Review of verification activities and developments

Clive Wilson –Expert Team on diagnostics, validation & verification

32nd EWGLAM/17th SRNWP meetings – Exeter 4-7 October 2010

Contents

- Consortia activities
  - COSMO – see Marco's talk in tomorrow's session
  - Hirlam
  - Met Office – Identifying the "best" forecast see talk tomorrow
  - IMWM filters- Marek Jerczinski
- ECMWF TAC Subgroup on verification
  - SEEPS precipitation score
- SRNWP-V programme

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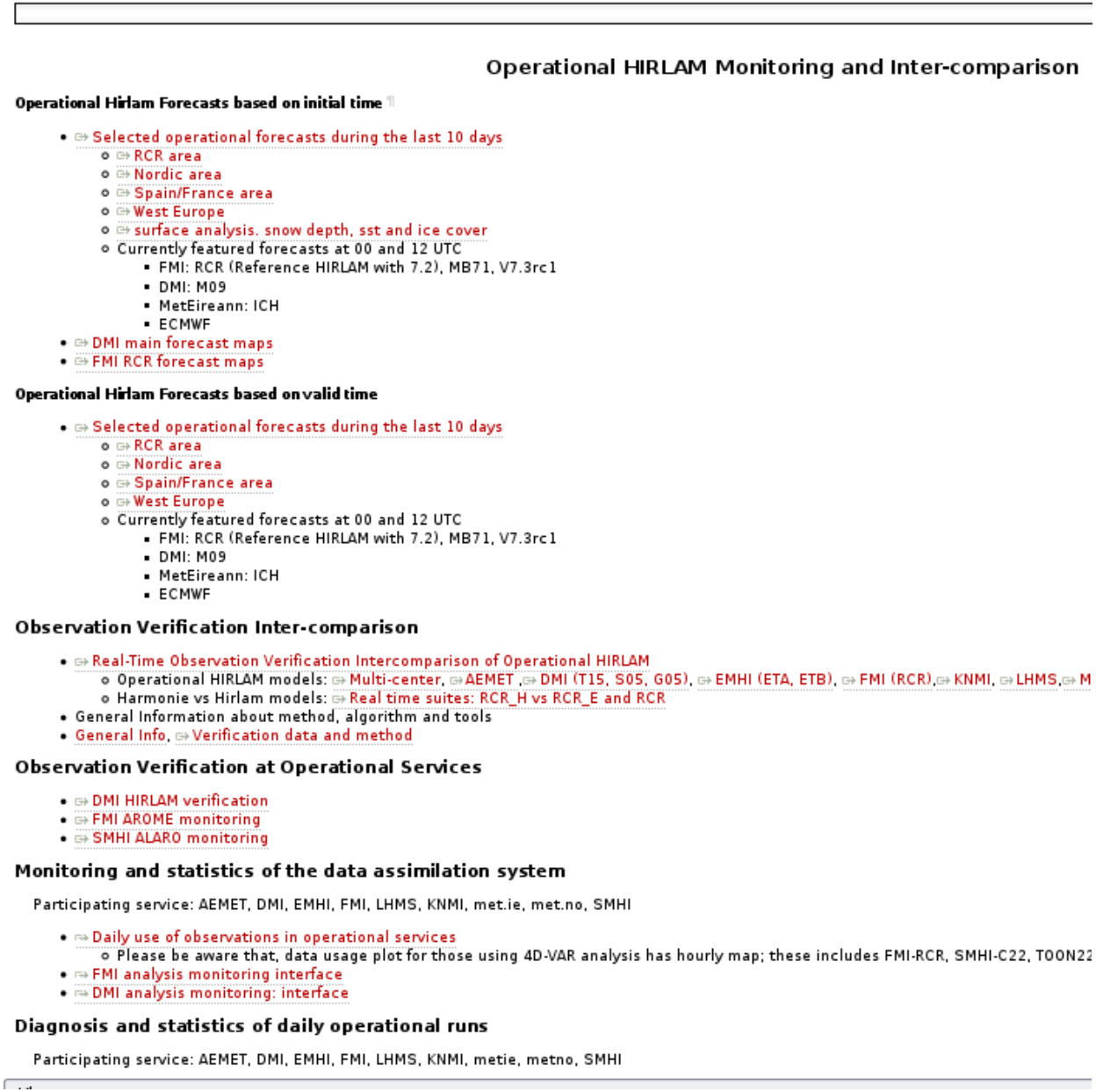
monitoring facility

- **Common tool, central collection & maintenance**
- **Monitoring data from operational & real time suites**
- **Full access to HIRLAM/ALADIN community**
- **Observation verification**
- **Monitoring and statistics of data assimilation**
- **Diagnosis and statistics of daily operational runs**
- **Mast data verification**
- **…**
- **Latest development: inter-comparison of forecast charts**



Operational HIRLAM Monitoring and Inter-comparison

Operational Hirlam Forecasts based on initial time

- Selected operational forecasts during the last 10 days
  - RCR area
  - Nordic area
  - Spain/France area
  - West Europe
  - surface analysis. snow depth, sst and ice cover
  - Currently featured forecasts at 00 and 12 UTC
    - FMI: RCR (Reference HIRLAM with 7.2), MB71, V7.3rc1
    - DMI: M09
    - MetEireann: ICH
    - ECMWF
- DMI main forecast maps
- FMI RCR forecast maps

Operational Hirlam Forecasts based on valid time

- Selected operational forecasts during the last 10 days
  - RCR area
  - Nordic area
  - Spain/France area
  - West Europe
  - Currently featured forecasts at 00 and 12 UTC
    - FMI: RCR (Reference HIRLAM with 7.2), MB71, V7.3rc1
    - DMI: M09
    - MetEireann: ICH
    - ECMWF

