3.5 COASTAL – The Coastal Effects (& Cities) Effects on Meteorology

Model used: **Enviro-HIRLAM**

Read, the general description of the HIRLAM (HIgh Resolution Limited Area Model) model at the HIRLAM official website at:
http://hirlam.org/index.php?option=com_content&view=article&id=64&Itemid=101
See for more details the scientific documentation on the HIRLAM model at:
http://hirlam.org/index.php?option=com_docman&task=doc_download&gid=270&Itemid=70

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Introduction Background:
The modelling of the mesoscale atmospheric flow over various types of underlying surface in a coastal region is a rather complicated task. A difference in the respond to radiative forcing due to various heat capacities of water and land causes strong temperature and pressure gradients within the atmospheric boundary layer. These thermodynamical features generate local circulation in the middle latitude coastal zone usually known as a sea/land breeze. The breeze is a major mechanism regulating air quality in coastal cities, in particular during summer anticyclonic patterns. The proper simulation of breeze characteristics including variability of corresponding meteorological fields in space and time provides reliable tool for numerical weather forecasts as well as diagnosis of transport and evolution of atmospheric pollutants. The Enviro-HIRLAM model appears as a valuable instrument for investigating the breeze circulation and provides the comprehensive analysis for the meteorological fields such as pressure, temperature, humidity and wind.

Main Goal:
(i) to study principal mechanisms forming the breeze circulation;
(ii) to show spatial and temporal variability in meteorological fields associated with the breeze circulation;
(iii) to elucidate the impact of the breeze circulation during summer anticyclonic patterns on (re-)distribution of pollutants within the coastal zone.

Specific Objectives:
1. Practical exercises in technical manipulation with the model code .
2. Implementation of graphical tools/packages to the model output to display up breeze features in diurnal variations of air temperature, wind direction, humidity, heat fluxes, etc. as well as describe redistribution of emission concentration.
3. Consolidation of simulation results in a form of an oral presentation (max 15 min).

Literature List:
Before the Summer School students may read the following papers:

REQUIRED READINGS

Korsholm U.S., A. Baklanov, A. Gross, A. Mahura, B.H. Sass and E. Kaas, 2008: Online coupled chemical weather forecasting based on HIRLAM – overview and prospective of Enviro-HIRLAM. *HIRLAM Newsletter*, 54: 1-17.

Rajib Pokhrel, Heekwan Lee, 2011: Estimation of the effective zone of sea/land breeze in a coastal area. *Atmospheric Pollution Research*, 2: 106-115. doi: 10.5094/APR.2011.013

http://www.yorku.ca/pat/research/dsills/primer.html

RECOMMENDED READINGS

C. Azorin-Molina, A. Sanchez-Lorenzo, J.Calbo, 2009: A climatological study of sea breeze clouds in the southeast of the Iberian Peninsula (Alicante, Spain). *Atmósfera,* 22: 33-49.

Priit Tisler, 2009: HIRLAM wind forecasts near the coastline. *HIRLAM Newsletter*, 45: 99-104.