IMPACT OF VERY HIGH RESOLUTION NON-HYDROSTATIC LIMITED AREA MODELS IN FORECASTING OF SEVERE HAIL STORM OVER COMPLEX OROGRAPHY DOMAIN

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I. THE PROBLEM OF LAM'S POOR SKILL IN PREDICTION OF A SQUALL LINE'S GENESIS IN THE EASTERN PO VALLEY DURING NORTHERN MID-HI TROPOSHPERIC WINDS EVENT

The convective event forecast in Po valley is representing a hard challenge for numerical simulation of squall line genesis especially in eastern valley, where the very complex orography (including the sea) is responsible for a latent and sensible heat flux exchange with the nearest sea which is not adequately depicted from GCM and LAM with horizontal resolution lower than 6 km. A typical situation where GCM and LAM fail to correctly simulate a squall line genesis is the dry northern advection. Squall lines born from this pattern of circulation appear to be often severe with large and heavy hail events.

II. RETROSPECTIVE INTEGRATION OF VERY HI RESOLUTION LAM (NMM 2 KM – EMM 1.3 KM) IN HEAVY HAILSTORMS OCCURRED IN LAST 20 YEARS IN NORTHERN ROMAGNA'S PLAIN DURING NORTHERN MID TROPOSPHERIC ADVECTION

This work was directed to test the skill of our operational highest resolution LAM in forecasting of hi energy squall lines generated from northern mid tropospheric wind condition, especially those events which are largely underestimated or completely not depicted in GCM and coarse LAMs

The initialization of retrospective runs was a problem; the reanalysis data (NCEP 2.5°) have got a poor resolution for integrating a hi resolution simulation.

For the NMM model we made several coarse LAM runs (21 km – 13 km resolution) that had to initialize (in dry run) the hi resolution domain with richer boundary conditions than the NCEP reanalysis

The hi resolution domain covers the centre and the north of Italy, quite large to include entire Po Valley and central and north Adriatic sea (in order to obtain a realistic atmospheric boundary layer and sensible – latent heat flux exchange with the sea)

For the EMM model we made a telescoping nesting (one way nest with feedback) from a domain of 21 km resolution scaling progressively to a 1.3 km domain including the eastern Po valley

The highest resolution domains don't use any convective parametrization scheme while the coarsest domain was integrated with Betts Miller Janic cumulus parametrization

III. RESULTS AND CONCLUSIONS (TIMES NEW ROMAN 10-BOLD CENTRE JUSTIFIED CAPITAL)

The forecast of severe squall lines during northern mid tropospheric wind events take advantage from hi resolution model on a domain with particular orography like northern Italy.

If it could potentially be possible to simulate elsewhere a behaviour of a 2 km resolution model comparing it to a 10-15 km resolution model (Pauluis 2005), the very high resolution LAMs would give better results on the Po Valley scenario in terms of convective activity while the coarsest resolution LAMs are affected by significant dry bias and appear to be "lazy".

A better representation of orography and ABL is responsible for limiting the influence of catabatic activity due to northern winds at about 50-60 km south of the Alps and the simulation gives a more realistic depiction of surface flux exchange with the sea

The enhanced convective activity simulated by HI RES model drives to enhanced cold pool dynamics which is responsible for regenerating unstable air masses (Tompkins, 2001);

A modification in LSM was required due to limiting cold pool dimension in low troposphere in order to contain the duration of convective activity and the potentially positive bias in precipitation amount

IV. AKNOWLEDGMENTS

(Text in Times New Roman 9-normal justified - see example below)

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