Plans for GLAMEPS, HarmonEPS and FROST-14

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22th Workshop / All-Staff Meeting 2012

Grand Limited Area Model Ensemble Prediction System

GLAMEPS – plans for a version 2

GLAMEPS is a common project for operational EPS in the short-range in the HIRLAM and ALADIN SRNWP consortia

GLAMEPS – possible updates in version 2

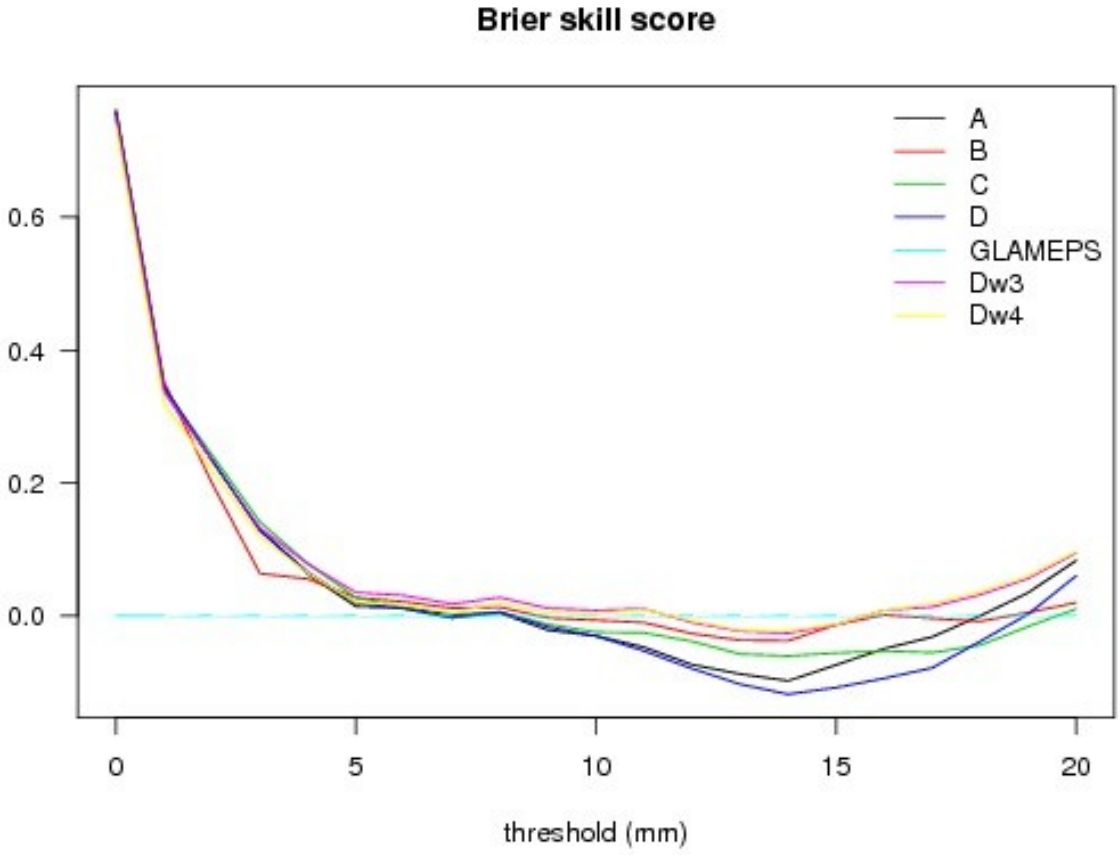
Based on two experiment periods in 2010/2011 the following experiments are underway with the full GLAMEPSv1 set up:

- EXP_2.0: Control hindcast experiment for GLAMEPS_v1
  - *Reference experiment*
- EXP_2.1: Perturbations based on Hirlam CAPE SVs blended with ECEPS
- EXP_2.2: Perturbations based on Hirlam ETKF blended with ECEPS
- EXP_2.3: Perturbations based on Hirlam EDA blended with ECEPS

- A new R-based verification system is being developed

Statistical post-processing for bias- and variance-corrections and multi-model combination (ELR)

