

Dynamic downscaling by RCA

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Project 10: “Formación en generación de escenarios regionalizados de cambio climático mediante modelos regionales de clima”

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Outline.

- Main objectives.
- Dynamic downscaling
- RCA 3.5 Regional Circulation Model.
- Previous work.
- Post-process.
- First results.
- Brief conclusions.
- On going work.

Main objectives.

- Project 10 is a part of a bigger AEMET project enshrined in a plan developed in collaboration with “Puertos del Estado”.
- Objective: “to prepare the appropriate developments and to do climatic integrations” completed “by oceanic simulations”.

Dynamic downscaling.

- A set of useful techniques, processes and scripts for increasing the resolution into global data and getting more details. → to do: climatic regionalization.
- Objective: Increasing the resolution and adding lost effects or events to the results. Lost effects and events could be shown by using a smaller grid.
- Method: Regional Circulation Model (RCM) + Boundary conditions from global data (reanalysis and GCMs). Model equations + physical parametrizations (non-linear effects and unseen effects and events).

RCA 3.5 Regional Circulation Model.

- RCM: model equations + parametrizations.
- RCA 3.5 (Swedish Meteorological and Hydrological Institute, SMHI).
- Characteristics: Primitive equations scheme. Hydrostatic model. Eulerian advection scheme.
- Parametrization scheme mainly based on HIRLAM.

RCA 3.5 Regional Circulation Model.

- Resolution of integrations: 0.22° .
- Area of integration: Mediterranean sea, Europe and Magreb (Longitude $[-21.96, 42.5]$, latitude $[22.5, 50]$).
- Grid: NLON=294, NLAT=126.
- Integration in ECMWF-c1a. Parallel numerical integration.
- Boundary conditions: ERA-Interim (1989-2010), 0.5° . ERA40 (1960-2000), 0.75° . ECHAM5. HadCM3.
- Other external conditions: climatic data provided by HIRLAM and orographic data.

Previous work.

- Preparing, installing and compiling RCA 3.5 on ECMWF-c1a.
- Running integrations. ERA-Interim (with flag -DHIRLAM [1989-2010], without flag -DHIRLAM [1979-2010]). ERA40 (1960-2000).
- Preparing post-process package.

Post-process.

