Status of surface assimilation in Harmonie

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Introduction

In order to check the EKF surface data assimilation performance, it has been decided to increase the number of observation analysed (right graph), because the number of stations available in GTS over the Iberia Peninsula was really small.

The Spanish automatic station network is dense enough to our purpose (aprox 750 stations) most of them take an observations each 10 minutes.

CANARI is not able to select the observation of one station closer to the analysis time. (Francoise Taillefer, personal communication). So we had to do a selection of the closest observation to the analysis date in advance.

The experiment runs several days before the period of interest.

Spanish network of automatic observation stations.

Harmonie Setup

Harmonie version: 36h1.3

Non-hydrostaic dynamics

Arome physics

Surface physics : SURFEX with 3 layers of the soil.

The area is focused in the Iberian Peninsula.

The central points of the domain are:

LATC = 40.0º and LONC =-2.5º.

Lat x Lon = 480 x 576

Grid size = 2500

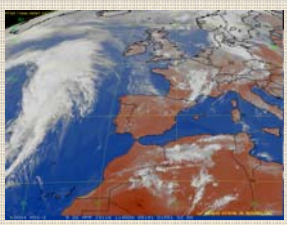
Model levels = 65

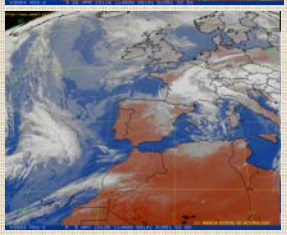
Dynamics time step = 60 sec

CANARI was used for analysis of T_{2m} & RH_{2m} observations.

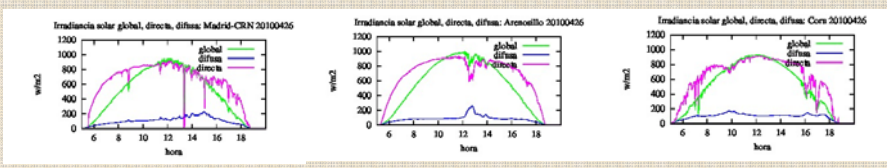
Date of the experiment: 2010042612 & 2010050512

Synoptical situation.





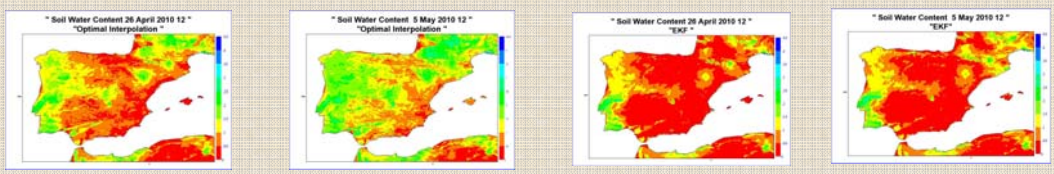
Observation of Solar Ratiation



No cloudiness and weak wind over our area of interest for the first day, as we can see in the satellital image and the observation of direct and diffuse ratiation for this day.

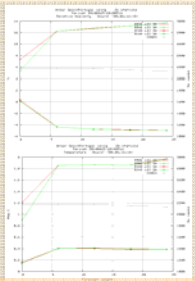
For the second day there was low cloudiness over the North and the East of the Iberian Peninsula.

Soil Water Content



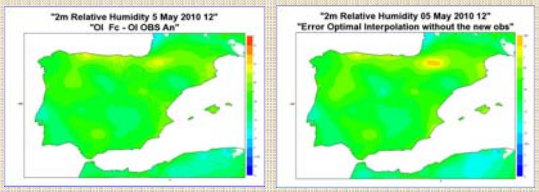
Soil water content in the second layer of the soil of the two experiments for both case studies.

Verification.



There is not any impact in 6 hours forecast if we introduce the new network of observations.

There are very few days in which there is some impact in the forecast. Only in May the 10th and 11th



The low impact of introducing a very dense network of observations is not expected.

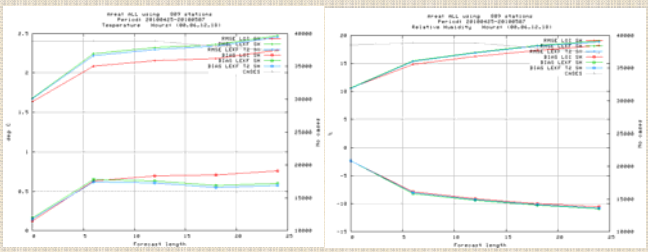
Maybe we have to be more carful with CANARI.

To take into accont the number of observation used in each box of analisis of optimal interpolation or with the structure functions used in CANARI.

The spatial structure of the errors are also similar in both experiments.

It is the same for the first day (not shown) and very similar for the sencond day. But we can say that the error were decreased more if we use the biggest network of observation (left graph) in the areas with bigger error.

Verification EKF vs OI



Experimets:

Red => Optimal Interpolation

Green => EKF using only Soil Water Content of the second layer of the soil like control variable

Blue => EKF using Soil Water Content and Soil Temperature of 2nd layer of the soil like control variable.

In the verification graphs OI has better behaviour than EKF.

CONCLUSIONS

Although it seems than Extender Kalman Filter do not verify as good as Optimal Interpolation scheme and the performance is slower, it is necessary in order to use satellite observations of soil water content (ASCAT and SMOS). It is hope that the use of this new observation would increase the quality of the analysis and the forecast.

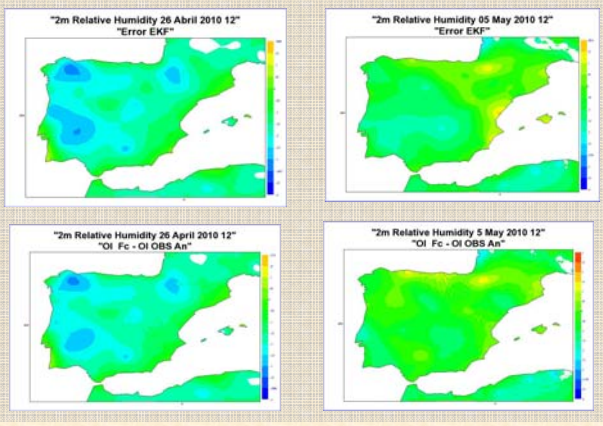
Like was shown in previous works the jacobians of EKF are more consistent with the soil characteristics than the OI ones. So it is hope to need more time running than OI in order to reduce the forecast errors. There is also a problem when the climatological files are too dry, in this case the soil water content would be below the wilting point, so the sensibility of the EKF are very low and it takes too effort to moist the soil.

The use of Soil Temperature like control vector decrease the error of T2M and HR2m.

More effort is needed in order to update CANARI to the new resolution and observation setup, and to take into accont of some tunning variables like the horizontal lengthscales or the number of observation per box analysis.

There is a lot of work to do in order to understand the behavior of EKF in Harmonie.

Error evolution of EKF vr OI.



At the beginning of the period the spatial distribution of the errors are pretty similar in both experiments, but if we let run the experiment more time we can see the that the errors in the optimal interpolation experiment were decreased in comparision with the EKF one. The evolution of the soil water content of the second layer of the soil is important for understanding.

The Extremadura and Galicia areas (in the West part of the iberian península) are the most representative of this fact.

We notice in the EKF an area where the forecast was more wet than it should be in the coast of Valencia (in the East coast). For the moment we don't have any explanation for this behavior, maybe it is an effect of coastal winds or cloudiness.

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