Example from February 2012, 06 UTC + 30h.
For different ways of calculating ELR

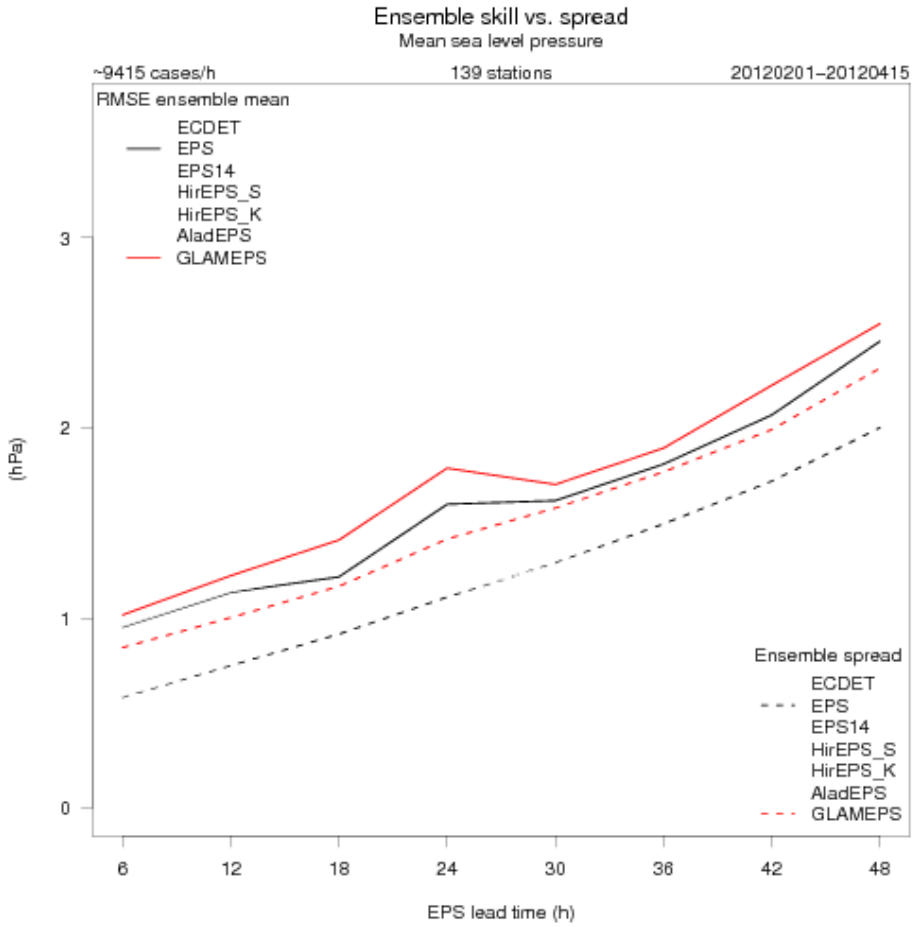


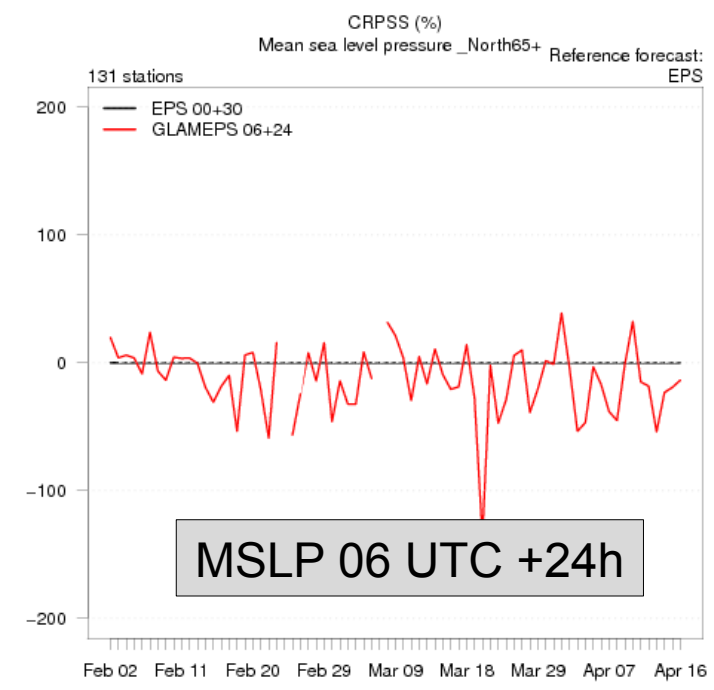
R&D for further improvements include:

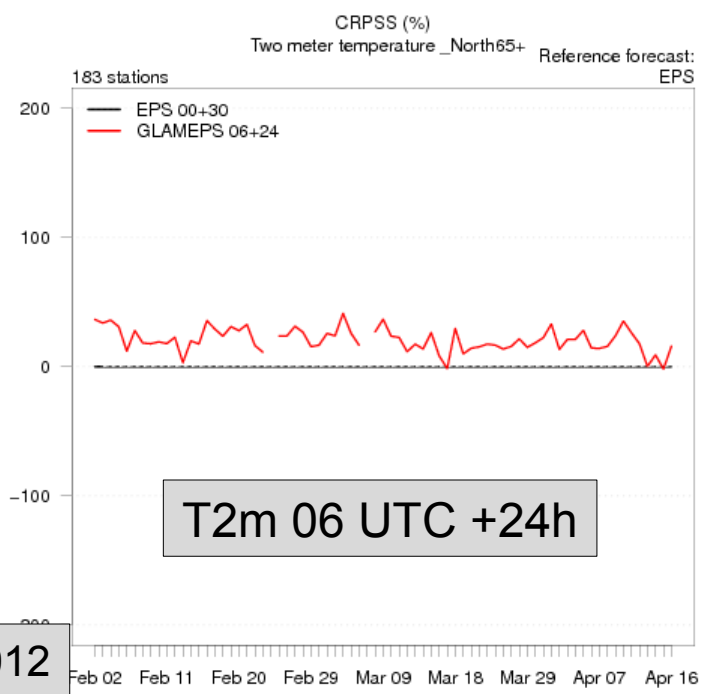
Not started:

- Increase the number of Aladin ensemble members
- Experimentation with combining with LAEF
- Perturbations of physics parameters

GLAMEPSv1 verified for stations north of 65°N – in connection with the WMO group for better predictions in polar regions



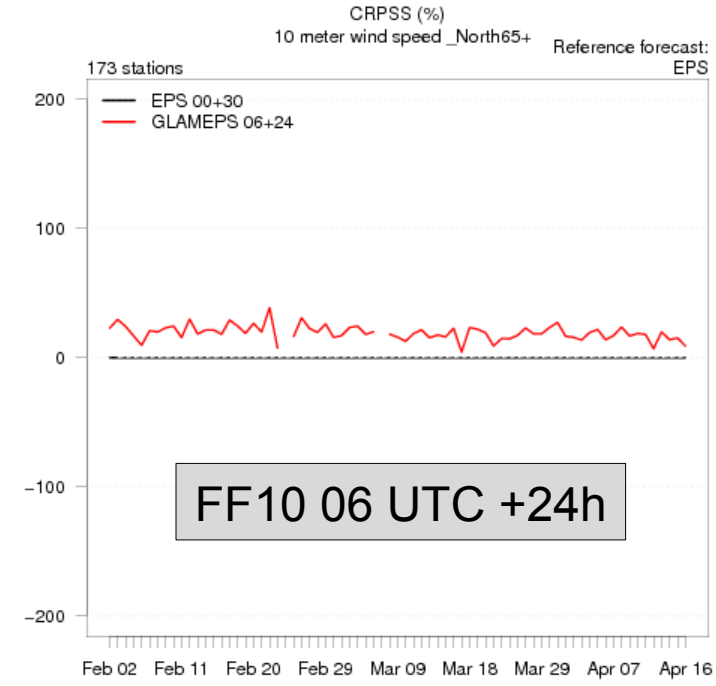


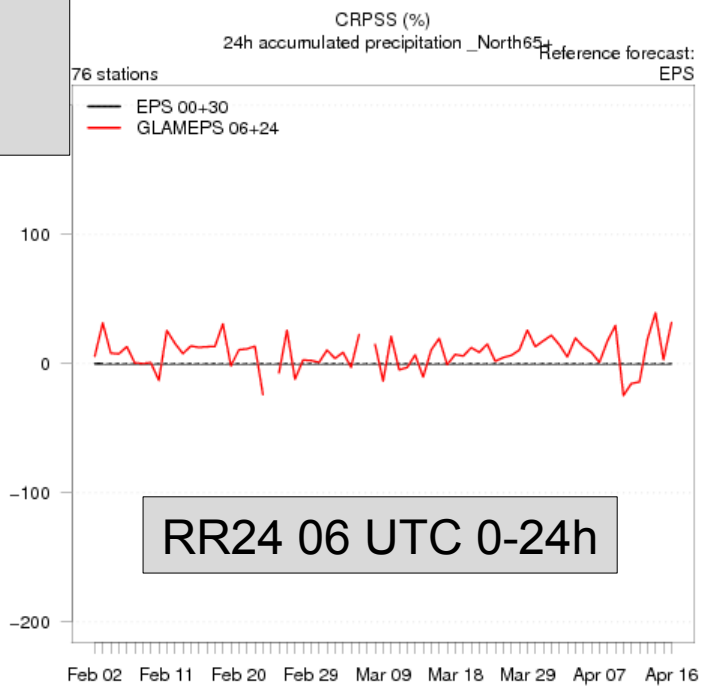


1 Feb 2012 – 15 Apr 2012

EPS

GLAMEPS





HarmonEPS

- Intention is to provide to the member weather services a prototype probabilistic forecast system on non-hydrostatic, convection-permitting scales
  - Not pan-European

- To enable reliable predictions of probabilities for high-impact weather events which are confined in space and time by:
  - Meso-scale dynamical structures
  - Orographic and other fine-scaled surface forcing

