Danish Meteorological Institute
NWP news 2011

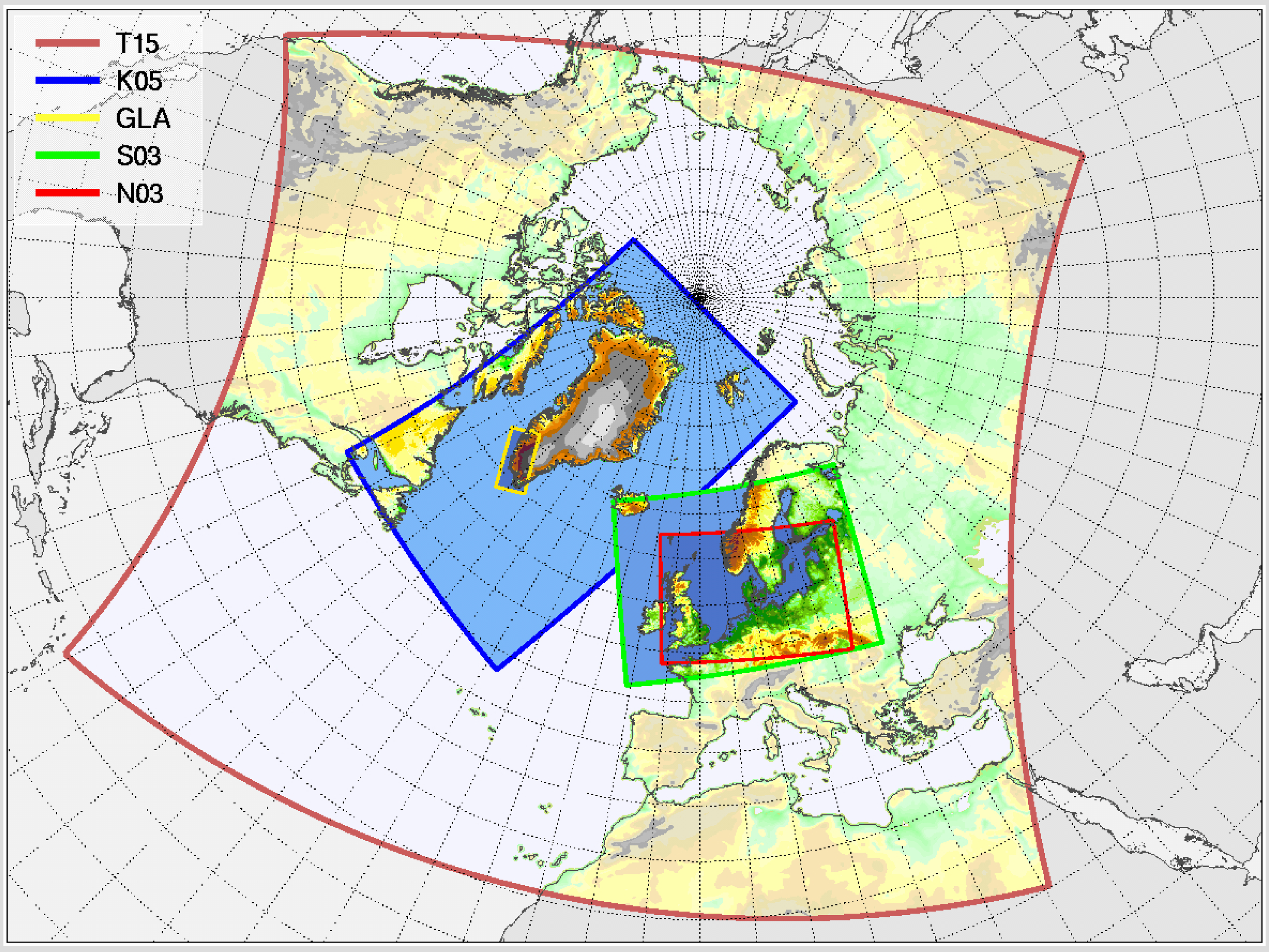

Fig . 1

	GLA	K05	S03	E05	N03
Model	Harmonie	Hirlam	Hirlam	Hirlam	Hirlam
Horizontal resol.	2km	0.05 °	0.03 °	0.05 °	0.03 °
Vertical levels	65	40	65	40	40
Boundary fields	ECMWF	ECMWF	ECMWF	ECMWF	E05
Forecast length	36 h	48 h	54 h	48 h	24 h
Run interval	6 h	6 h	6 h	6 h	1 h

Products from operational Ensemble prediction system at DMI

- Operational DMI ensemble prediction system E05 based on HIRLAM :
- In 2011 special products have been developed from the system.
- Focus on derived products which are user-oriented, with emphasis on precipitation fields, e.g. estimating risk of 15 mm/30 min (`flash-flood´ ) and `heavy precipitation´ (> 24mm /6h)

