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## Introduction

GLAMEPS stands for **Grand Limited Area Model Ensemble Prediction System**, and is an initiative on a limited area models ensemble prediction system with participating countries from the ALADIN consortium (<http://www.cnrm.meteo.fr/aladin>), and from the HIRLAM consortium (<http://joomla.hirlam.org>).

GLAMEPS is a multi model limited area ensemble prediction system including additional perturbation methods within the different models, like use of multiple parameterisation schemes or stochastic physics. GLAMEPS combines the advantages of the multi-model approach with the variability of configuration within a certain LAM model.

## Development

### GLAMEPS version 0

GLAMEPS was launched in summer 2006 in a cooperation between the ALADIN and the Hirlam consortium, with the idea to provide to the partners a LAM ensemble system for production of forecasts on a large common model domain covering the North Atlantic and the European Area, including as much as possible the areas of interest of each partner.

Originally GLAMEPS was thought as a decentralized production system, where several institutes contribute ensemble members to an overall ensemble, with possibility for central and individual post-processing.

With GLAMEPS also development of the Hirlam EPS script system was started. Similarly ALADIN was also prepared for use within GLAMEPS. As a third model component, Euro-TEPS system was considered, but finally it didn't enter into production.

Version 0 was rather experimental. It included options to make use of boundary data from ECMWF-EPS or from the Euro-TEPS ensemble, and different perturbation approaches were experimented with in an effort to get to an ensemble system suitable for operational production.

### GLAMEPS version 1

This version was established from late 2008 on, and it aimed to become the first GLAMEPS system to run in real-time. Until its final establishment as a time-critical (option 2) production system on the ECMWF computers in 2011, it was tested meticulously and further developed in order to be monitored by ECMWF operator staff.

Ensemble configuration:

- 12 + 1 Aladin members
- 12 + 1 Hirlam members using Kain-Fritsch convection parameterization
- 12 + 1 Hirlam members using Straco convection parameterization
- 14 + 1 ECMWF members from ECMWF-EPS plus the high-resolution run

the "+1" represents the *unperturbed* control member

all in all **54 ensemble members**

Cycling configuration:

- 12-hourly, twice a day
- 54h forecast length
- product generation twice a day

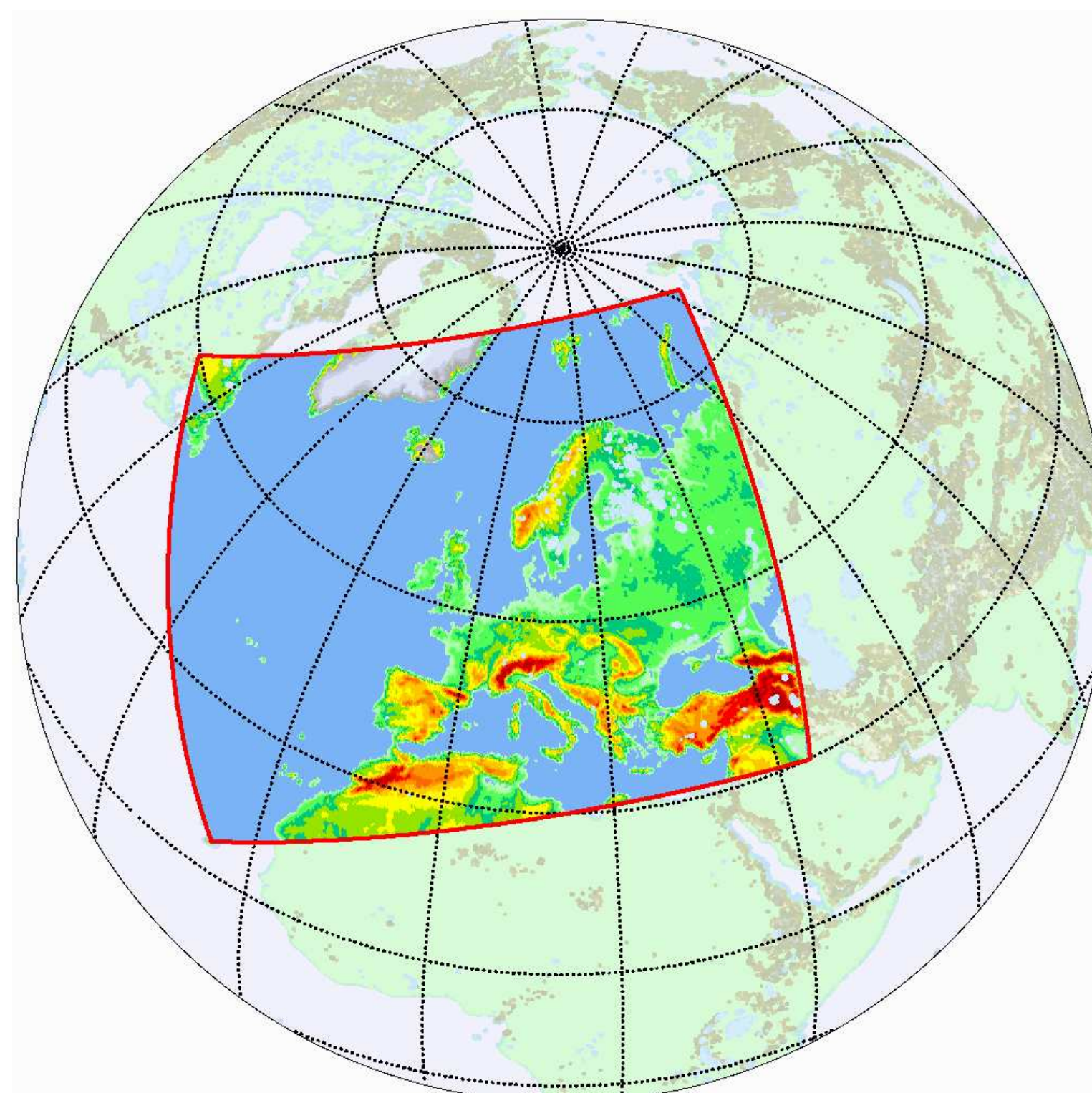
Model Data Domain (common GLAMEPS domain):