Planning ”HarmonEPS” experiments - 1

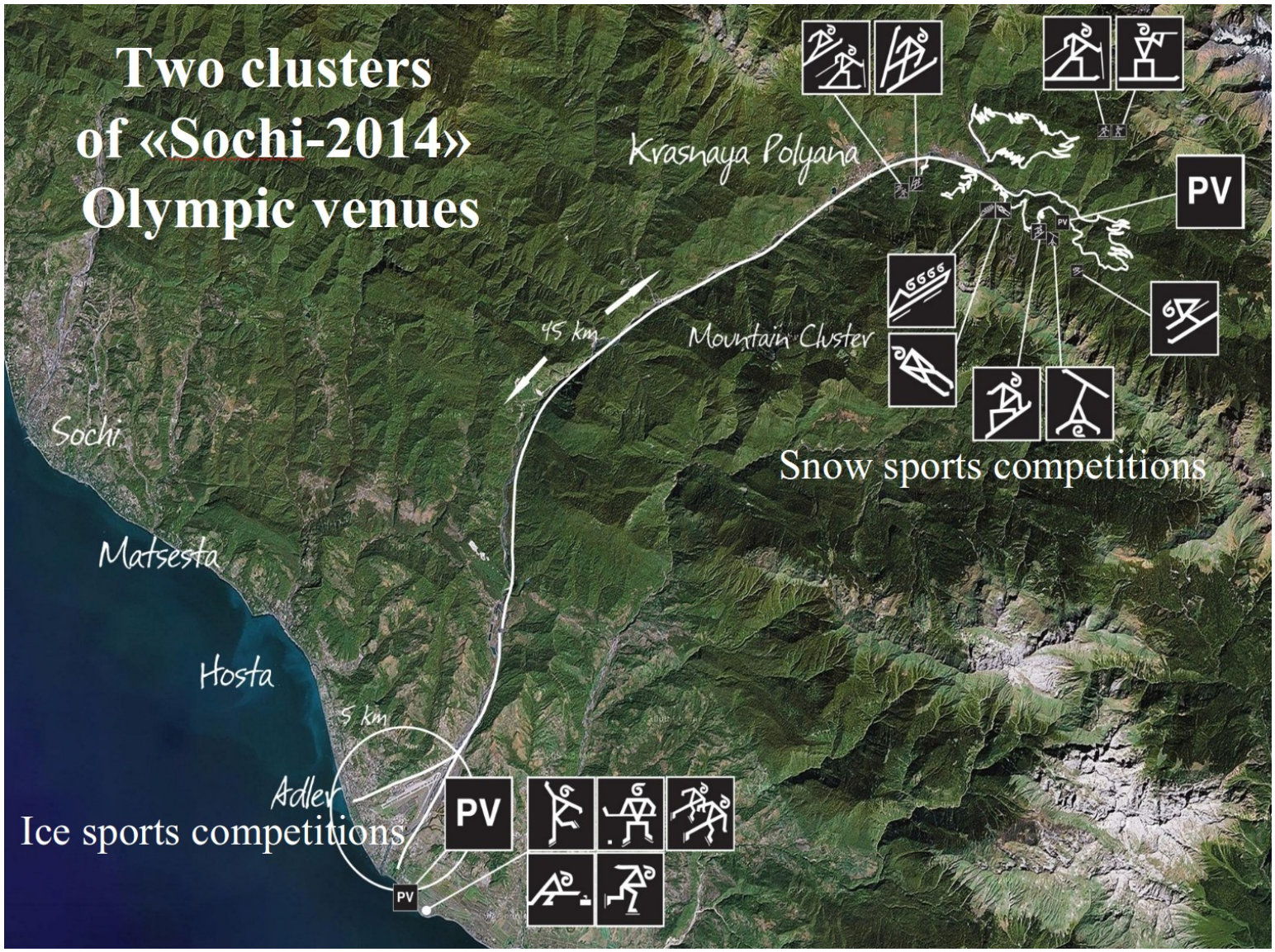
- A convection-permitting EPS
- Sub-European area and Sochi-area
- 2.5 km resolution
- + 36 h lead time.
- 20 members, 10 members with AROME and 10 with ALARO -> continue the multi-model approach
- Output to be produced every hour
- Surface assimilation included for every member.

Planning ”HarmonEPS” experiments - 2

- Full DA and 6 h cycling for the control,
- HarmonEPS to be run every 12 h (06/18UTC).
- LBC-data, intend to use increased resolution ECEPS (~16km) with single-step nesting, test also direct nesting from EC EPS at ~32 km
  - → Boundary data produced for for three weeks in 2011
- Simply choose the 20 first members from EC EPS to nest in.
- Step-wise develop
  - RUC with DA, and
  - finally hybrid DA and high-resolution observations

FROST-14

Forecast and Research in Sochi Olympic Testbed



The range of altitudes for various sport events is broad:

- Alpine skiing tracks 960-1945 m - topmost
- Ski jumping 600-900 m - lowermost

Project components:

- Obsevations
- Nowcasting
- Deterministic NWP
- Ensemble NWP
- Data assimilation
- Information Technologies
- Training and understanding
- Verification and Impact Assessments

Participants in FROST-14

- HMC
- ARPA-SIMC
- DWD
- Env. Canada
- NCAR?
- CMA
- ZAMG

- NOAA
- TIGGE
- HIRLAM
- FMI
- Basel University
- UKMO?

Second FROST Meeting April 2012. Red Square, Moscow

HIRLAM contribution to FROST

2011:
•GLAMEPS semi operational (FDP) Technical work in setting up Harmonie to run in ensemble mode finished. First test with HarmonEPS for the area of Sochi run successfully (RDP)

2012:
•Providing GLAMEPS results routinely (FDP) – Delivery of GLAMEPS to FROST from May/June 2012
•Run HarmonEPS experiments for the area of Sochi.
•Calibration of EPS forecasts (RDP).