- 25 members
- Run at 5 km grid at an area similar to S03
- Run every 6 hours
- Fc-length= 48 hours
- 40 model levels

Sensitivity to
- initial conditions (5 members)
- two condensation schemes (*2)
- stochastic physics (*2)
- two surface schemes

Fig.2a

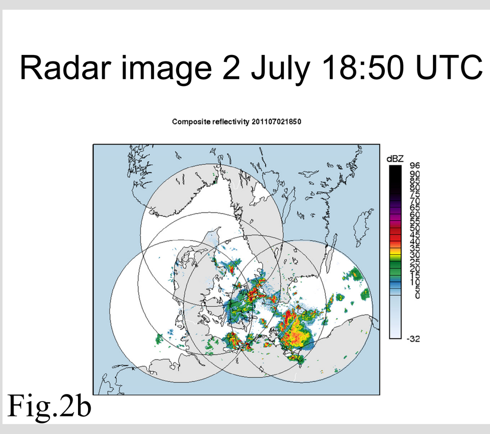

Fig.2b

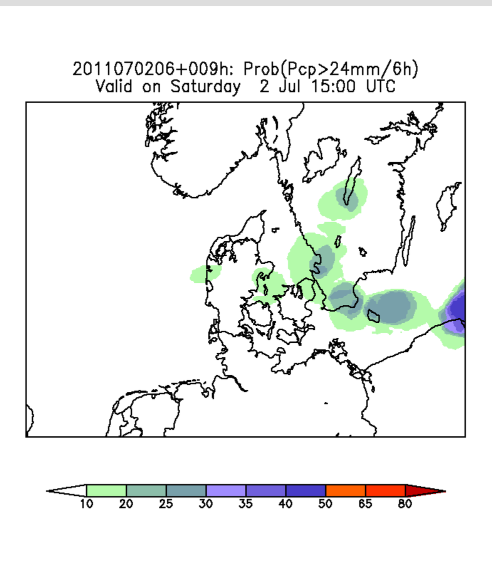

Fig.2c

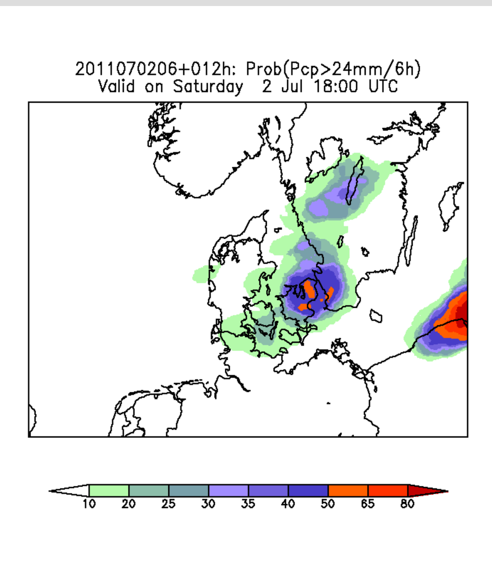

Fig.2d

Fig.2a-d: Successful `probabilities´ describing extreme rainfall on 2 July 2011 in Copenhagen and surroundings: Fig.2a shows flooding at train station outside DMI. Note the explosive development of forecast during 3 hours (Fig. 2c-d) and the observed radar image on 2 July 18:50 utc (Fig.2b)

Operational models at DMI October 2011

The model areas are shown in Fig.1:

S03 (green frame): Main deterministic model for NW-Europe with HIRLAM data-assimilation
E05: (green frame): Hirlam ensemble prediction system with 25 members
N03: (red frame): Current `nowcasting´ system running Hirlam 3D-VAR, and nudging for cloud related parameters. Detailed output for road-weather applications. No radar data assimilated yet.
GLA: (yellow frame in Greenland): High resolution Harmonie with grid size 2 km , using own surface analysis.
K05: (blue frame in Greenland): Hirlam model for Greenland.

The coarse mesh model T15 (brown frame) is still run operationally for emergency preparedness. In addition, operational birch pollen forecasting is based on Enviro-HIRLAM (model area not shown)

Plans 2012:

From 1 January 2012 the model S03 is expanded to cover the entire Scandinavia and Iceland. A Harmonie setup will be developed for an area similar to the red frame, including assimilation of both radar– and satellite information. Details about operational use of the setup in 2013 will be made by the end of 2012.

A verification scheme considering `significant´ or `extreme´ weather and upscaling principles

Definition of scheme considering 'significant' or extreme weather and upscaling principles

- A new NWP score is defined
- SWS ~'significant weather score' is constructed to show the virtues of a high resolution model compared with a competing model which will often be run at a lower resolution.
- A comparison of the two models is done on a common area.
- The potential of high resolution models to better predict extreme weather is considered by identifying sub-areas with the most extreme or significant weather at the verification time.
- The size of the sub-areas defines the degree of upscaling used to address the spatial part of the `double penalty issue´ associated with increased model resolution.