- rotated lat-lon grid
- 646 x 492 gridpoints, ~11km mesh size
- domain area outlined in figure on middle column

### GLAMEPS version 2 (current production system)

Work on version 2 of GLAMEPS was started in mid 2013 with the aim to increase horizontal resolution, but especially also in order to configure the ensemble setup in a new way. Major elements of this new setup were hereby:

- from 2 daily runs (12h-cycles) to 4 daily runs (6-h cycling)
- 6-hour lagged ensemble member configuration
- remove ECMWF-EPS members from the member list (ECMWF-EPS thus only providing boundary data, and no longer contributing to the GLAMEPS ensemble with direct ensemble member model output)
- replace the Aladin model with two flavours of the Alaro model
- extend product palette



## GLAMEPS current production system

Ensemble configuration:

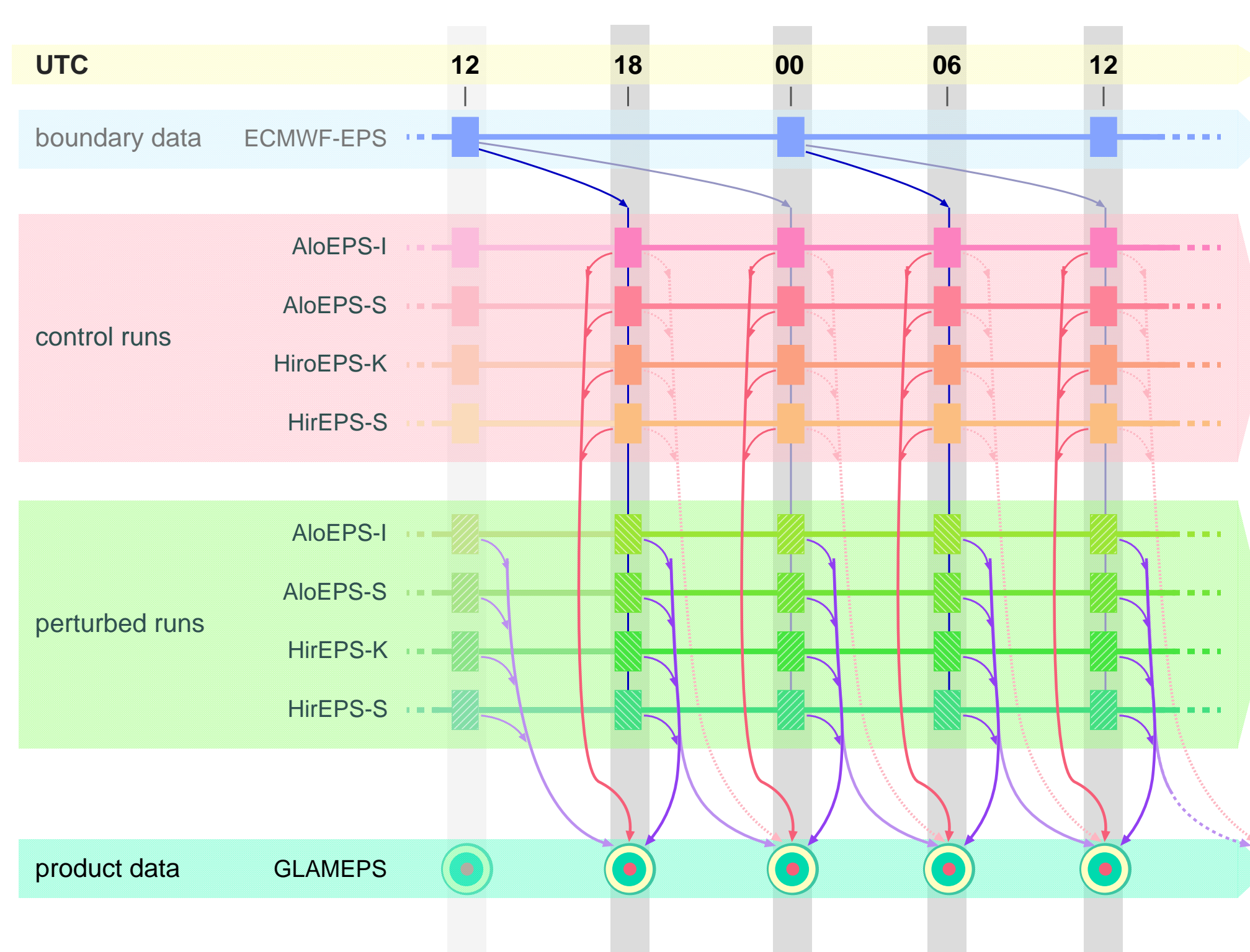
- 12 + 1 Alaro members using the ISBA model at the surface
- 12 + 1 Alaro members using the SURFEX model for surface
- 12 + 1 Hirlam members using Kain-Fritsch convection parameterization
- 12 + 1 Hirlam members using STRACO convection parameterization

the "+1" represents the *unperturbed* control member

all in all **52 ensemble members**

Cycling configuration:

- 6-hourly, 4 times a day, with alternating perturbed members, i.e. 6+1 members per cycle for each model flavour
- 12-hourly boundary update (ECMWF-EPS)
- 54h effective forecast length
- product generation 4 times a day, based on latest two cycles
- 12h prolonged cycle forecasts for backup facility



GLAMEPS Model Data Domain:

- rotated lat-lon grid
- 870 x 660 gridpoints, 40 vertical levels, ~8km mesh size
- same domain area as version 1 (see figure above)

## Products

### Model output data

Main Data Stream ([archived](#)):

- temperature at 2m, and pressure levels 925, 850 and 500
- winds at 10m, and pressure levels 925, 850 and 500
- MSLP, and pressure level heights for 925, 850 and 500hPa
- dew point temperature at 2m
- wind gust at 10m
- total accumulated precipitation, snowfall and cloud cover
- downward shortwave radiation

Secondary Data Stream ([not archived!](#)):

contains many more parameters like min-max temperatures at 2m, CAPE, humidity on pressure levels, cloud parameters, zero-degree level etc.