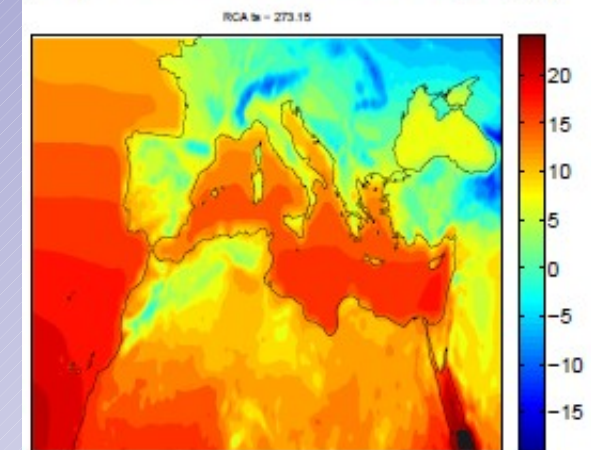
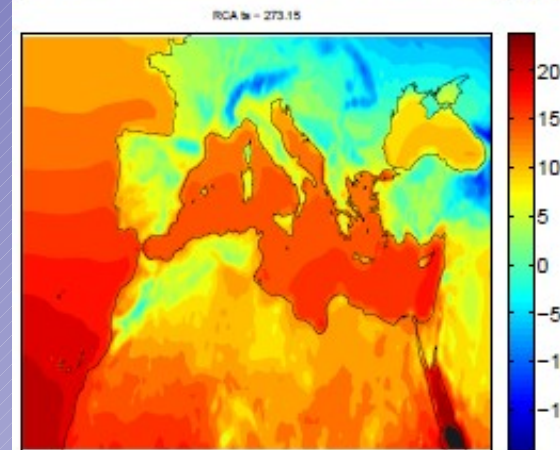
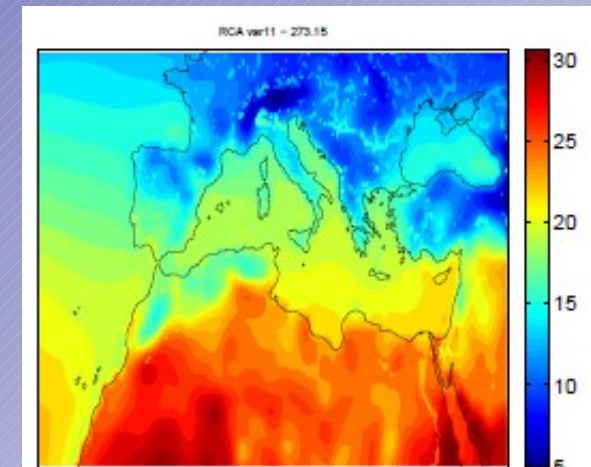
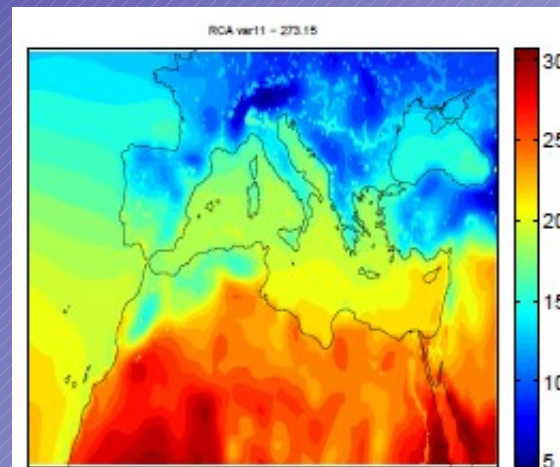
- Script package provided by Rossby center.
- Adapted and copied into ozonosfera and ECMWF-c1a.
- First part: data manipulation and maximum/minimum value control by CDO.
- Second part: Graphic package, using Matlab.
- Analysis possibilities: daily mean, daily max/min, monthly mean, monthly max/min, multi-year monthly mean, seasonal (a decade) mean, yearly mean, multi-year monthly mean values of monthly min/max, multi-year monthly min/max values of monthly min/max and cycle wind values calculation.

Post-process.