Definition of scheme considering 'significant' or extreme weather and upscaling principles

Computational scheme:

1) Define the total area over which the verification should be done. For models to be compared it has to be a common area.
2) Define an 'event' to be verified and choose a number of 'upscaling areas' associated with the event : The scheme will normally process a certain fraction of the most extreme observations over the verification area considered.
3) Define a method to identify the `significant´ (extreme) observations associated with `upscaling areas´. A natural constraint to impose is that the distance between selected observations should be long enough to imply selection of non-overlapping upscaling areas.
4) Choose a threshold distance between `observation´ (e.g. observation point) and model grid points used in the verification.
5) Compare the `observation´ with all forecast grid points within the threshold distance and compute score of the event. In the simplest form it will be either 0 or 1 (failure or success respectively)
6) Compute the 'significant weather score' SWS by updating summary statistics of the two models compared and computing the fraction between the sums.

The `significant weather´ score (SWS):

$$SWS= \left(1 + \sum_{j=1}^{K} J_{meso}\right) / \left(1 + \sum_{j=1}^{K} J_{ref}\right)$$

Conclusions and outlook

- The first results of SWS are promising showing the expected impact of increased horizontal resolution for prediction of significant weather
- Tests will be continued for much longer verification periods and involve other parameters and models.
- Operational experience comparing different models over time indicates that several weather scores of individual models tend to vary in similar ways as a consequence of changing weather conditions considered over scales of months. The SWS is expected to be less prone to weather dependent variations on these time scales because a fraction is computed between the success of the models compared.

First results

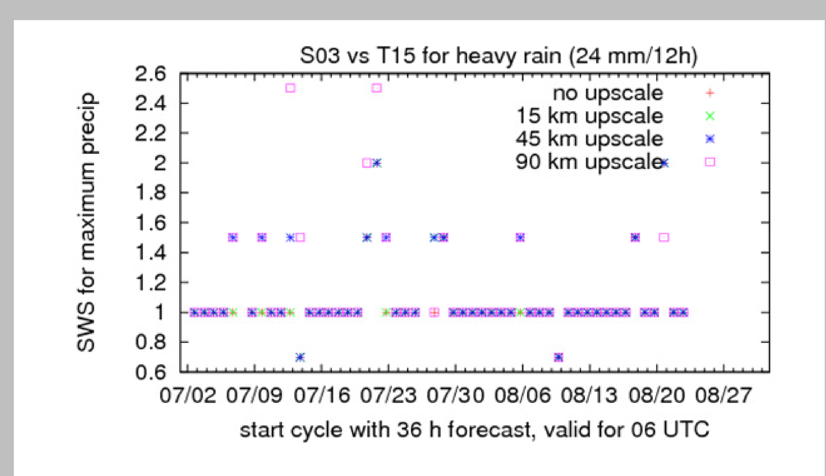

Fig.3a

First results

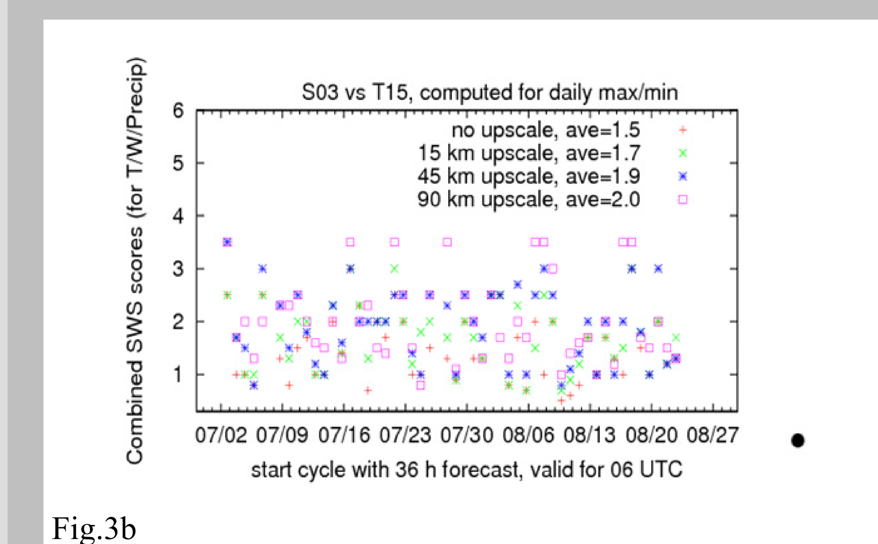

Fig.3b

Fig. 3a-b: Computing new `SWS´ in July 2011 based on the operational models S03 and T15. The scores computed for individual days are shown, respectively, for maximum precipitation (Fig.3a) and combined for 2m temperature , 10m wind and precipitation. Results are presented for different ranges of upscaling. The values are typically larger than 1 which is the result in favor of the high resolution model.

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