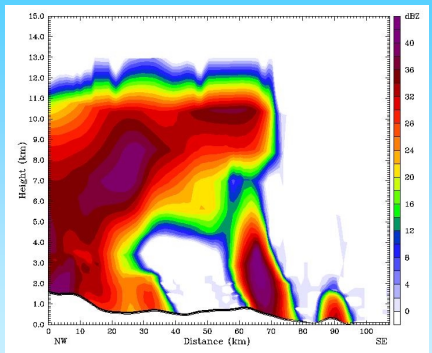
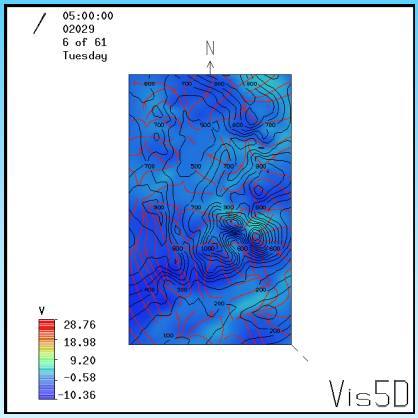
MM5 and other meteorological interests inside IEEC





David Pino

IEEC Departament de Física Aplicada

Overview

- Historical interest (GPS data assimilation).
- Moreover, nowadays use of MM5 (calibration of physical parameterizations, severe weather, complex topography).
- Future work (radiation, coupling with hydrological and chemistry models).

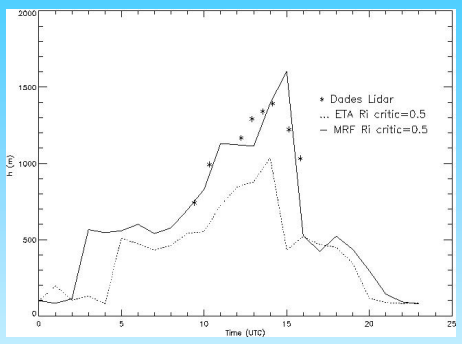
Historical work

• GOT inside IEEC has great experience in GPS data process used for positioning, sea state studies (wind retrieval and sea level), ionospheric information and atmospheric water vapor content:

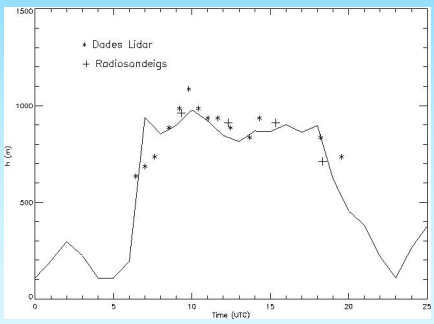
- • Comparison of zenith wet delay (delay suffered by the GPS signal due to the atmospheric water vapor content), obtained with MM5 and GPS data for different atmospheric conditions and places. This comparison allows us for study the best physical parameterizations of the model.
- • 3D-VAR and 4D-VAR data assimilation of water vapor content, obtained by means of GPS signal delay, in the model. Improvement of the prediction (Cucurull PhD).
- • Comparison of wind speed above the sea surface between GPS measurements at 37 km altitude, satellite observations (ERS, QuickScatt, TOPEX) and MM5 predictions. Good agreement in non convective conditions.

Last studies:

1 . PBL parameterizations (in collaboration with Vilà et al.)



Mixed layer depth observed with the **RS** at UB (+) and with the **LIDAR** at UPC (*) and obtained with the model (MRF solid and ETA dashed line) on 16 October 2000 (left) and on 2 July 2001 (bottom).