2013:
•Run HarmonEPS for the area of Sochi and provide output

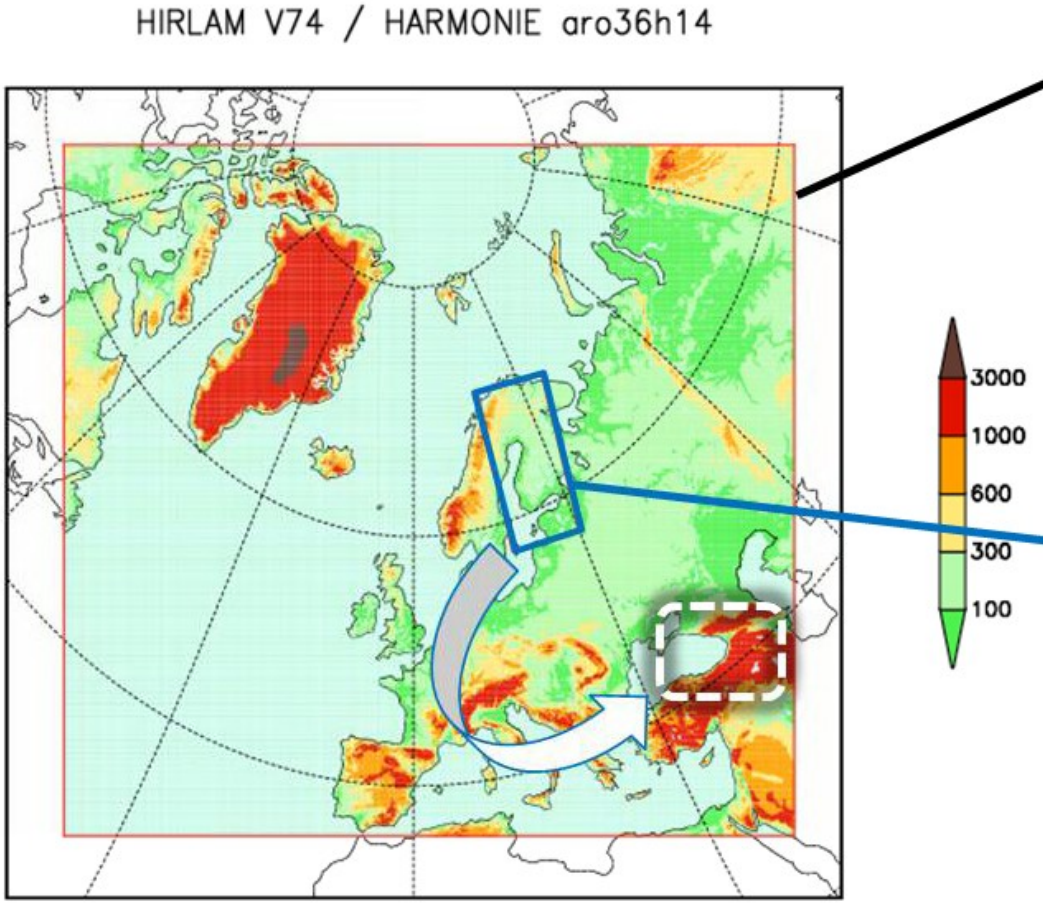
FMI – next slides

FMI Research Applications… for FROST-2014

- **Coordinating of forecast verification activities**
  - Potentially utilizing FMI verification software package to assess the quality of (some of) the forecast products / forecast providers
  - Verification training activities
- **Running of HARMONIE system for the Sochi area** (see next slide)
- **Establishing of a road weather piloting test bed along the roads leading to Olympics sports event locations**
  - "En-route" road weather forecasts from the Black Sea to the mountains
  - Depends on the availability of external project funding

FMI Research Applications... for FROST-2014

FMI models : Operational areas and resolution



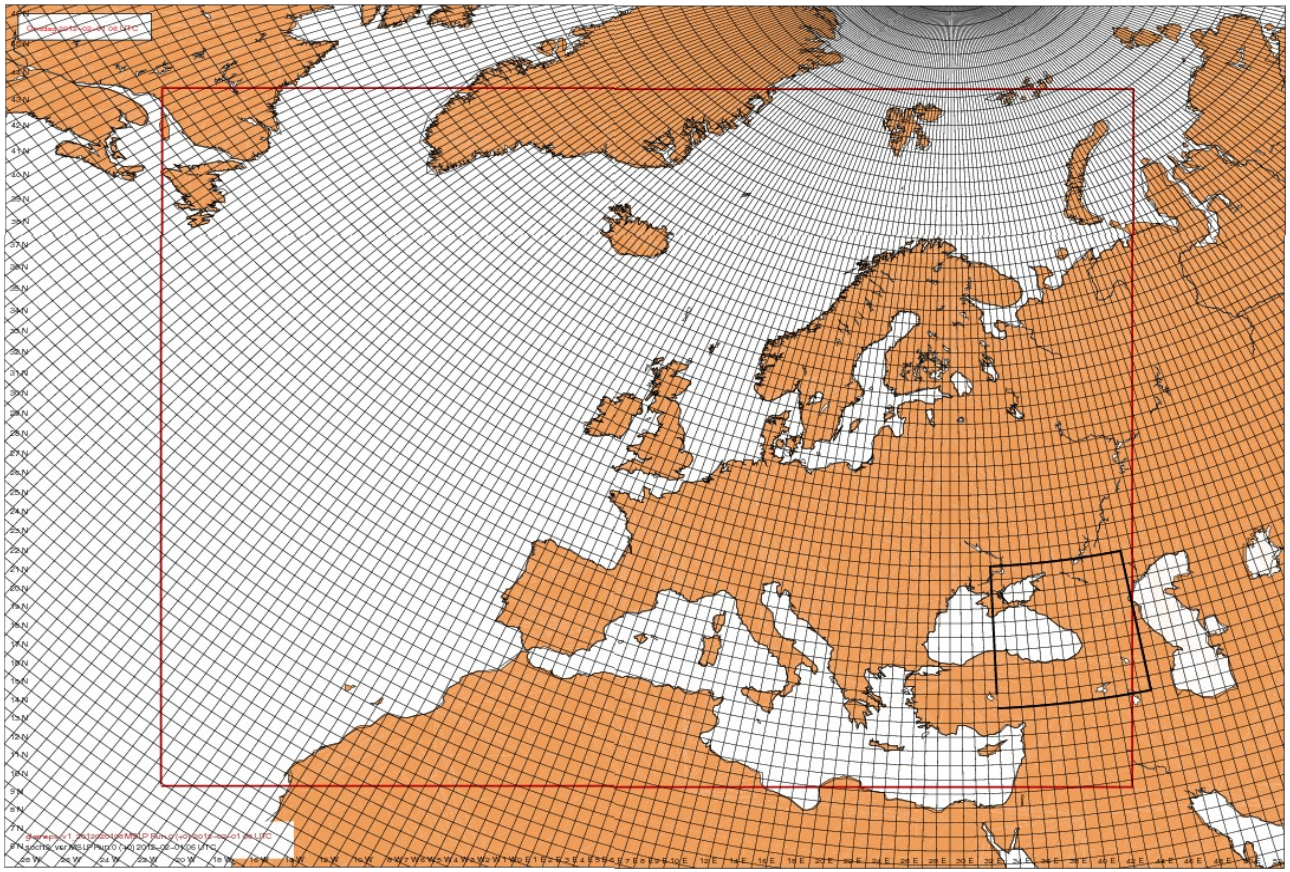
HIRLAM – V74

- ✓ Grid : 16 km → **7.5 km**
- ✓ Vertical levels : L60 → **L65**
  - ✓ 20 in lowest km
- ✓ 4* day + 54 hr
- ✓ Time-step : 150 s
- ✓ 4D-VAR

HARMONIE - aro36h14

- ✓ Grid : 16 km → **2.5 km**
- ✓ Vertical levels : L60 → **L65**
  - ✓ 20 in lowest km
- ✓ 4* day + 36 hr
- ✓ Time-step : 60 s
- ✓ 3D-VAR

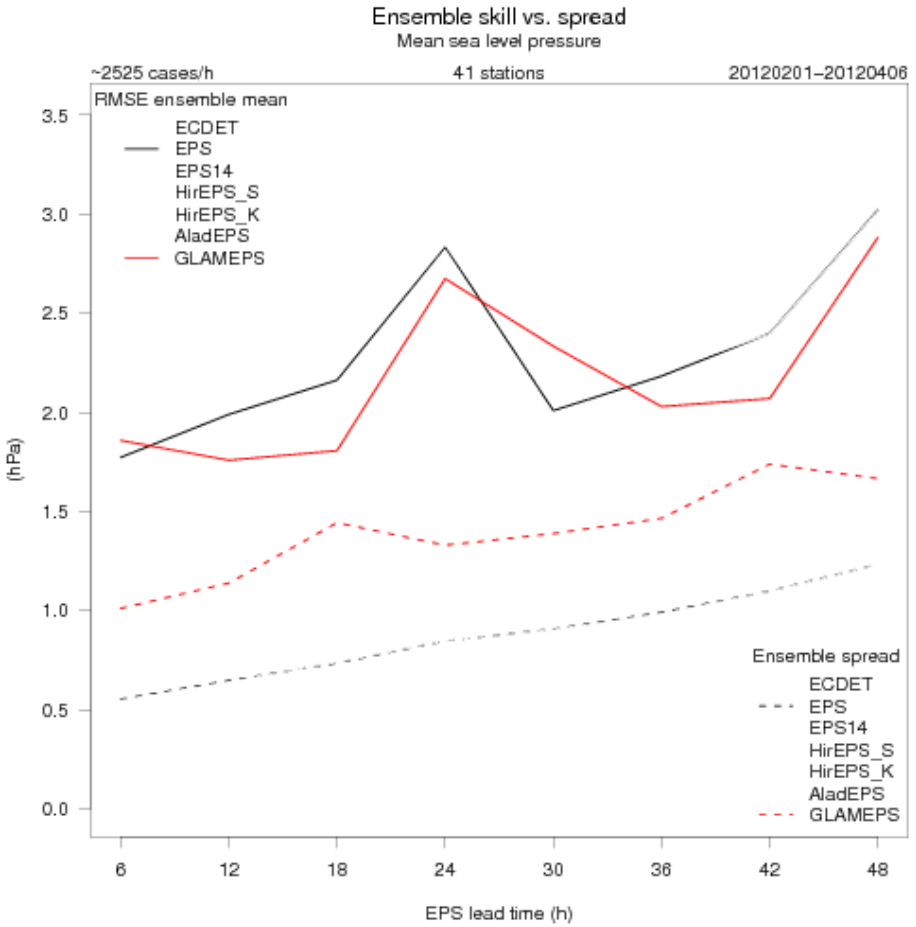
GLAMPES verification for the «Sochi area»



