Uncertainties in short-term forecasts of a Mediterranean heavy precipitation event: Assessment with satellite observations

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SUMMARY
The uncertainties in short-term forecasts of a 5-day episode of heavy precipitation in south eastern France were investigated. The episode took place from the 19–23 Nov. 2007 resulting in 400 mm of precipitation in certain areas. The ability of the model Meso-NH to capture the localization and magnitude of the precipitation was evaluated against measurements by a network of rain gauges over France and satellite observations from AMSU, SSM/I, and MSG. Three sets of 24-h Meso-NH simulations were built that differed in their initial and boundary conditions. Simulations which were initialised from ECMWF and ARPEGE analyses failed to capture the intensity of precipitation associated with convective events, and overestimated the amount of precipitation when the conditions were not convective. In contrast, simulations starting from ALADIN analysis were more successful in forecasting rain occurrence and amount.

SYNOPTIC SITUATION

Upper-level conditions: UTH from (top) AMSU-B observation and (bottom) Meso-NH ECM simulations with the vectors represent the 500-hPa wind and the red line the 300-hPa PV at 2 PVU.

Low-level conditions: (top) precipitable water from (top) SSM/I observations and (bottom) Meso-NH ECM simulations with the vectors and the red line represent the 850-hPa wind and the 925-hPa 9e at 315 K, resp.

CONVECTIVE REGIME ON 22 NOV 2007
The underestimation of precipitation over the Cevennes by ECM and ARP was due to the failure of the model to predict convective storms accurately, because of a lack of precipitable water over sea as suggested from SSM/I. ALA was more successful for rain because a more timely onset of convection over the sea.

STRATIFORM RAIN ON 20 NOV 2007
The overestimation of rain over the Cevennes by ECM and ARP was due to an overestimation of the wind speed in the Gulf of Lions where the low-level flow converged. The simulation the most successful for rain (ALA) was the one that gave the best simulation of wind speed.

PRECITABLE WATER AND CAPE FROM RADIOSONDES

RAIN CONDITIONS

(top) B3m5 and (bottom) 37V GHz BT from AMSU-B and SSM/I observations, at 1800 UTC 20, 21, 22 Nov. Black line is ∆37 at 40 and 50 K.

TIME SERIES

Surface wind speed at 1900 UTC 20 Nov. from SSM/I observation and Meso-NH simulations

CONVOLUTIONAL REGIME ON 22 NOV 2007
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STRUCTURAL FEATURES

ACCUMULATED PRECIPITATION OVER LAND

3D map of accumulated precipitation over land for the 24-h period from 0000 to 2300 UTC 22 Nov. 2007.