard types of weather: undisturbed, strong or weak trade winds. These simulations indicate that for synoptic winds weak to moderate, a small island like Grande-Terre is able to generate inland convergence zones during daytime. In this presentation, we apply this high resolution model to simulate this extreme rainy disturbance of 3-5 January 2011.

The evolution of modeling meteorological variable fields is analyzed in the most affected area of Grande-Terre (city of Les Abymes). The main goal is to examine local quasi-stationary updraft systems and highlight their convective mechanisms. The spatio-temporal distribution of simulated rainfall could help to design the prevention and evacuation plan, particularly for the flooding areas.

The meteorological variable fields simulated are evaluated by comparison with observed data of meteorological weather stations (French Met. Office) available in the area.

Brévignon, C., 2003: Atlas climatique: l'environnement atmosphérique de la Guadeloupe, de Saint-Barthélémy et Saint-martin. Météo-France, Service Régional de Guadeloupe, 92 pp.

Cécé, R., T. Plocoste, C. D'Alexis, D. Bernard and J.-F. Dorville, 2012: Modélisation numérique à l'échelle locale des situations météorologiques observées au cours de la transition saison sèche – saison humide à l'aide de WRF ARW V3 : cas de l'archipel de la Guadeloupe. AMA 2012, Toulouse.

Skamarock, W. C., J. B. Klemp, J. Dudhia, D. O. Gill, D. M. Barker, M. G. Duda, X.-Y. Huang, W. Wang, and J. G. Powers, 2008: A Description of the Advanced Research WRF Version 3.Tech. Rep., National Center for Atmospheric Research.