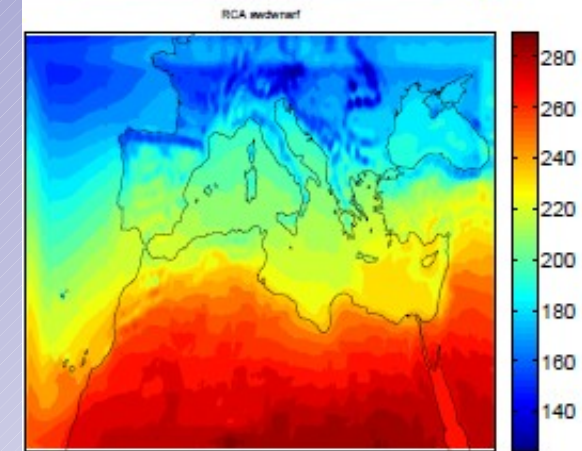
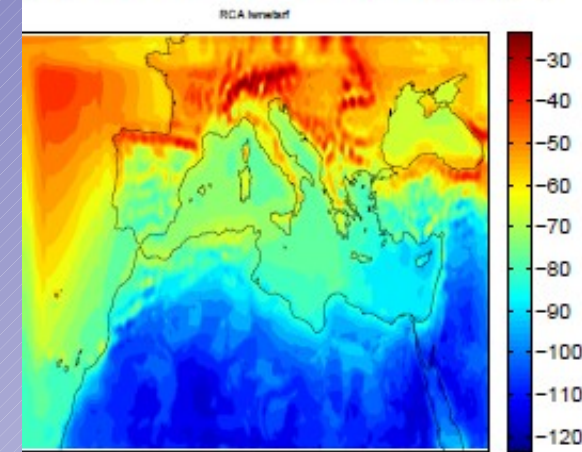
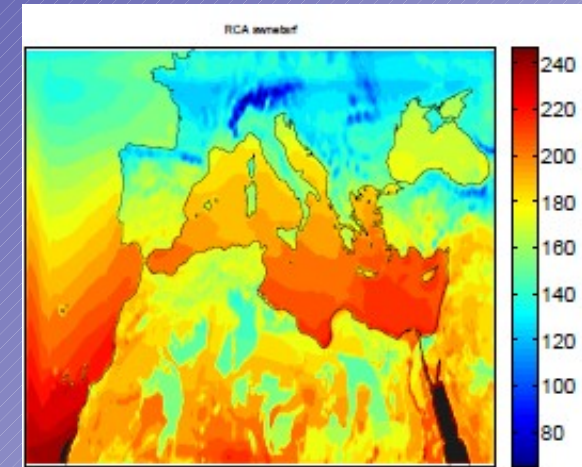
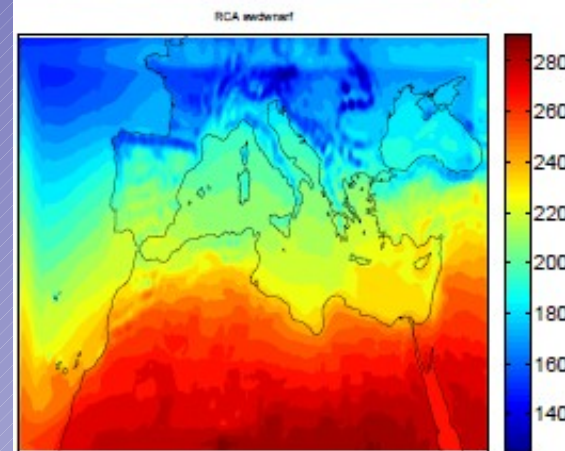
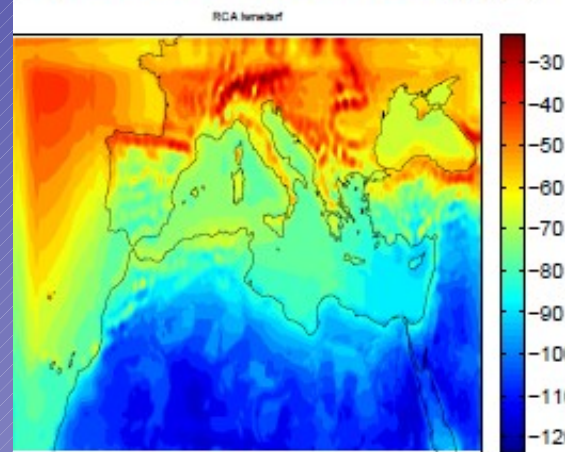
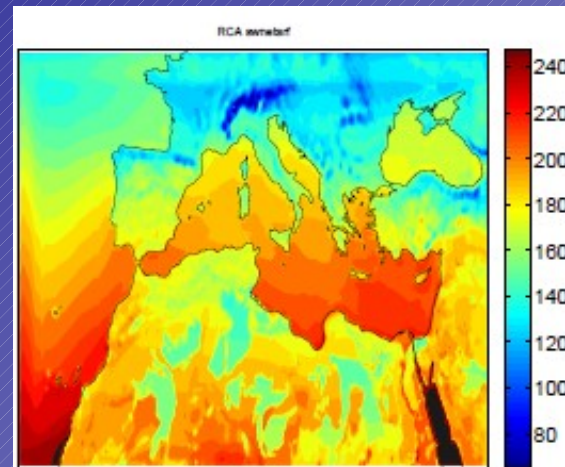