Spread/skill for MSLP for 41 stations in the Sochi area

Feb 1 2012 – Apr 6 2012

GLAMEPS and EC EPS



GLAMEPS rmse

GLAMEPS spread

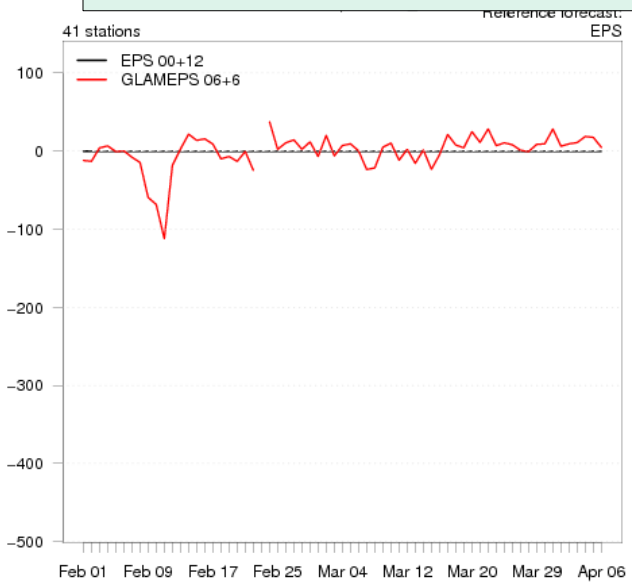
EC EPS rmse

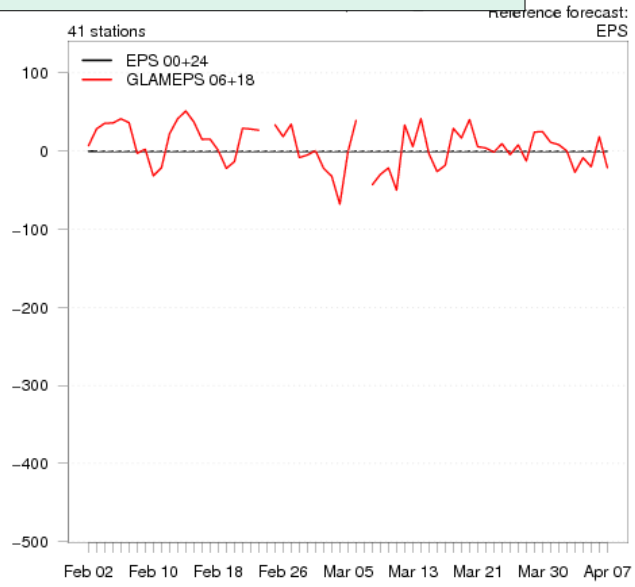
EC EPS spread

CRPSS (%) for MSLP for 41 stations in the Sochi area

Feb 1 2012 – Apr 6 2012

EC EPS reference

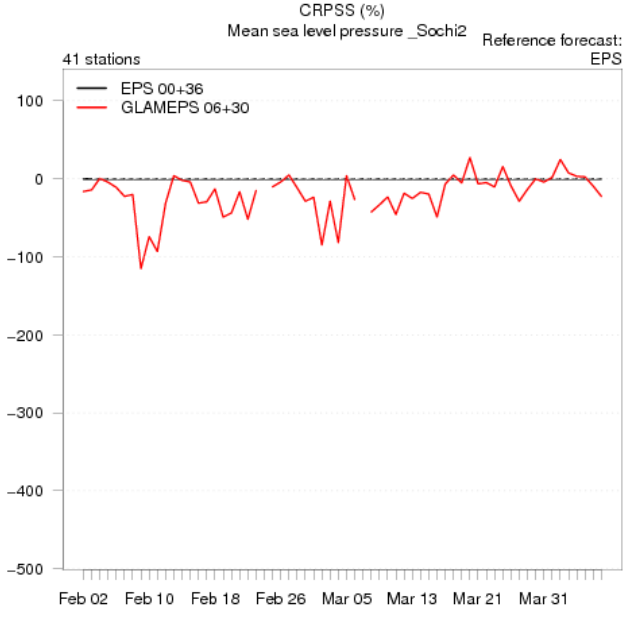




<- +12h +24h ->

EPS

GLAMEPS



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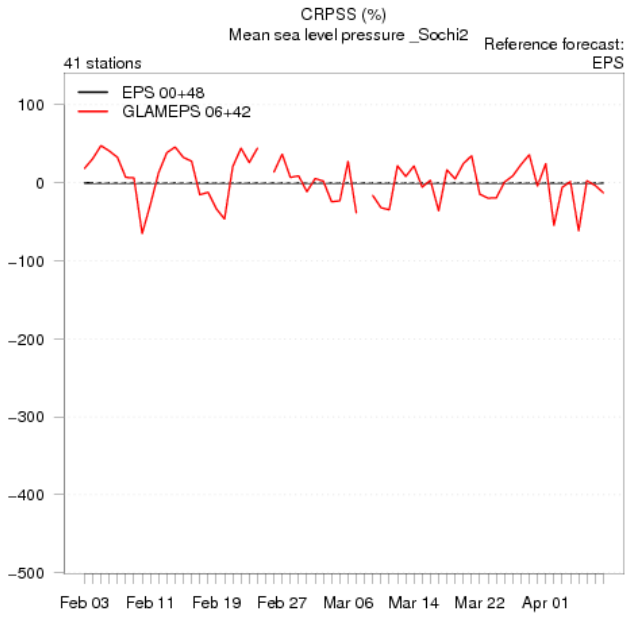
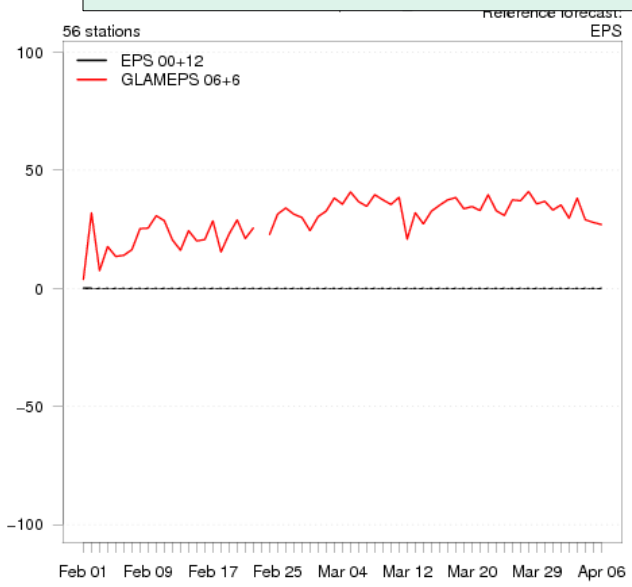