Table Extraction Data ([archived](#)):

SQL table data for more than 10.000 locations from within the GLAMEPS domain:  
parameters: MSLP, 2m temperature, 10m wind, total precipitation

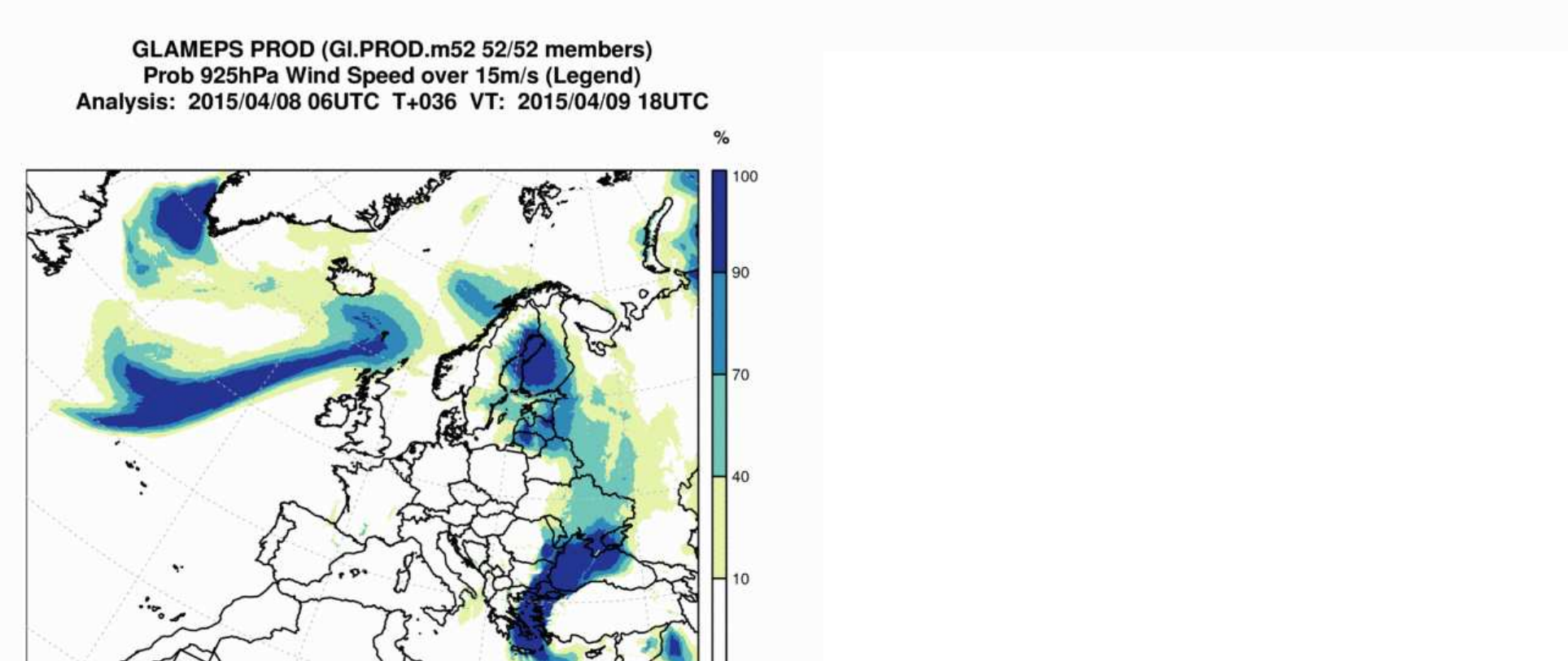
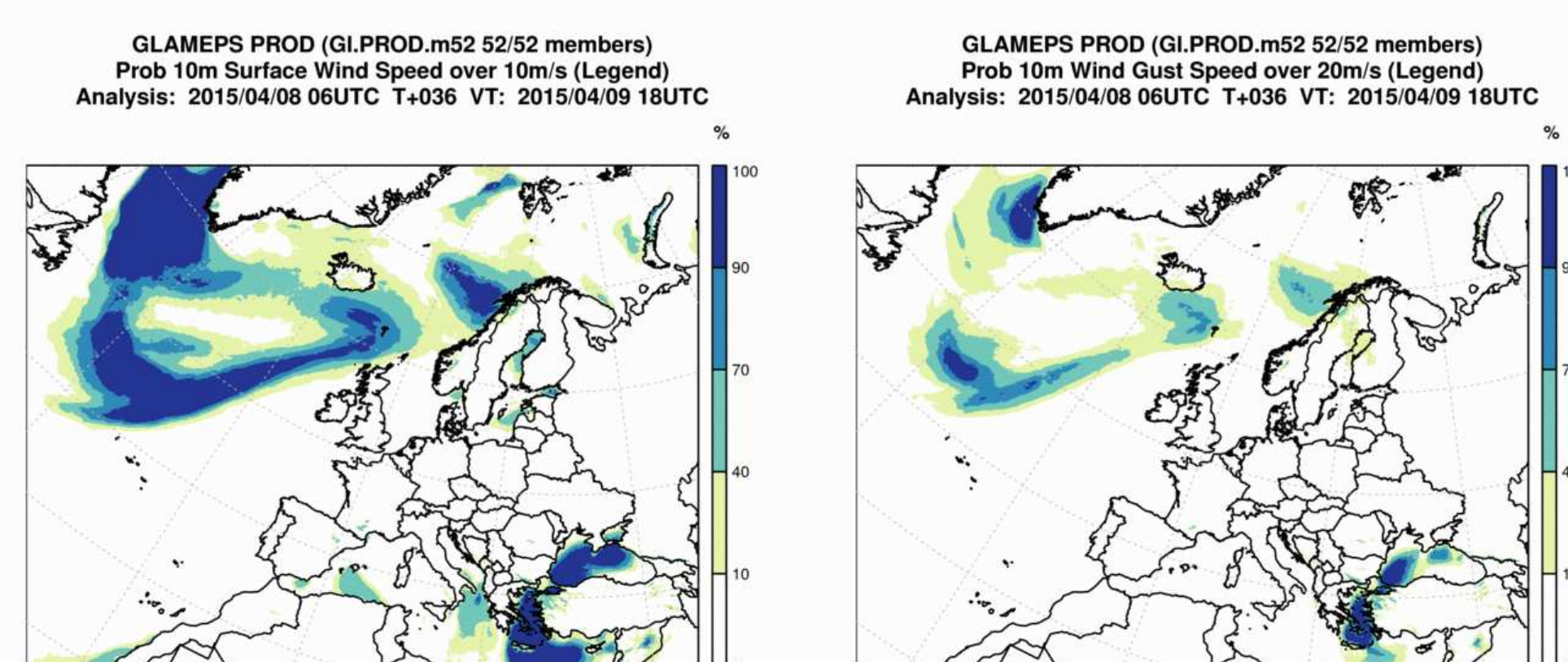
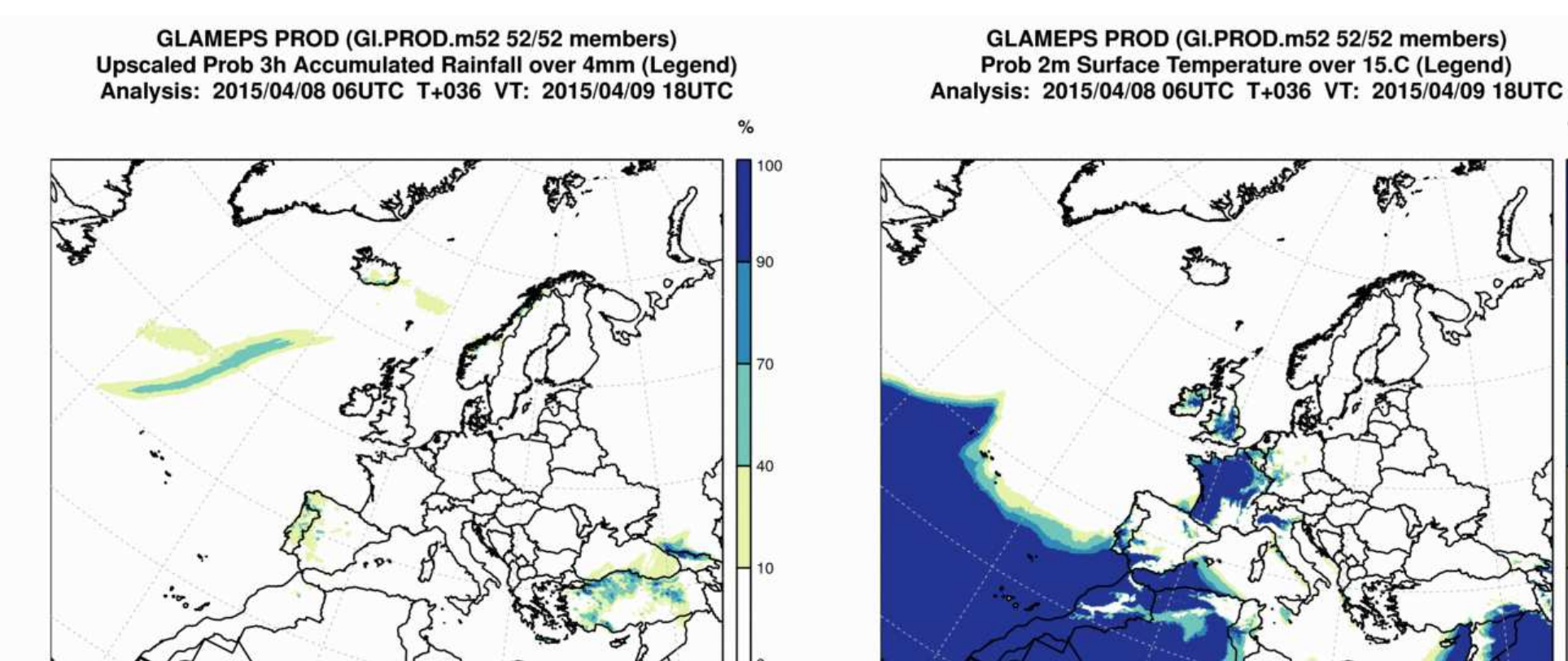
### Model Level Data