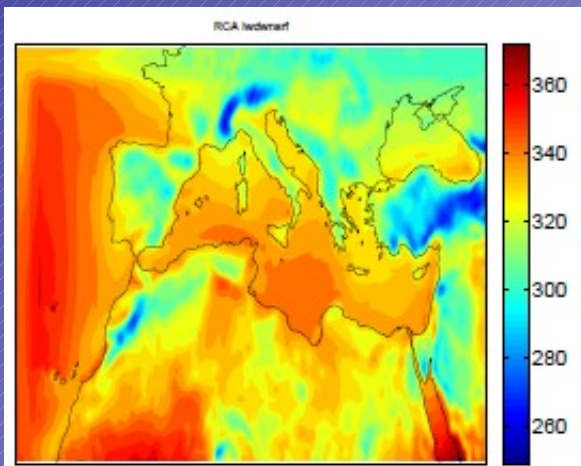
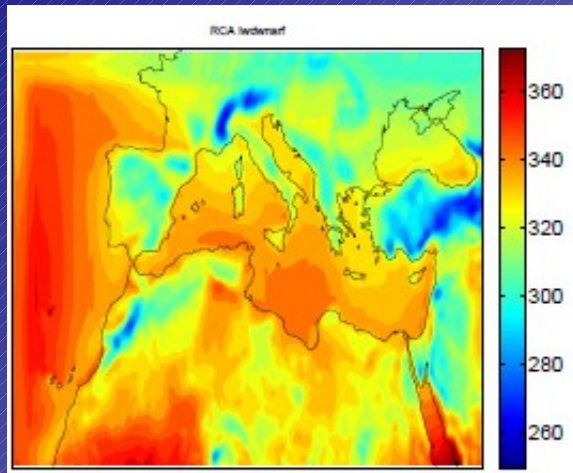
- Analysis possibilities: comparison and evaluation data. Reanalysis and GCMs data.
- Analysis possibilities: regional annual cycles and time series calculation and plot.