CRPSS (%) for T2m for 56 stations in the Sochi area

Feb 1 2012 – Apr 6 2012

EC EPS reference



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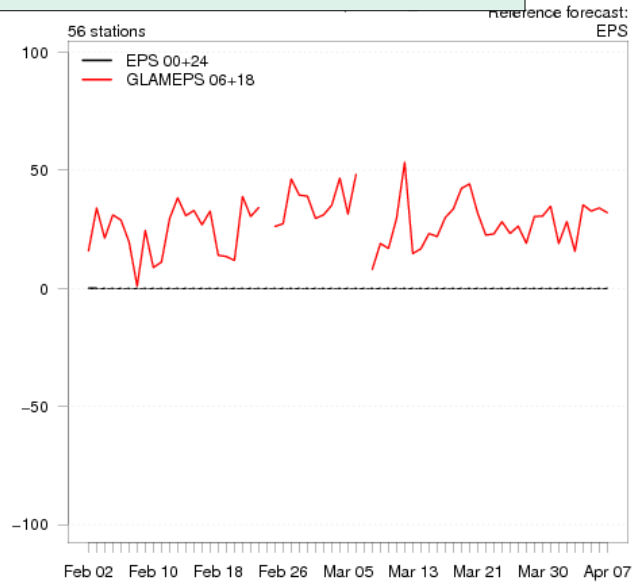
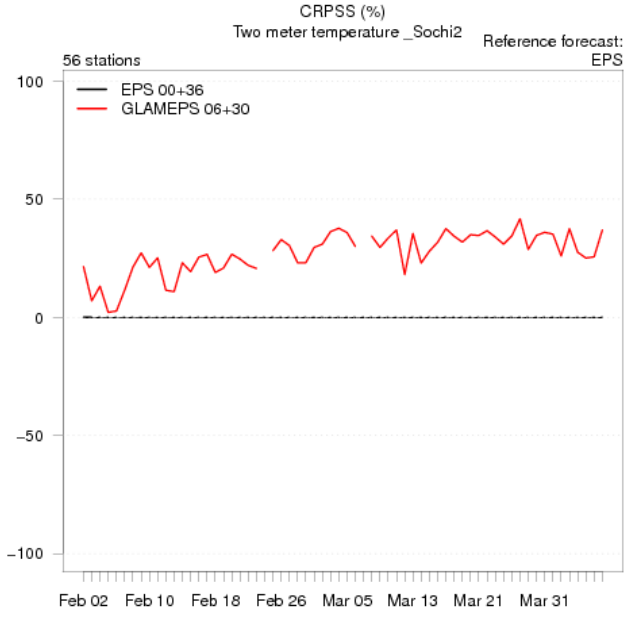


EPS

GLAMEPS



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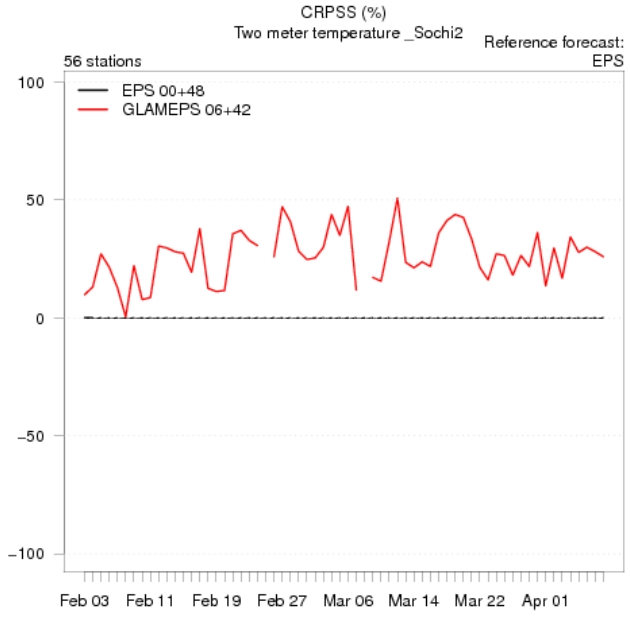
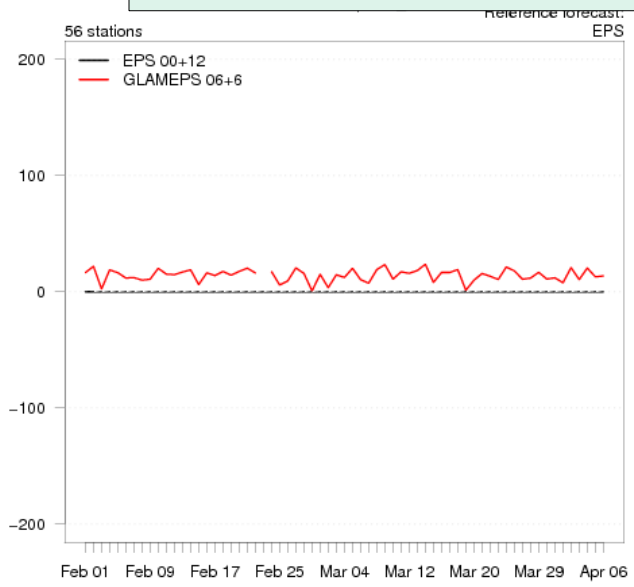
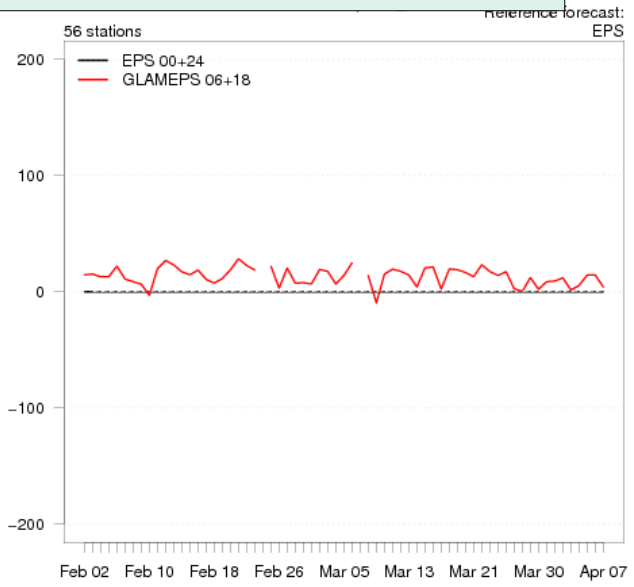