Observation Verification Inter-comparison

- Real-Time Observation Verification Intercomparison of Operational HIRLAM
  - Operational HIRLAM models: Multi-center, AEMET , DMI (T15, S05, G05), EMHI (ETA, ETB), FMI (RCR), KNMI, LHMS, M
  - Harmonie vs Hirlam models: Real time suites: RCR_H vs RCR_E and RCR
- General Information about method, algorithm and tools
- General Info, Verification data and method

Observation Verification at Operational Services

- DMI HIRLAM verification
- FMI AROME monitoring
- SMHI ALARO monitoring

Monitoring and statistics of the data assimilation system

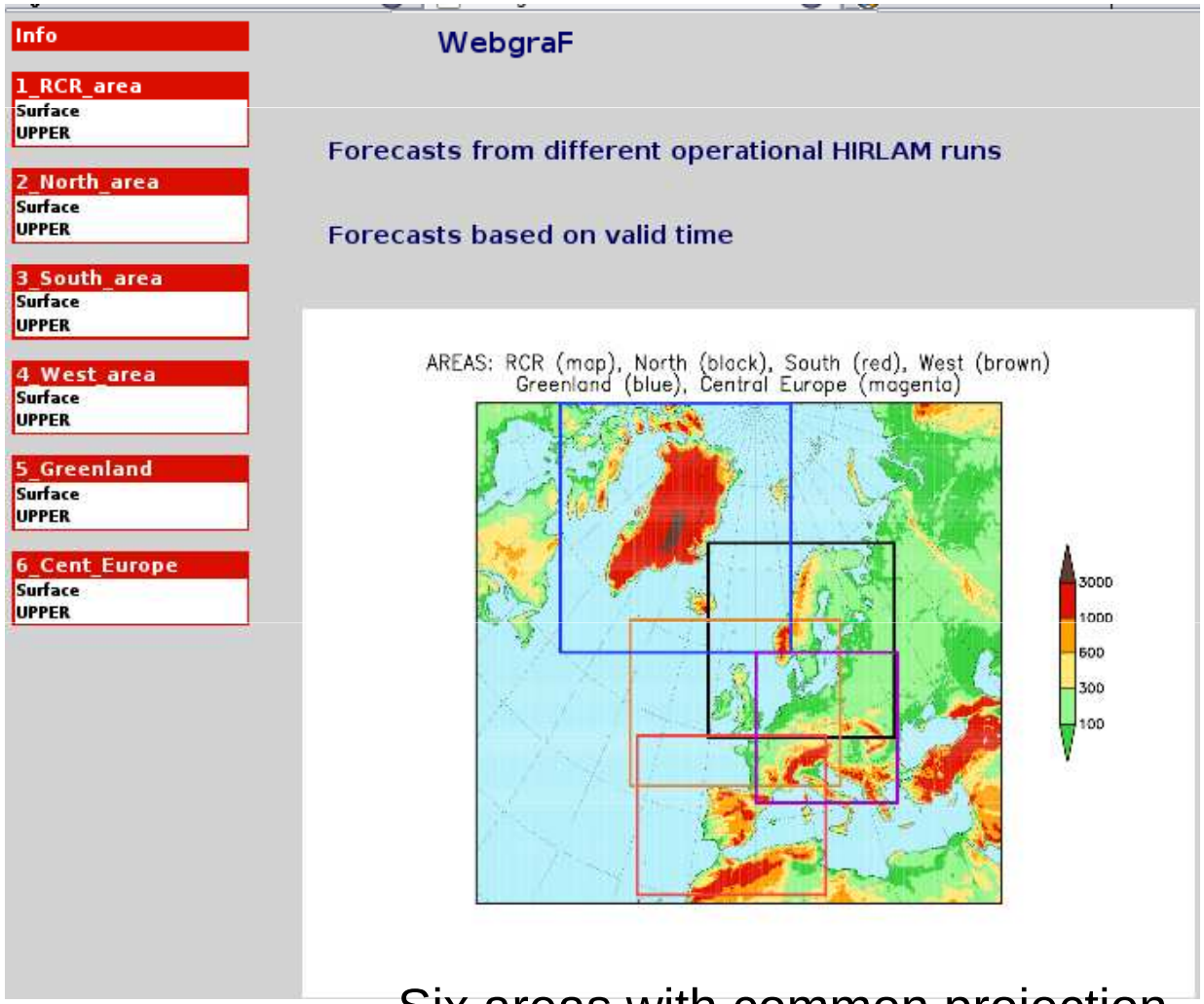
Participating service: AEMET, DMI, EMHI, FMI, LHMS, KNMI, met.ie, met.no, SMHI

- Daily use of observations in operational services
  - Please be aware that, data usage plot for those using 4D-VAR analysis has hourly map; these includes FMI-RCR, SMHI-C22, TOON22
- FMI analysis monitoring interface
- DMI analysis monitoring: interface

Diagnosis and statistics of daily operational runs

Participating service: AEMET, DMI, EMHI, FMI, LHMS, KNMI, metie, metno, SMHI

Chart inter-comparison:

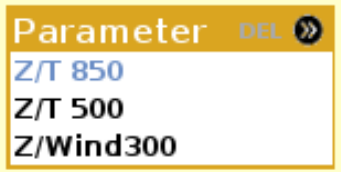


Six areas with common projection

11+ suites:

9 surface fields:

3 upper air fields:



../2_North_area

Surface

Experiment

MB71(FMI
RCRa(FMI)
V73rc1(FMI)
Trunk(ECMWF)
trunk201006
M09(DMI)
I15(METIE)
ECMWF

Parameter

T at 2m (C)
Clous Z700
Ps, V10m
V10 Streamlines
Ps Prec Int
Ps V10 speed
Ps Gust Speed
Eq. Pot.Temp.
PBL height