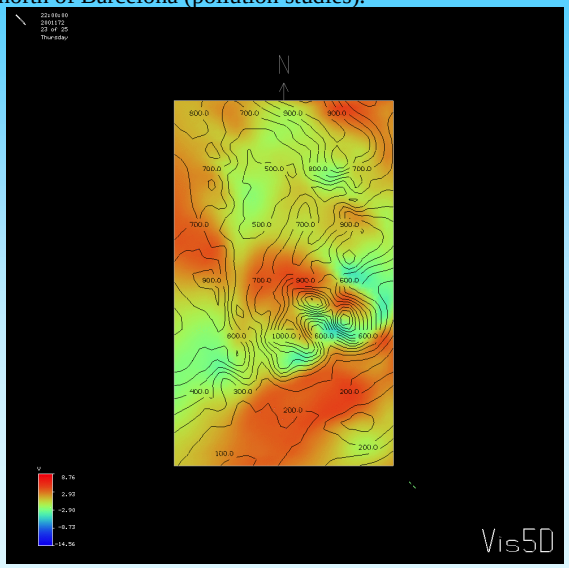
Better results are obtained with MRF than with ETA, GS or Blackadar parameterizations in an urban area and under convective conditions.

Last studies:

2 . Winds regime in complex terrain **(in collaboration with Soler et al.)**

We have studied the winds regimen in a complex topographic zone called La Plana, located to the north of Barcelona (pollution studies).

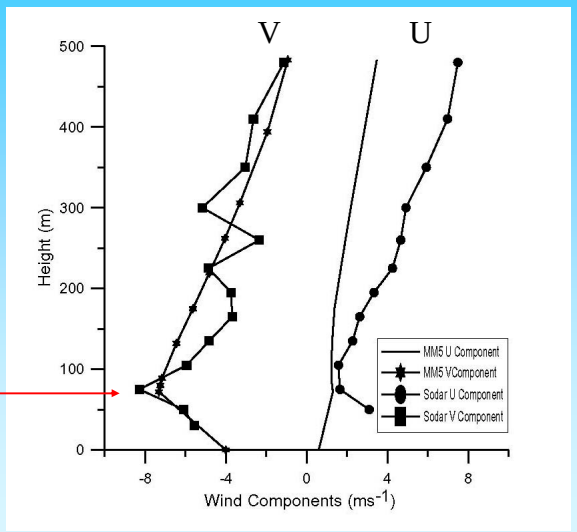
Surface wind evolution at La Plana on 21 June 2001 (sea breeze entrance).



2.1 Comparison with observed profiles (1 km. resolution)

Vertical profiles of horizontal winds observed and simulated at 4 UTC on 29 January 2002 at the south exit of La Plana (La Garriga).

Drainage winds coming from the north.

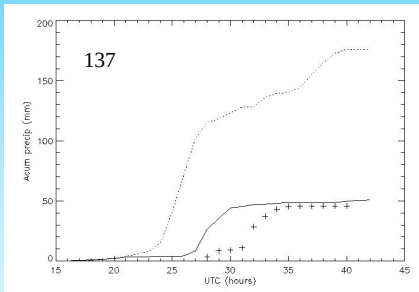


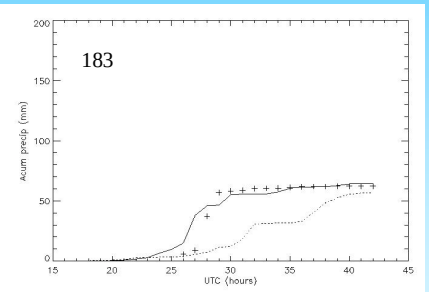
Last studies:

3 . Severe weather comparison with rain gauge stations and meteorological radar

(in collaboration with Sempere et al.)

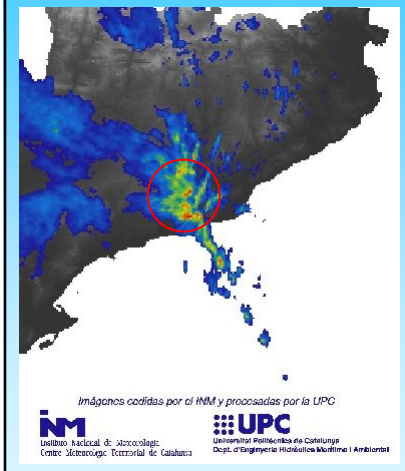
Time evolution of the accumulated precipitation during 9 and 10 June 2000. Observations (crosses), MM5 5 km resolution (dotted lines) and MM5 2 km resolution (solid lines). Stations in the Montserrat area