CRPSS (%) for ff10 for 56 stations in the Sochi area

Feb 1 2012 – Apr 6 2012

EC EPS reference





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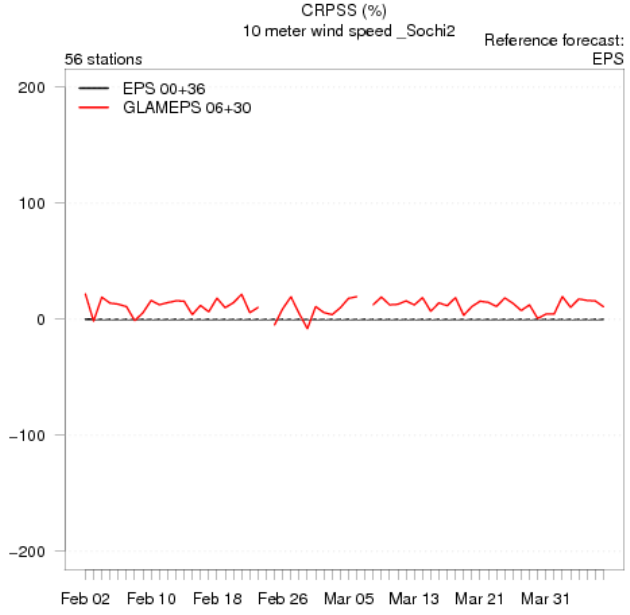
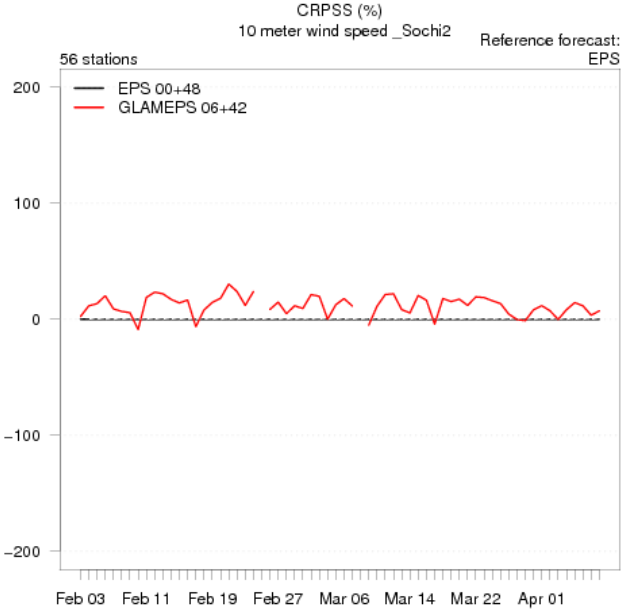
EPS

GLAMEPS





<- +36h +48h ->

CRPSS (%) for RR24 for 12 stations in the Sochi area

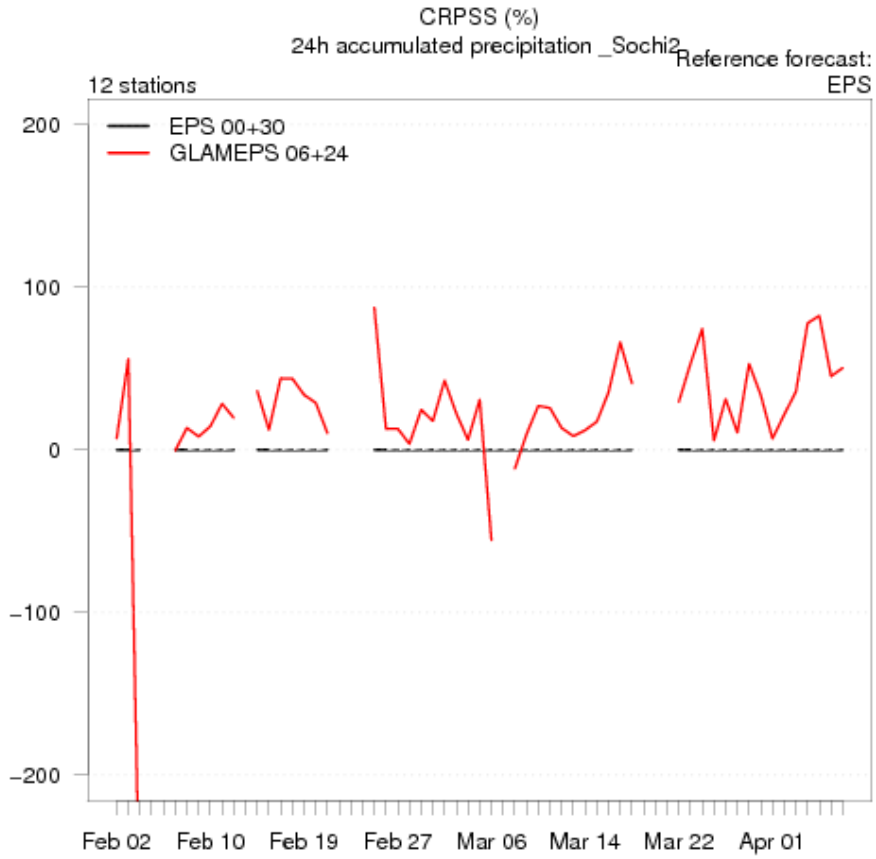
Feb 1 2012 – Apr 6 2012

EC EPS reference

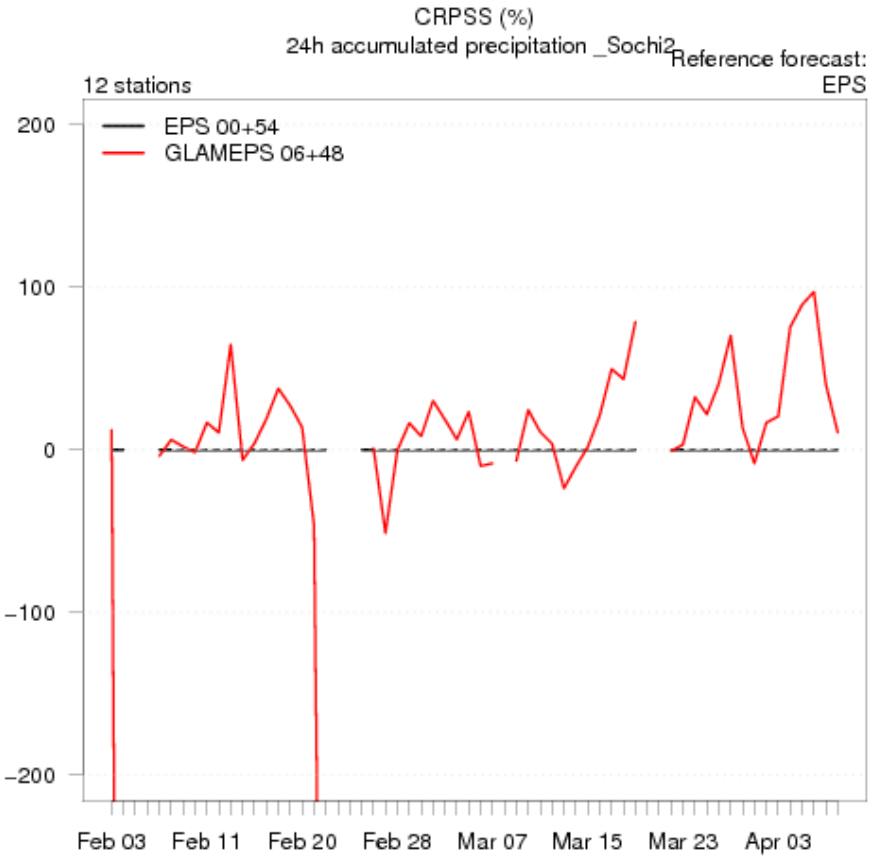
EPS _____

GLAMEPS _____

Acc 0 – 24 h



Acc 24 – 48h



SUMMARY ON PROBABILISTIC SYSTEMS and FROST-14

GLAMEPS:
- Accepted as TCF2 at ECMWF in January 2012
- Technical requirements are being dealt with (Kai Sattler)
- Soon operational
- Verification of the pre-operational GLAMEPSv0 showed clear benefit over EC EPS (Tellus 63 A, special issue)
- Verification of current version (GLAMEPSv1) for northern areas and Sochi area are promising
- Several new experiments are being run at the moment – expecting results by end of this year

HarmonEPS:
- Much technical work was needed to make Harmonie run in ensemble mode
- Even more to get it to run efficiently :)
- So far only simple experiments with pure downscaling has been carried out
- "Real" experimentation to start (hopefully) before summer

FROST-14:
- GLAMEPSv1 to be delivered before summer 2012
- Great opportunity to compare our HarmonEPS with other convection-permitting ensemble systems

Open position at the Norwegian Meteorological Institute
in developing the EPS systems – to be announced soon!