First results.

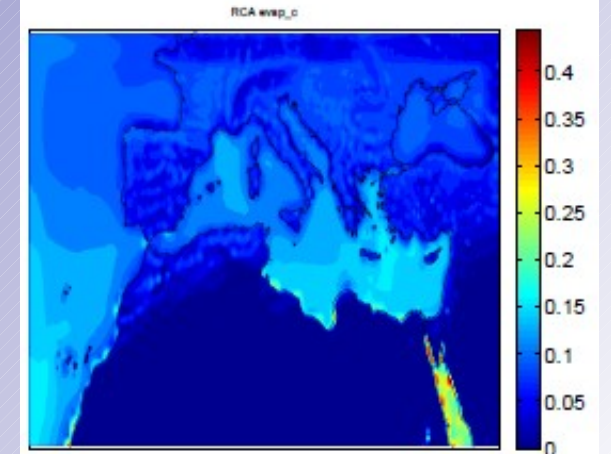
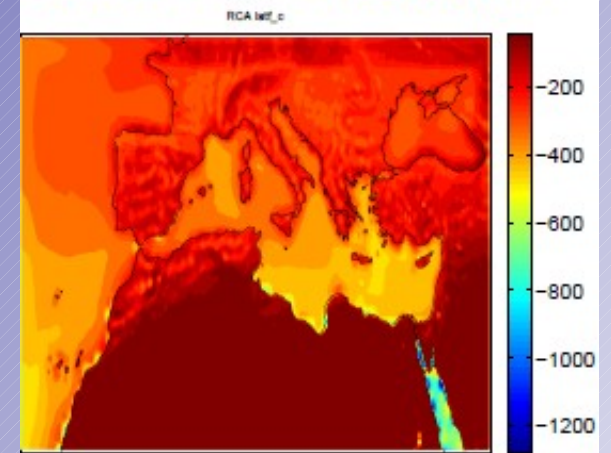
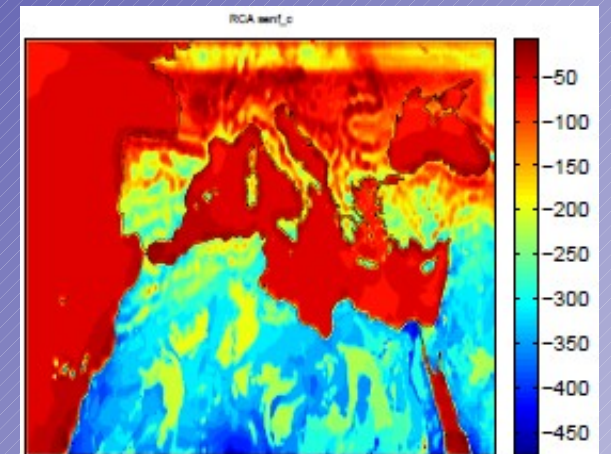
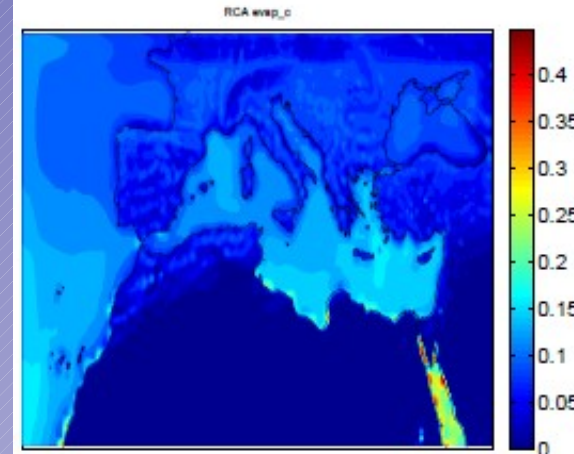
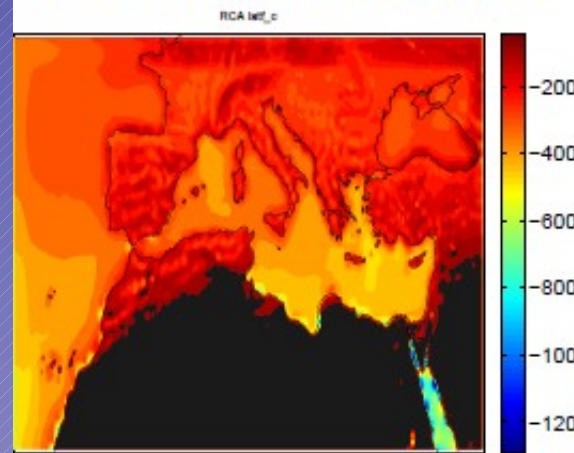
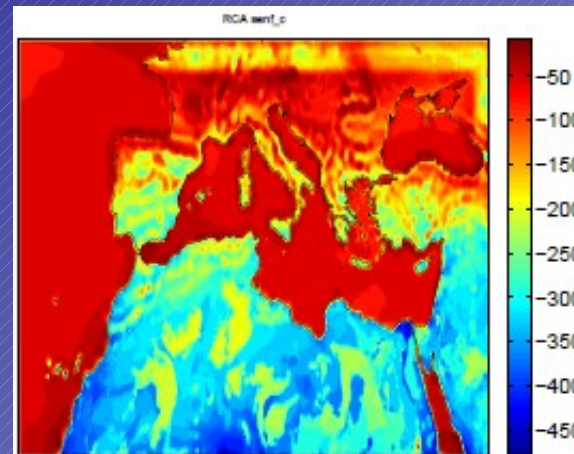
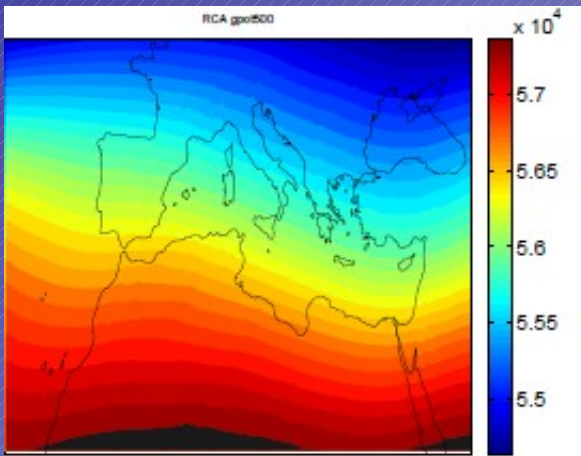
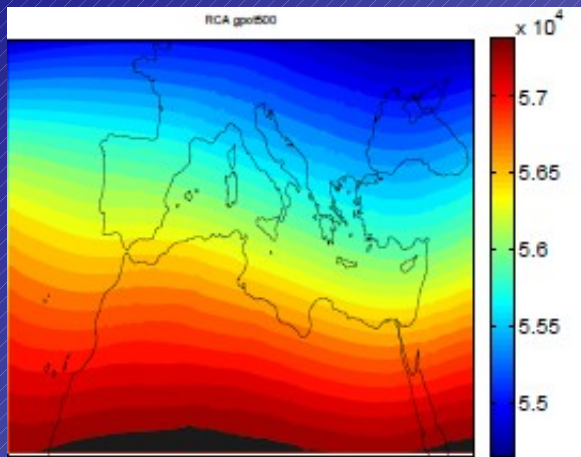
- First comparison: ERA-Interim integrations with (1989-2010) and without (1989-2009) -DHIRLAM flag.
- Variables: sst (var11) mean, max/min; ts mean, max/min; short and long wave net surface radiation; short and long wave downwards surface radiation; sensible heat flux; latent heat flux; total evaporation; 500 hPa geopotential.