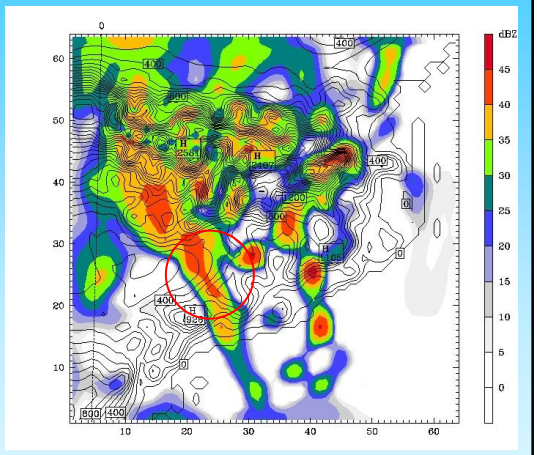


In spite of the nature of the convective storms (30-50 km horizontal length scale and lifetime of 30-45 minutes) good results are obtained for some gauge stations. It is expected that the comparison with the radar data will give better results.

Radar reflectivity at 2 UTC on 10th June 2000



Observed



Simulated with RIP

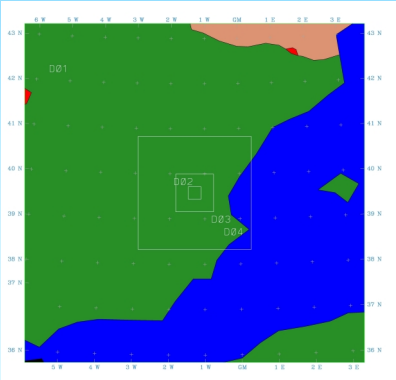
Future work:

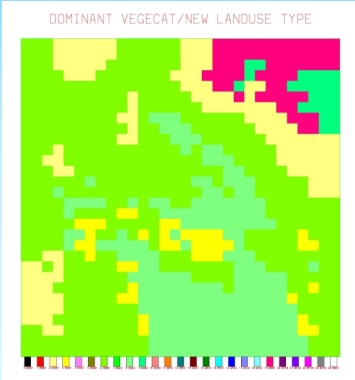
1. **Coupling MM5-chemistry model** **(in collaboration with Soler et al.)**
2. **MM5 possibilities to be used inside an hydrological model** **(Sempere et al.)**
3. **SEVIRI- and GERB-MSG validation-calibration** **(SCALES project):**

➢ By working in an specific area (*Valencia Anchor Station*) we want to validate GERB (Geostationary Earth Radiation Budget) radiances

➢ at the top of the atmosphere (CERES-NASA measurements and MM5 products)

➢ at the surface (high quality surface measurements and MM5 products)





Basic MM5 options

Installed and running: HP V2500 (V3.4) and Linux PC (V3.6)
Usually **4** nested domains:

- 27-σ vertical levels.
- High resolution in the smallest domain (1-2 km) and 30 sec. topography
- Initialized with ECMWF model data.
- No data assimilation except for the first studies.

• PBL: **Medium range forecast**. Non-local scheme. Turbulent fluxes are calculated as a function of u_*, w_* and z_i. We calculate the exchange coefficients of heat and moisture from the exchange coefficients of momentum by means of the Prandtl number.

• Radiation: **Cloud-radiation**. Accounts for longwave and shortwave interactions with explicit cloud and clear air.

• Explicit moisture schemes: **Simple-ice**. Adds ice phase to cloud and water fields. No supercooled water and immediate melting of snow below freezing level.

• Cumulus parameterization:

- Anthes-Kuo scheme (grid sizes > 30 km)
- Grell (grid sizes 10-30 km)
- For grid sizes < 5-10 km no cumulus parameterization is recommended

MM5 output operations

• We treat the MM5 output by means of different graphic programs interfaces)

- GRAPH MM5 program
- RIP
- Vis5D
- Vertical profiles of the variables in an specific grid point obtained directly from the MM5 output. Full radiation budget (INTERPB, readv3.f90).
- MLH obtained by means of critical Richardson number (Vilà).