Thank you

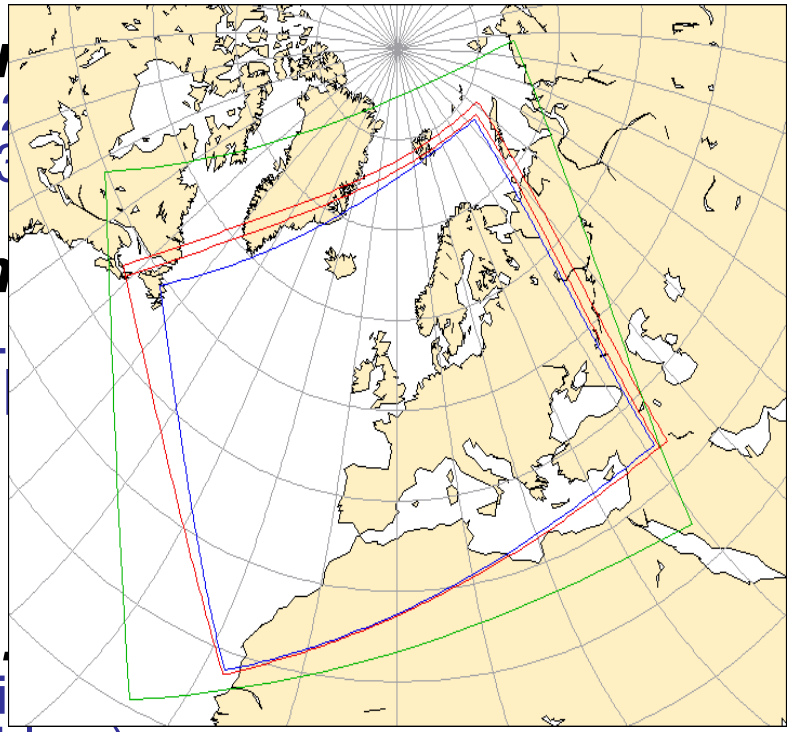
Tests with pre-operational GLAMEPS_v0 for the "synoptic" scales:

52 ensemble members; 13 per
EC EPS (12 + 1) + HirEPS_K (12
+ HirEPS_S (12+1) + AladEPS (13

·***~13km grid resolution***
(Aladin 509x416, 12.9km,L
(Hirlam 486x378, 0.115deg,

·***Forecast range: 42h***

·***Multimodel approach.***
2 versions of Hirlam (different cloud / preci
2 different LAMs (Aladin and Hirlam)
3 different analyses and control forcasts
(EC EPS_00, HirEPS_K_00, HirEPS_S_00)



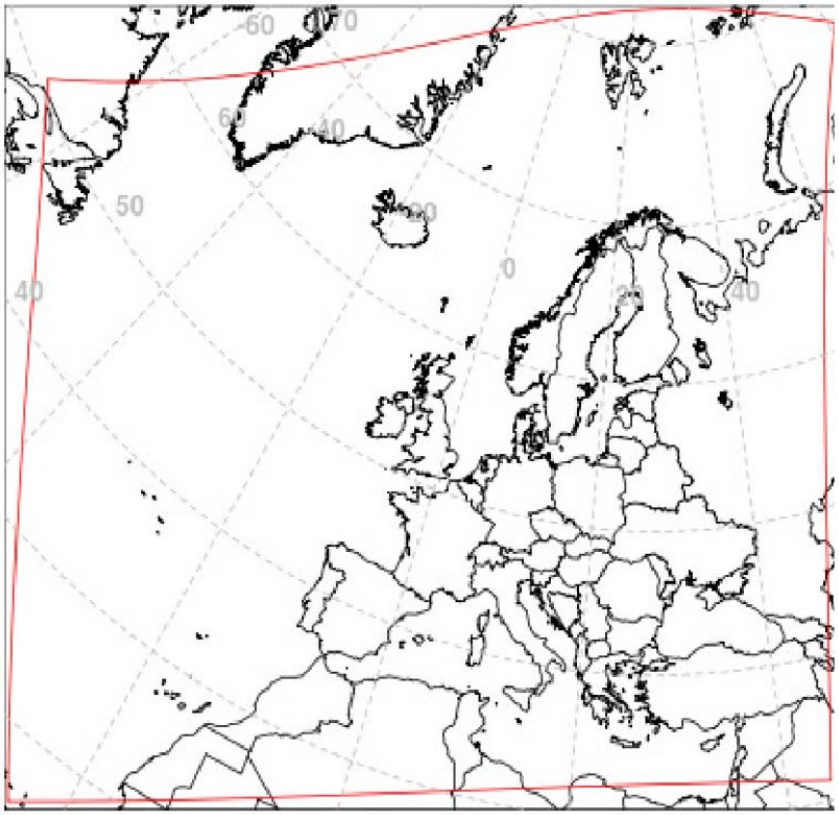
Pre-operational GLAMEPS_v1 for the "synoptic" scales:

54 ensemble members:
·EC DET (1) +
·HirEPS_S (12+1) +
·HirEPS_K (12+1) +
·AladEPS (13) +
·EC EPS (14) = 54

Forecast range: 54h

·06 and 18 UTC (EC 00 and 12 UTC)

~11 km resolution
Aladin: 629x529, 11.8 km, L37
Hirlam: 646x492, 0.10° (11,1 km), L40



Black frame: Aladin domain
Red domain: Hirlam domain and common output domain

Pre-operational GLAMEPS_v1 for the "synoptic" scales:

Multi-model approach:
2 versions of Hirlam (different cloud / precipitation schemes)
2 different LAMs (Aladin and Hirlam)
3 different analyses and control forecasts
(EC_DET, HirEPS_K_00, HirEPS_S_00)

Separate data-assimilation cycling for the ground surface for every member of the three LAMs *(obs not perturbed so resulting spread is due to different model histories)*

'stochastic physics' for the HIRLAM members (tendency perturbations)

Challenge: high-impact weather

- **High-impact weather often involves a wide spectre of scales, for which:**
  - the larger ”synoptic” scales condition the potential of occurrence
  - the smaller embeded ”meso-”scales determine the structure of the extreme features
    (peak precip. and wind; fast temp. changes; etc.).

- **Key issue: to transform the predictability on the meso-scales into skilfull and valuable predictions**
  - the large growth rate and low saturation level of small scale errors is a limiting factor for predicting high-impact weather