Qualitative evaluation of WRF forecast simulations against HyMeX SOP1 measurements on the moisture feeding of IOP 15

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WSF 54km

Forced by GFS analysis

WRF 54km

Massif the western

Forced by GAUGES

Temporal and spatial variability are well represented by WRF in comparison with ground-based and airborne LIDAR.

IOP 15: 20-21 October 2012

This IOP was a three day event (20-22.22° of October) following IOP 14 on the 17-18.19° with rain over the Cévennes. Rain occurred successively over Spain (20°, the Cévennes (21°), the southwestern Alps (21°) and Corsica and Sardinia (22°)). Large scale conditions were a north-west elongated trough along Portugal on the 20° followed by a cut-off low over Gibraltar which moved northeastward (21°) and extended strong cyclogenesis over the Balearic islands.

Focus is given on the 20° and 21° October, with the use of both observations (balloons, ground-based LIDAR and airborne LIDAR) and WRF 54km and 9km resolution downsampling of GFS analysis. The main characteristics of the water vapour field feeding the precipitation simulations are studied through the records by the instruments. In addition, a comparison between model performance and observations are qualitatively performed.

CONCLUSIONS

About the moisture field calculated by instruments in IOP12 and analyzed in comparison with WRF

The airborne LIDAR shows features such as the lee effect of the Balearic islands on the spatial structure of the moisture field feeding the Spanish MCS. The balloon shows that its moisture feeding the Spanish MCS may partly come from local evaporation over the sea due to local wind speed (<10m/s), it is concentrated in the lower levels. The importance of wind speed over seas for setting the boundary layer height and potentially changing the LFC are key features for the initiation of convection, as shown by the second LIDAR profile. Daily cycle of the moisture field is strong at Cévennes between the 10th and 21st. It is sometimes associated with 1000-1010 mb clouds on the 20th and 21st (19° in the observations) just following the peak in the boundary layer. In the lee of a MCS, the boundary layer gets shallower and its moisture content decreases perhaps both because of convection, lower wind speed and lower short-wave radiation fluxes beneath the clouds.

About the performances of WRF 54 and 9km used as a downsampling of GFS analysis:

The balloon shows about 1000mb, generally higher dew point and lower wind speed in the boundary layer than for the model. It captures the days of high moisture over the western Pyrenean system passed over the area...