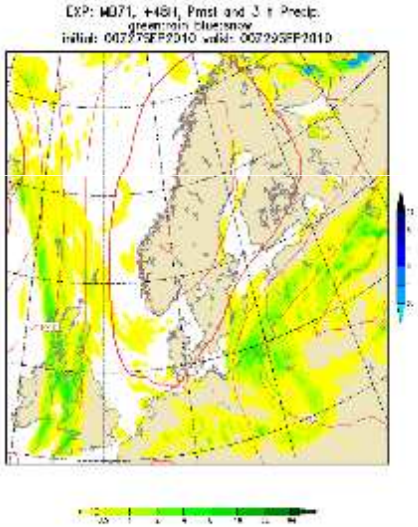
Help

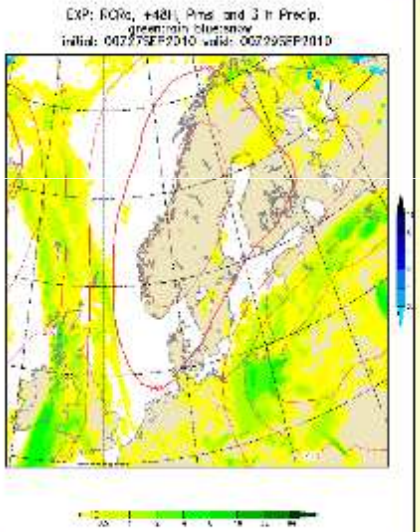
Resize

Forecast Charts based on Valid Time

Valid time: 2010092900 | Lead time: +4 | All | Save | Clear | ECMWF;Ps Prec Int;2010092900;+4

Surface charts from different operational HIRLAM models





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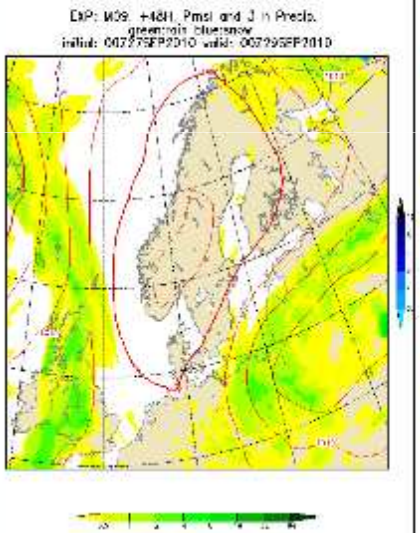

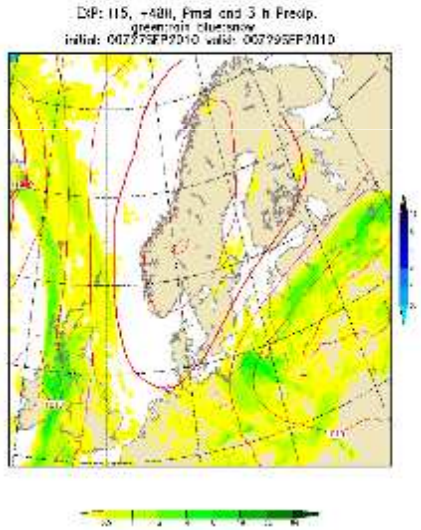

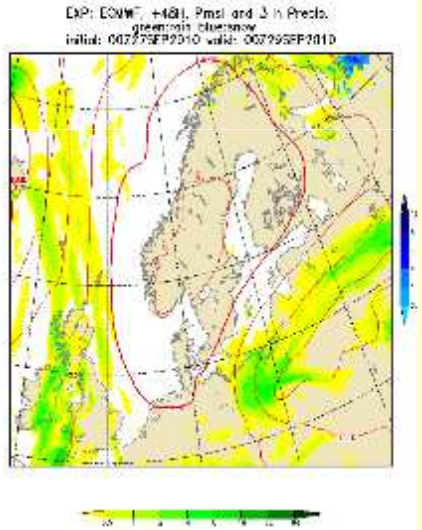

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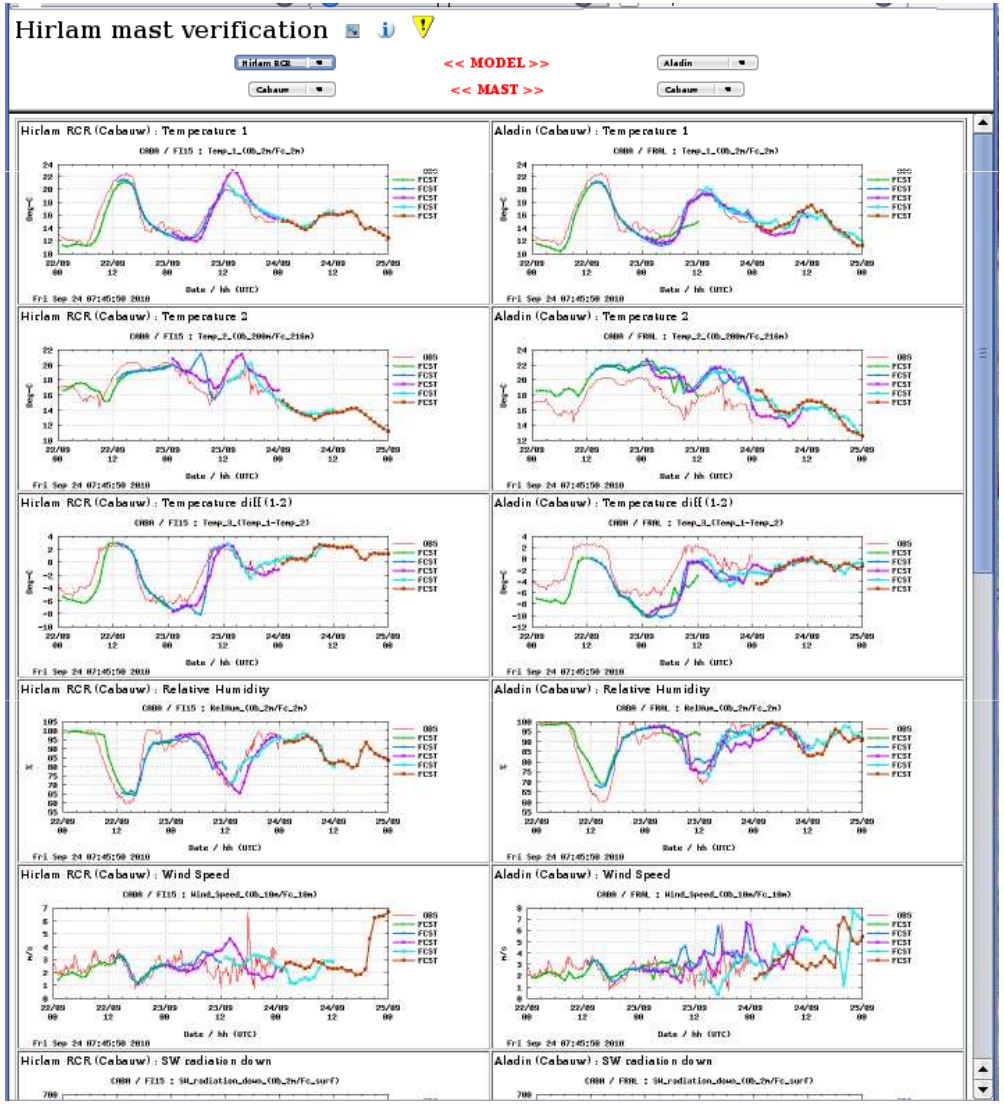
On-line mast intercomparison facility