full model level data in the original models' file format for the **latest 4 cycles available** on ECMWFs super computer

## GLAMEPS current production system (cont.)

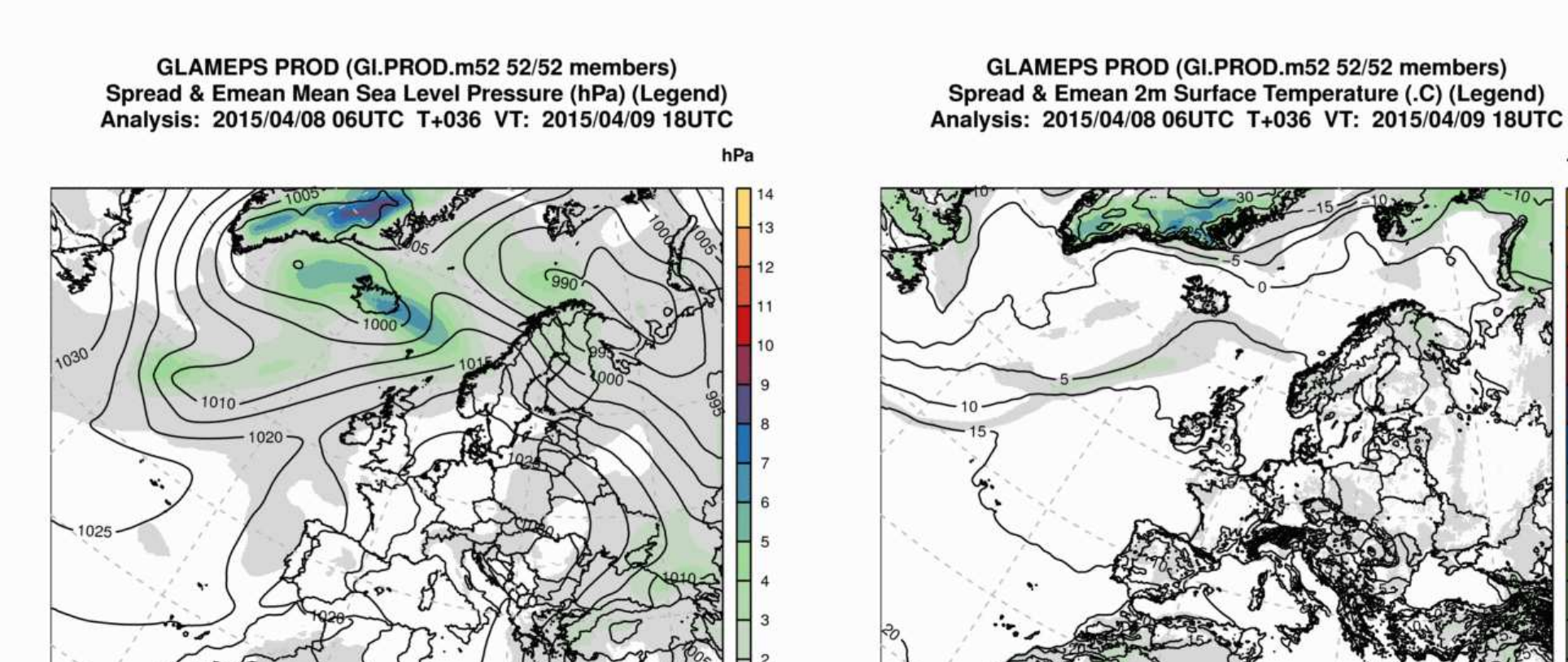