First results.

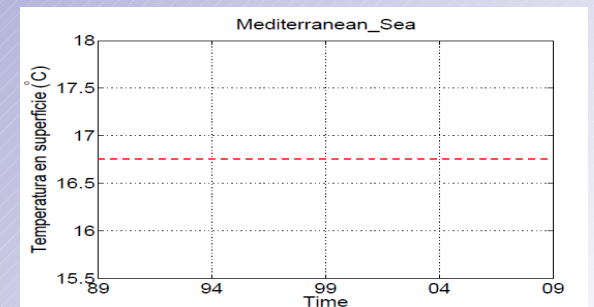
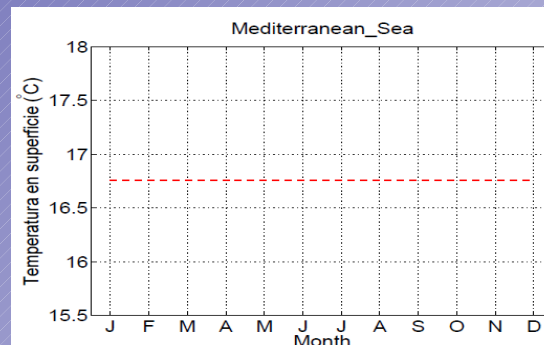
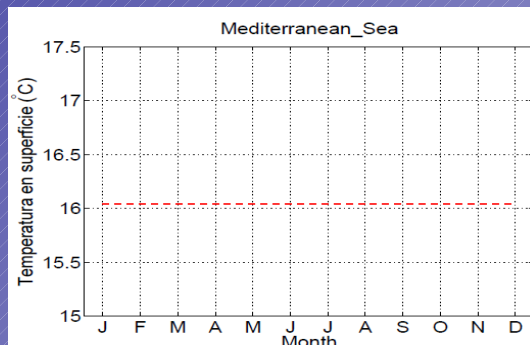
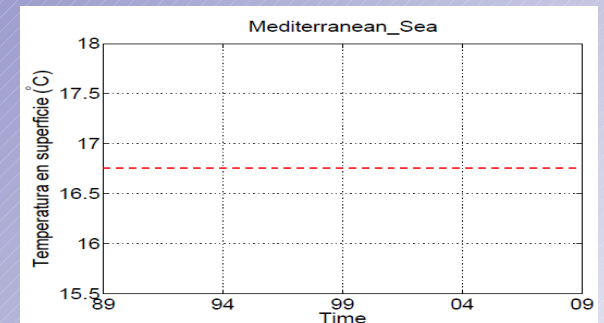
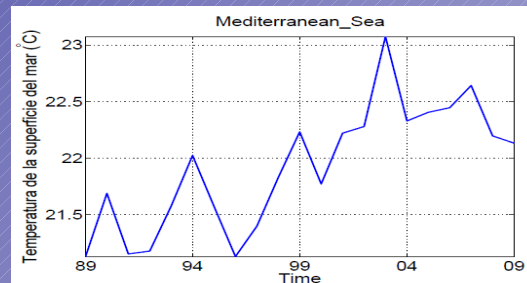
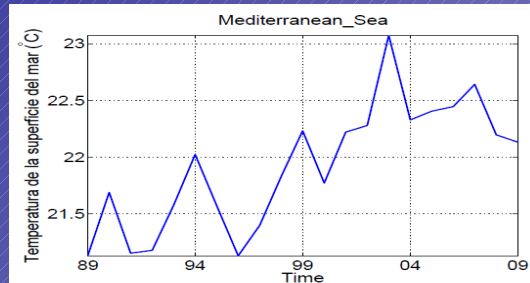
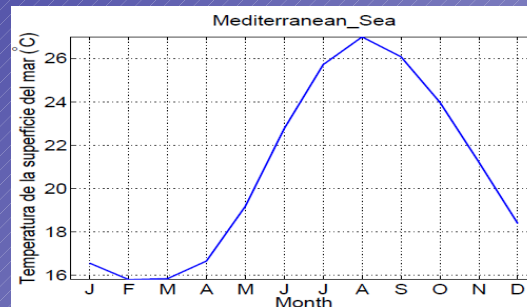
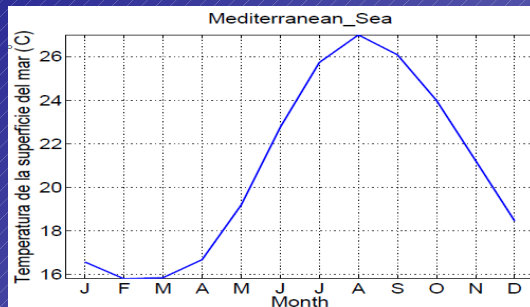
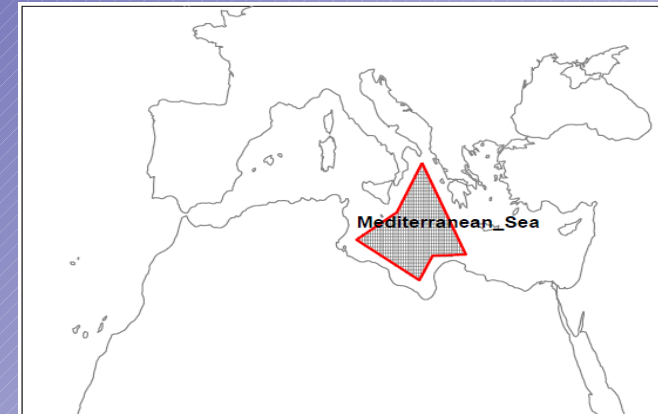


First results.



