3 – 4D wind field computation from mesoNH individual profiles

Main hypothesis : use the first derivative of the 3D wind field:

\[ f(t, x, y, z) = \frac{\partial f}{\partial t} + \frac{\partial f}{\partial x} \frac{dx}{dt} + \frac{\partial f}{\partial y} \frac{dy}{dt} + \frac{\partial f}{\partial z} \frac{dz}{dt} \]

\[ \Delta t = 3h \] to remove small scales especially for divergence and vorticity, \( \Delta t = 200m \).

MesoNH has been run from 2007 October 20 to 31. Some vertical profiles are extracted above different sites of the HYMEX area, over the western part of the Lion Gulf (western part of the Mediterranean basin). Each vertical profile is used to simulate a UHF profile. These virtual profiles are associated in order to build networks using at least 3 ‘radars’ (see figure on the right). For each network, a 4D wind field (U,V,W) is calculated, using the linear method described above.

The aim is to find the best set of ‘radars’ to describe the simulated mesoscale wind field.

4 – Virtual profiles above the selected sites

5 – Restitution from the various networks over Marignane

Time-height cross-sections of wind vector and windspeed (from mesoNH) between October 25 and 27 : rather different profiles.

6 – Horizontal wind fields comparison

7 – Mesoscale divergence and vorticity

Time-height cross-sections of divergence calculated at the network centroid (except for the first figure which is the divergence locally calculated by mesoNH). Divergence, of course, strongly depends on the network size.

Time-height cross-sections of vorticity calculated at the network centroid (except for the first figure which is the vorticity locally calculated by mesoNH). Vorticity as divergence depends on the network size.

8 – Other situations to be studied

Three representative cases of high precipitation events over southeastern France have been investigated in this period: O., V. Ducrocq, D. Ricard, C. Lebeaupin, S. Anquetin, 2008 : A numerical study of three catastrophic precipitating events over southern France. I. Numerical framework and synoptic ingredients. Quart. J. Roy. Meteor. Soc., 134, 111-130: two extreme flash-flood episodes (with large rainfall accumulations exceeding 500 mm in 24 hours) on 8-9 September 2002 and 12-13 November 2009, respectively, and a more typical event for the Cévennes foothills region (25 October 1995).

We plan to test different shapes of profilers networks on these 3 cases.