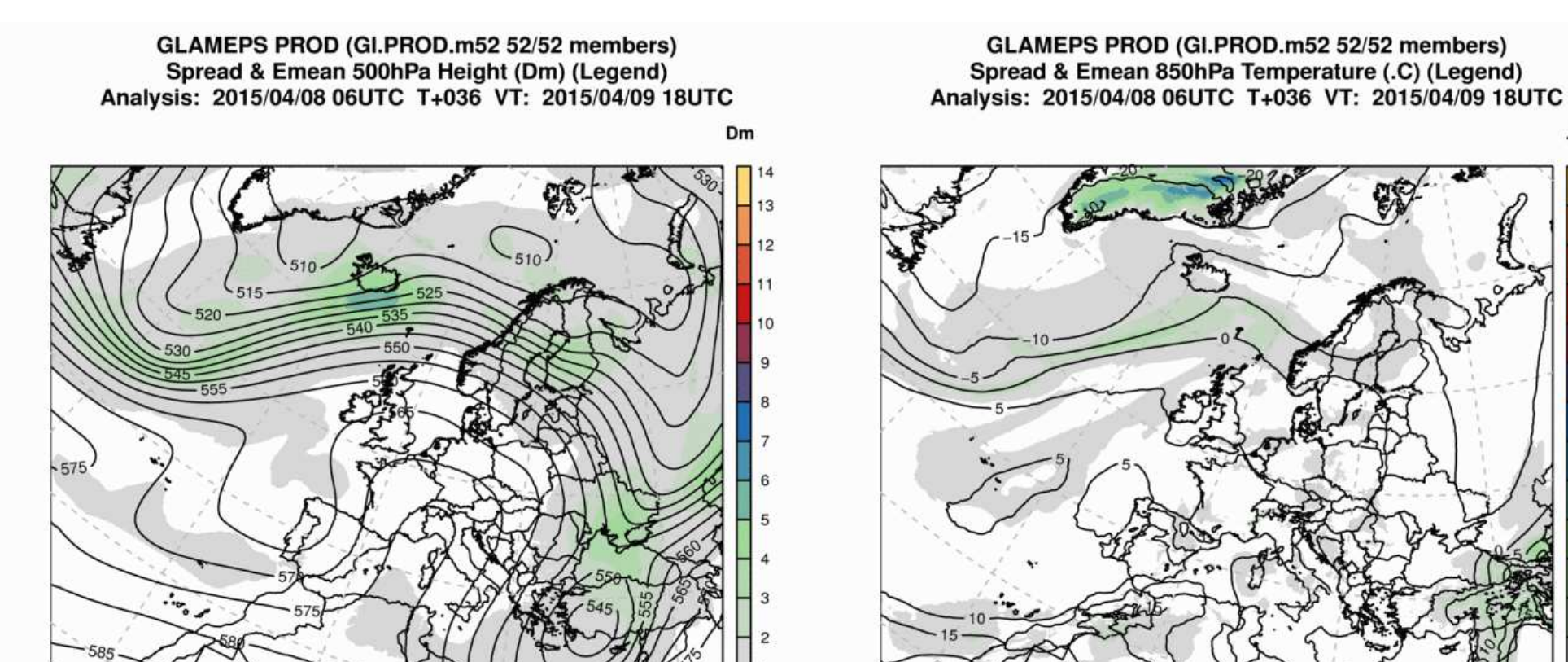
### Probability Maps

- 3h accumulated precipitation
- 10m and 925hPa wind speed, and 10m wind gust
- 2m temperature