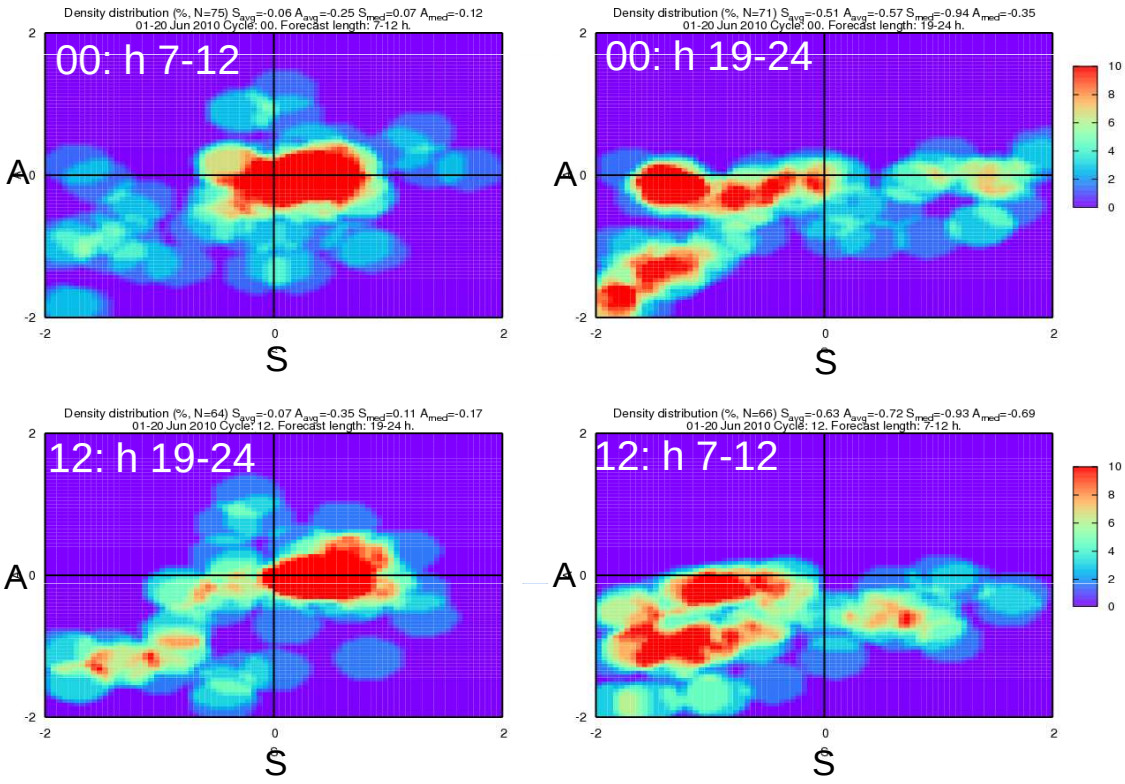
- **Forecast verification in real-time**
  - http://fminwp.fmi.fi/mastverifnew (password protected)
- **Towers and masts**
  - Sodankylä, Cabauw, Valladolid, Lindenberg, Kivenlahti, Kuopio, Rovaniemi
- **Models**
  - HIRLAM, AROME, ALADIN, ARPEGE, IFS (latest)
- **Parameters**
  - Screen temperature and relative humidity, 10-m wind speed, T at lowest model level
  - Surface radiative and turbulent heat fluxes
  - Surface momentum flux
- **Participation**
  - More mast and model data welcome!
  - Contact: Markku.Kangas at fmi.fi