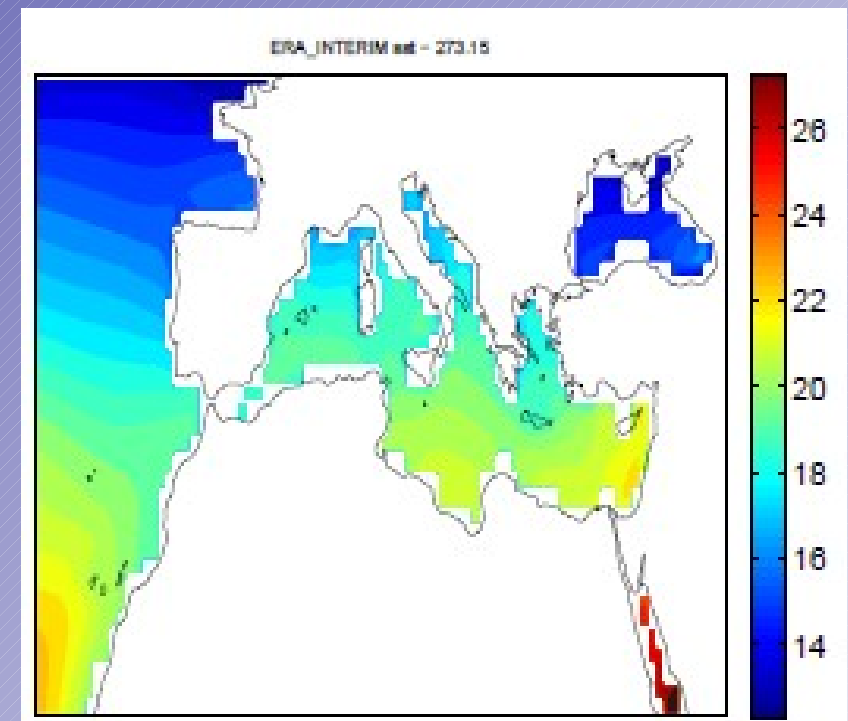
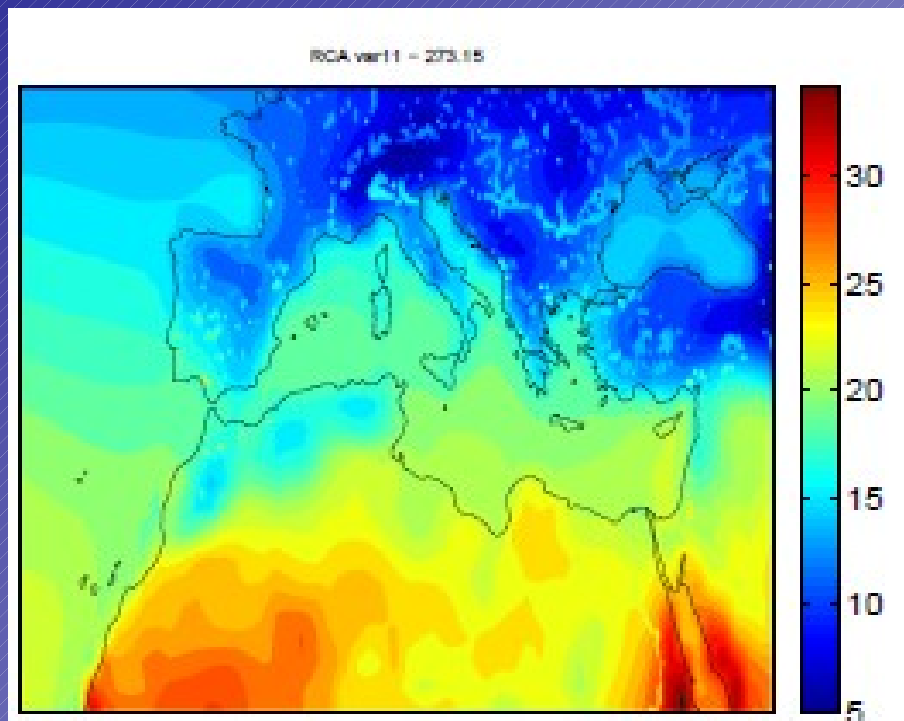
First results.

- Ts and sst annual cycle plots and whole period time series. Something is wrong with ts!!!



First results.

- First comparison with evaluation data: ERA-Interim in period 1989-1991. Variable: sst.



Brief conclusions.

- Our efforts seems to be not futile. RCA integrations are similar to the ERA-Interim boundary conditions (not so difficult) but with a higher resolution and more detailed.
- Something is wrong with ts.
- -DHIRLAM flag seems to be not so relevant.
- There are some problems with precipitation and short wave downwards surface flux.

On going work.

- Finish RCA-ERA1 comparison and begin RCA-ERA40 comparison.
- Plot all variables ERA1 and ERA40 integrations and compare with other analysis. For example: climatic forecasts obtained by statistical downscaling.
- Post-process of integrations of models HadCM3 (ref, high, low) and ECHAM5 (A1B scenario).
- Having a look to parametrizations of model.