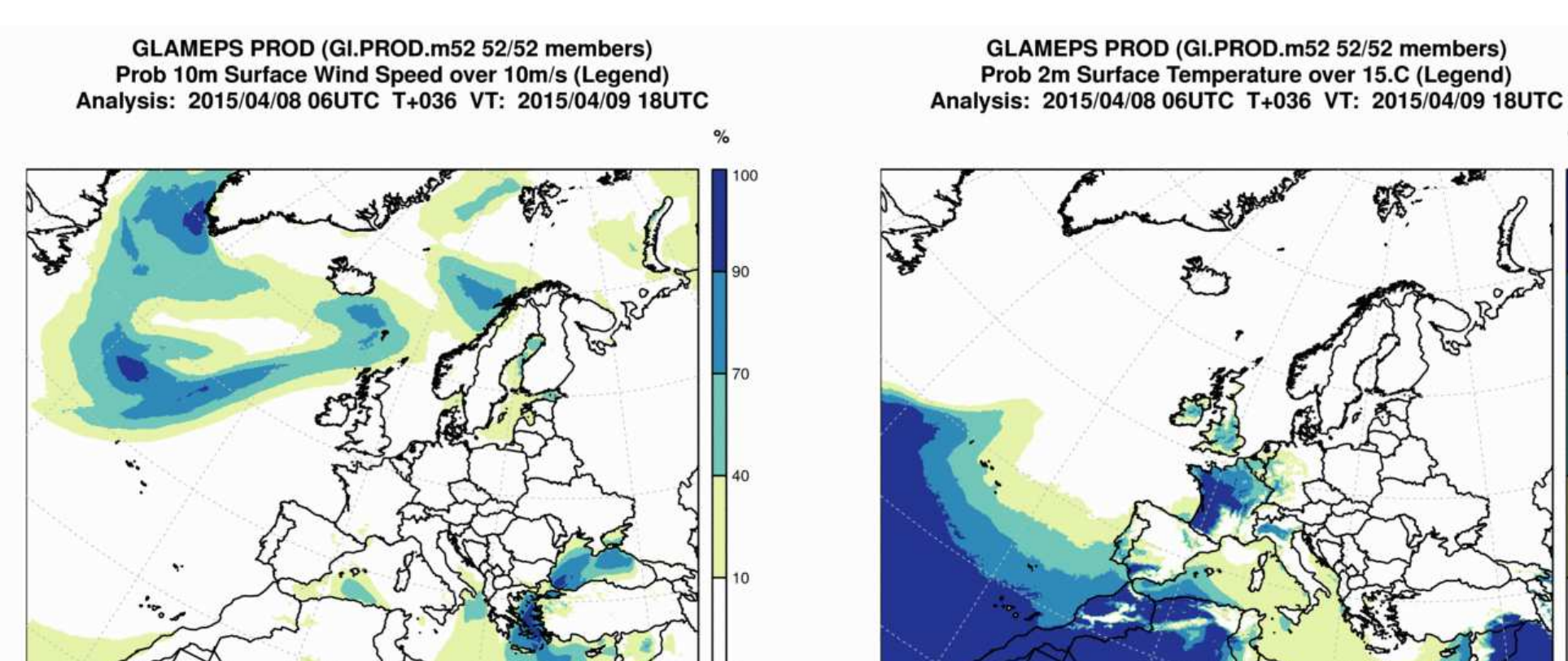
### Maps for Ensemble Mean and Spread

- mean sea level pressure and 500hPa height
- 2m and 850hPa temperature



## Considerations for further development

- calibrated products (under development)
- from ~8km to ~5km grid
- CAPE SVs in HirEPS (Sibbo van der Veen)
- analysis perturbation inflation for HirEPS
- AloEPS model perturbation based on diffusion
- AloEPS surface perturbations



## References

GLAMEPS Production System: Operations Status  
<https://glameps.org>

GLAMEPS Production System: Technical Information for Users:  
<https://hirlam.org/trac/wiki/GlamepsProductionUserInfo>

Alex Deckmyn, 2014: Introducing GLAMEPS-v2, a presentation at the ALADIN/HIRLAM 24th Workshop/All-Staff Meeting 2014, Bucharest