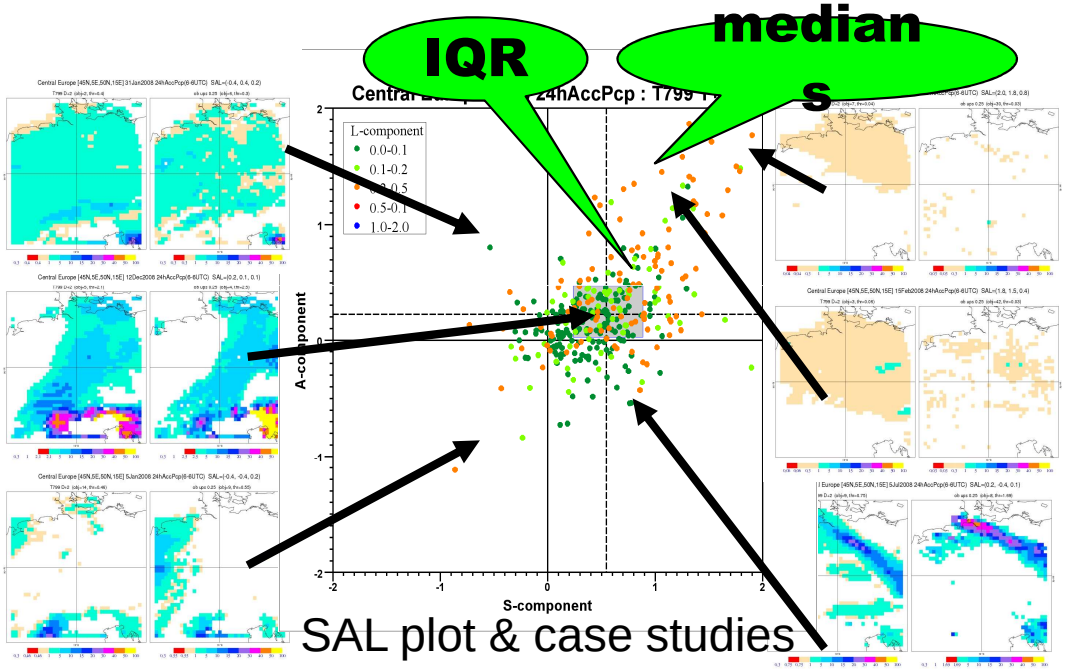
Obs. verification example:

- **SAL verification of simulated vs. observed radar reflectivity**
- **FMI AROME**
  - June 2010
  - Southern Finland
  - AROME cy33h1, 2.5 km/L40
- **Diurnal variation in SAL:**
  - Afternoon patterns too weak in amplitude and too small or too peaked (”missing events”)
  - Morning patterns slightly large or flat
- **Latest: gauge data (C. Santos, AEMET)**

Morning (4-9 am LT) Afternoon (4-9 pm LT)



SAL work AEMET-ECMWF



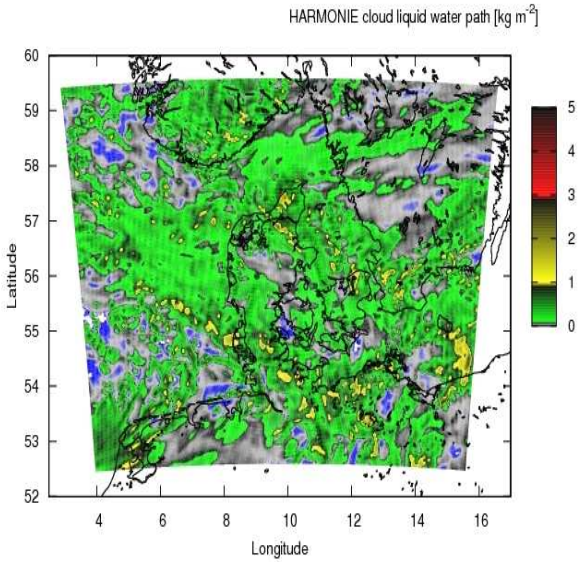
SAL plot & case studies

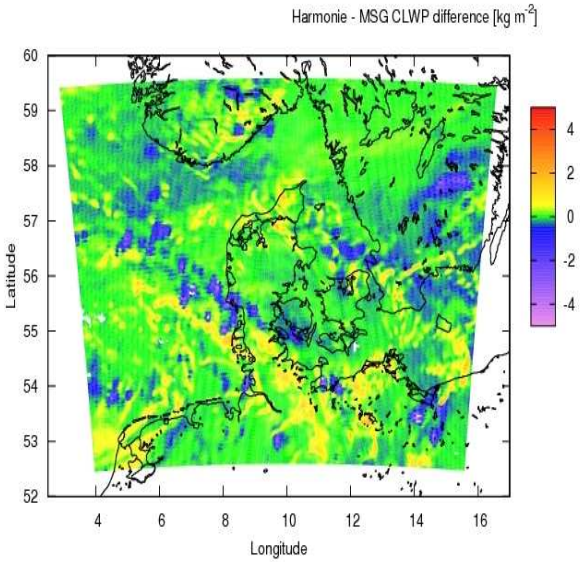
- SAL є Object-oriented
  - Wernli and Paulat, 2004
  - avoid classical verification problems (e.g. Double Penalty)
  - quantitative & detailed information
  - different aspects QPF performance
- Compare mod-obs
  - Up-scale pcp obs field
  - Objects ← simple algorithm
- Components (0=perfect) → SAL plot
  - Structure X [-2,2]
  - Amplitude Y [-2,2]
  - Location color [0,2]

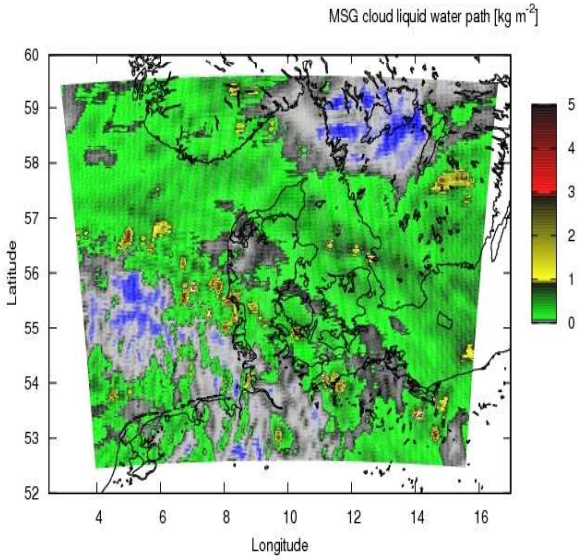
- Development
  - F77 code provided by Paulat and Zimmer (DWD)
  - F95 code by Guerrero & Santos (AEMET)
- Studies
  - AEMET: 2009 Spain; HIRLAM (5km), HIRLAM (16km), T799 (25km)
  - AEMET-ECMWF collaboration (A. Ghelli): 2008 Central Europe; T799 (25km), T399 cf (50km)
- Results look promising
  - Fair assessment for higher-resolution models

