"Relevance and Impact of Mesoscale Modelling for the region concerning Uruguay"

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1) Some regional features.

Supporting a transitional climate, between the real prairie-pampas climate southwestward, and the climate who sustain subtropical *Araucana Angostifoglia* forest northeastward, the region is under a distinct but alternating maritime influence. In fact, besides the nearby position of the South Atlantic Anticyclone, offshore the Rio de la Plata embouchure occurs the Malvinas-Brazil Confluence. That is maybe one of the underlying causes that, spite of the lack of main orographic accidents, Uruguayan territory and the nearby region are the place of many mesoscale phenomena. The fact is fully related: in addition of the well known occurrence of squall lines preceding quasi-stationary polar fronts, Alonso Gan and B. Rao (1990), among others, refers the area as a core of major cyclogenetic activity in Southern South America. Also Mesoscale Convective Complexes involve northern Uruguayan territory in their trajectory paths, as is pointed out by Figueiredo and Scolar (1996).

Many observational statements related to mesoscale activity have been outstanding in recent years in Uruguay. As a domestic example, we want to quote the number of closed cyclones during local summer (December to February). During 8 seasons (Dec-1980-Febr-1988), 91 days with closed isobars drawn every 4 mb above the country were reported (Caffera, 1996).

2) A smaller scale feature: the seabreeze.

Mesoscale phenomena take special interest in scales smaller than those involved in the preceding examples. That is the matter of seabreeze. As an example of the accomplishments to be done, there is a numerical study about local circulation in the Rio de la Plata Basin (Saraiva & Gandu, 1996), using the Regional Modeling System (RAMS) under a supercomputer frame.

In Uruguay, seabreeze events involve 500 km of coastline, including oceanic and large Rio de la Plata outside sectors. Also, several facts have been pointed out during the 90's. An example among others can be seen in the hourly/month table of 10 years of modal directions of the wind, measured 10m height at Aeropuerto de Carrasco Station (Caffera & Bidegain, 1991). Besides the well-known counterclockwise daily wind drift during the warm season, it appears a conspicuous steady eastward direction early in the afternoon during May and June, a fact needing improved research. Indeed, the cited counterclockwise wind drift implies steady Southeast coastal wind during the afternoon, from Montevideo City till the brazilian border, no matter the alignment or local shape of the coastline. This is a largely experienced fact for the huge people living in this sector of the seaside. But in coastline experimental sites situated westward Montevideo bay and hill, (a lesser inhabited seaside) a preliminary probing survey measures steady seabreeze direction during March, deviated up to 120º of simultaneous eastward values in midday and early in the afternoon (Caffera, De Garin and Pedrosa, 1996). This kind of phenomena could be depicted, and its physical causes may be pointed out, by means of downscaling numerical experiments similar to the one previously cited.

3-a) Overview of human geographical goals involved in the regional mesoscale atmospheric phenomena.

On a climatological point of view, the region of Uruguayan prime concern embraces its own territory (176.000 km^2), the northern watershed of Uruguay River (near 300.000 km^2), the maritime border (~250 km) and adjacent oceanic area, and the Rio de la Plata basin(130.000 km^2, near 400 km of northern own riverside). The last one constitutes the embouchure of the second major waterway in South America, called the "Hidrovía". Early in the 90's, the load to be freighted through this waterway was estimated for the year 2000 in 21,600 thousands tons (D'almeida & De Almeida, 1991). More recent estimates are some 30 % lesser, maybe due to climatic events related to the cold phase of ENSO actual episode. Rio de la Plata coastline is also the region of major human settlements in both the Argentinean and the Uruguayan borders. It is also the place of the main industrial location in both countries, and one of the most populated regions in all South America (~$17x10^6$ people).

3-b) Some related numbers from Uruguay

Rice, wheat, barley, corn and sunflower are the principal crops of the Uruguayan agriculture. The first one suffered a shut down in yield, from 900.000 tons in 1997/1998 to 190.000 in 1998/1999 due to climatic hazards. Sunflower yield duplicates in the same period due to similar but opposite sign reason. Milk and citric fruits are significant export goods, and foreign tourists represent an income flux reaching 759 millions of US dollars in 1997(Anuario Estadístico, 1999). All this national incomes are under the direct influence of squall lines, suddenly floods, sub-regional droughts and other diverse mesoscale atmospheric driven events.

4) The Challenge of Mesoscale Modelling

Our group has weak experience in modelling. The area of direct concern belongs on the Meso Scale. Impact of most Mesoscale atmospheric process seems to be quickly perceived on societal and administrative points of view. Taking all these points together, our choice is to build up our capacities in mesoscale modelling, in view to improve the knowledge of climate and climate variability within the region. There are other facts to take into account: Global Circulation Models are yet being running in both climatological and real-time modes in many of the main centres even in the Mercosur area. Operational Synoptic Scale Models are also common in the region. Numerical Modelling becomes a crucial faculty for the development of our scientific skills, but there is no sense in trying to reproduce very expensive competence already empowered in the area. These are also additional reasons to achieve our choice.

Many groups within our CRN are running Mesoscale Numerical Models yet. The scientific expertise and computing skills of these groups are known figures within the meteorological community. Among others, these groups commonly run RAMS and ETA versions. The first one because of its well-known high performance in crucial parametrizations in the meso-γ and micrometeorological features and nesting, the second one because its capabilities in stretching. So, our first guess was to attempt to install and operate one of these models in our department. But the expensiveness of the hardware needed to support them, the amount of their copyright fees and additional difficulties remain these aim above our capabilities. Then, our actual goal is to install and run the MM5 model. There is a shared free version that can be supported on a free Linux operative system, so it could be run on a relative cheap Pentium III frame with a reasonable-price Fortran77+Fortran90+C^{++} compiler. The model could be nested on a larger-ETA operational issue (to be furnished by one of the experienced groups within the Prosur, for example), and it supports many telescoping self-nestings, reaching till 2x2 km grid. Our purpose is not to reach such a zoom, but to run the model under typical and/or very perturbed conditions, in order to improve the knowledge of the mesoclimate behaviour and its causalities within the region. The spatial

resolution to adopt will be between 8x8 km and 30x30 km, depending on the kind of the specific mesoscale process.

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