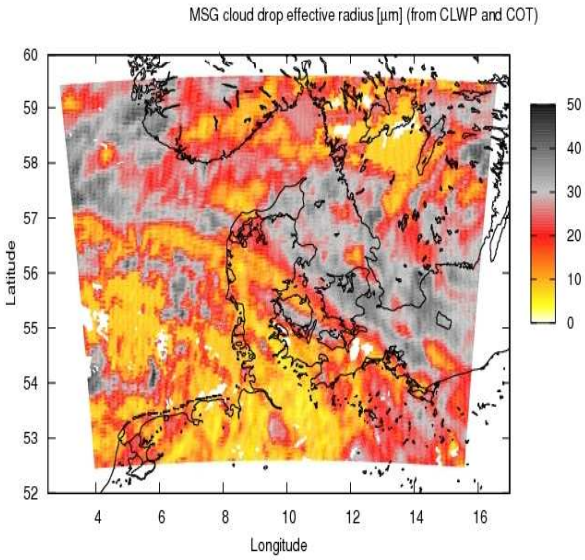
Comparison of model vs satellite retrieval

- **DMI (K. P. Nielsen): comparison on cloud physical property**
- **Total cloud condensate**
  - Upper left: HARMONIE
  - Lower left: MSG
  - Upper right: difference
  - Lower right: MSG effective cloud drop radii









2-D ICWM Filters

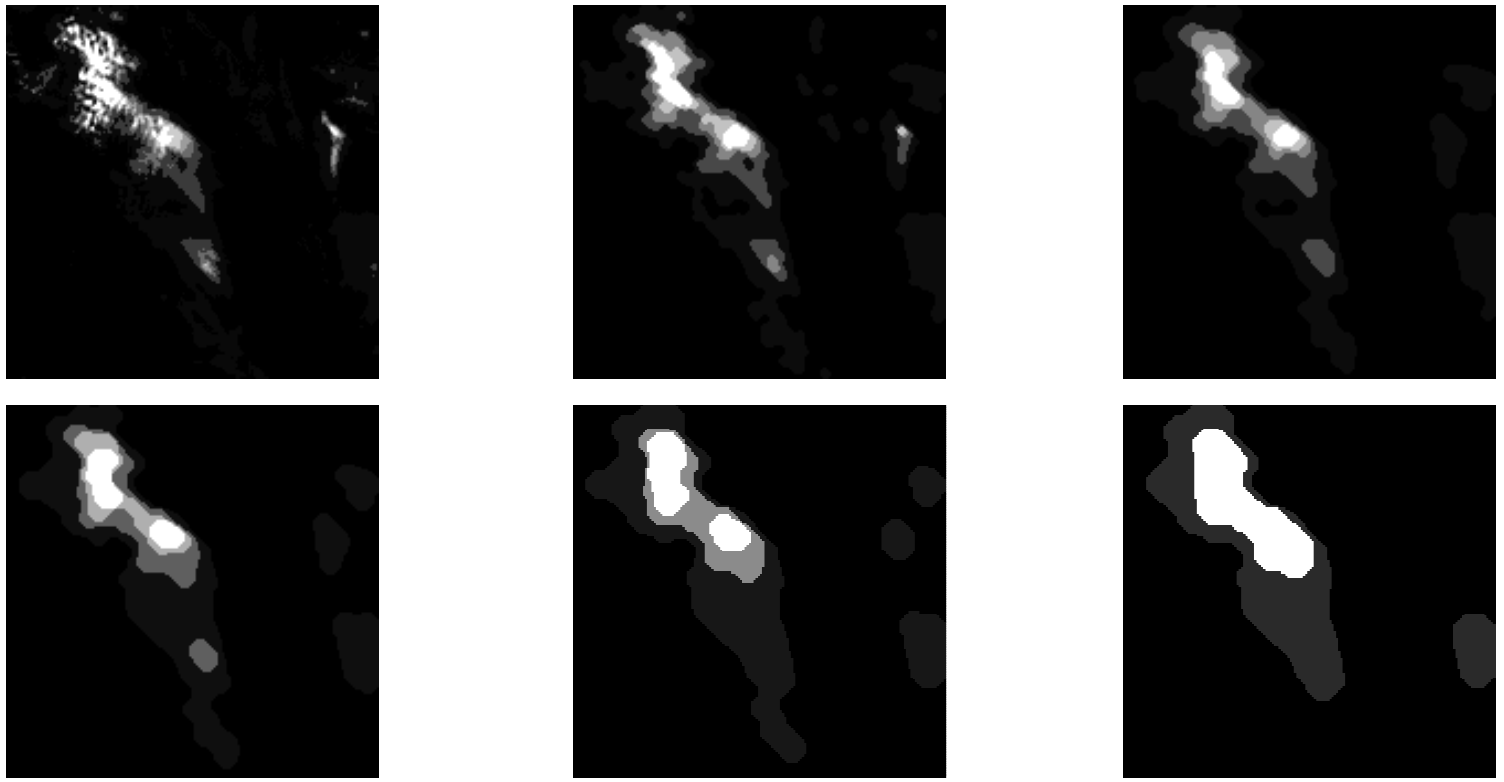
Marek Jerczynski

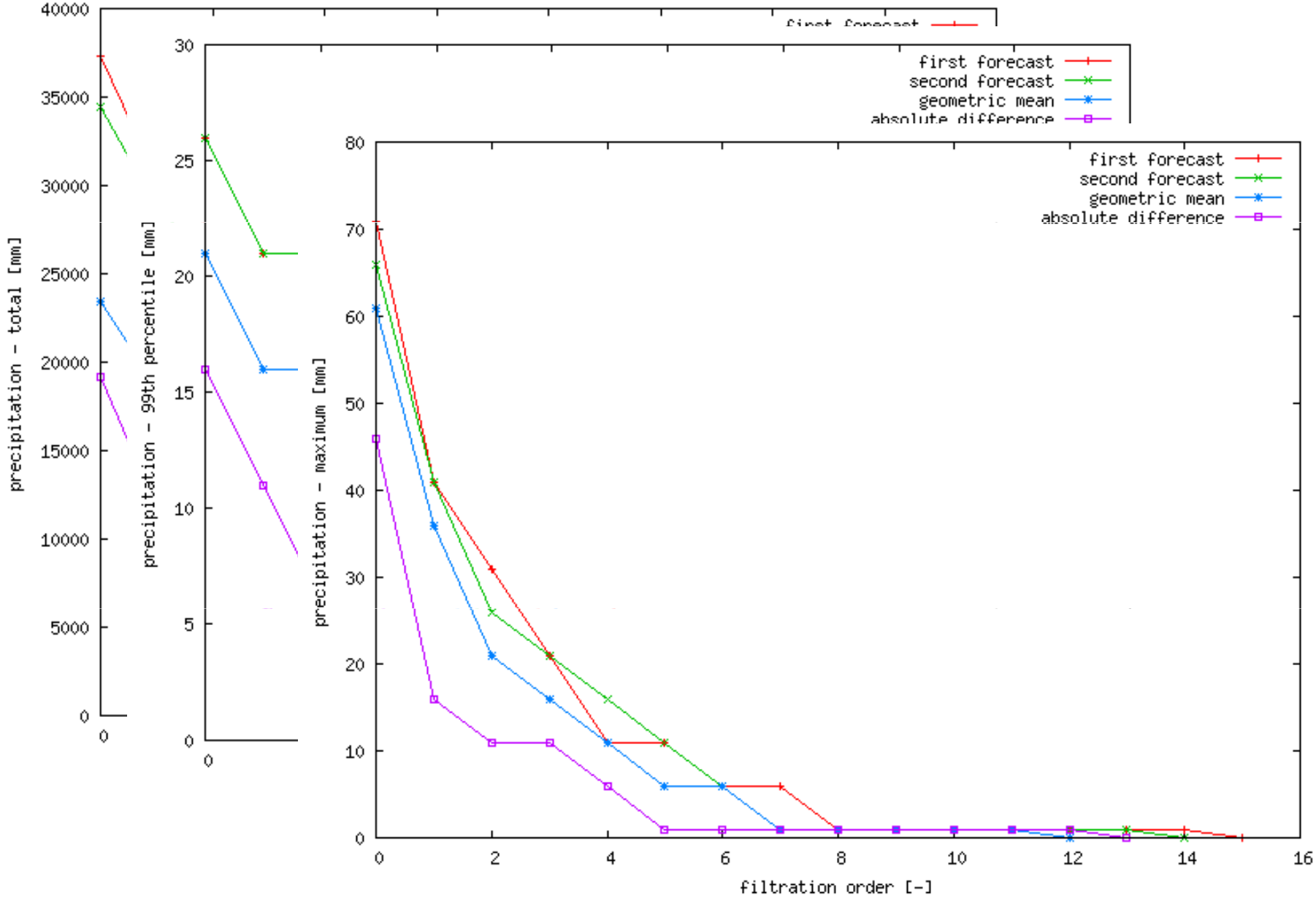
- Scale-separation tool for non - smooth meteorological fields on regular grids
  - filters: Iterative Four - Directional Composite Weighted Median Filters.
- 2-D ICWM filters
  - superpositions of 1-D weighted median filters
  - different sizes & weights in iterative smoothing in consecutive directions
  - Such 2-D filters have interesting features
    - robustness and idempotence

Precipitation field filtering

2 - D ICWM filter with two-parameter

- images are normalized
- precipitation boundary well preserved




precipitation - total [mm]
precipitation - 99th percentile [mm]
precipitation - maximum [mm]
filtration order [-]
first forecast
second forecast
geometric mean
absolute difference

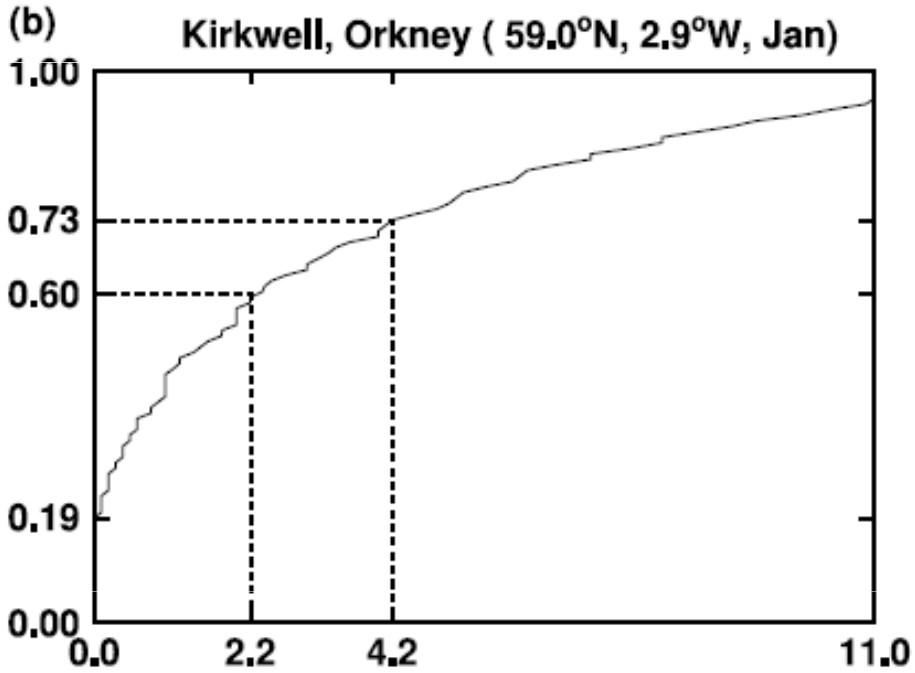
ECMWF TAC subgroup on verification- final recommendations for headline measures

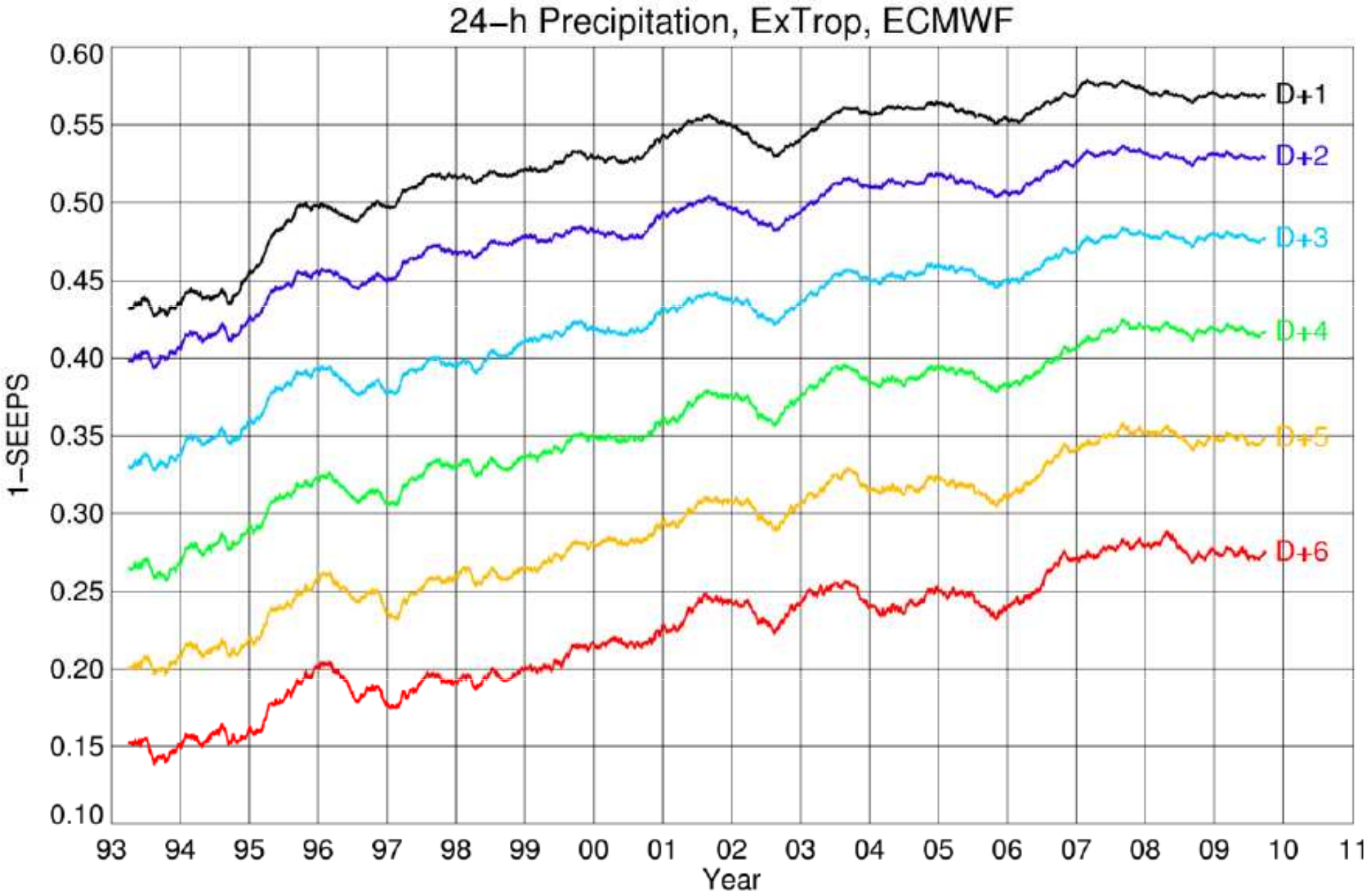
- 500hPA ACC (deterministic) and 850Temp CRPSS (EPS)
  - against analyses , extra-tropics, new climatology (ERA-I 1989-2008)
- Recommends 4 subsidiary scores
  - SEEPS 24h precipitation extra-tropics (deterministic)
  - Tropical cyclone position error (deterministic)
  - EFI 10m wind (EPS)
  - CRPSS for daily precipitation extra-tropics (EPS)

SEEPS=Stable Equitable Error in Probability Space

Rodwell et al, 2010, QJRMS 136

- Dry, light , heavy based on observed climatology (24h) at station – p_1 , p_2 , p_3
- Contingency table probabilities based on these categories
- Scoring matrix – stable, equitable
    - SEEPS=0 (perfect) , =1 (no skill - , eg constant)
- Now applying to 6h accumulations in SRNWP-V
    - 6h climatology (courtesy Mark Rodwell)




24–h Precipitation, ExTrop, ECMWF
1–SEEPS
0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
93
94
95
96
97
98
99
00
01
02
03
04
05
06
07
08
09
10
11
Year
D+1
D+2
D+3
D+4
D+5
D+6

SRNWP-V Programme