



GOBIERNO  
DE ESPAÑA

MINISTERIO  
DE AGRICULTURA, ALIMENTACIÓN  
Y MEDIO AMBIENTE



# **SLAF implementation in HarmonEPS: First results**

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**(Special thanks to Ulf)**

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# Introduction

## SLAF – Scaled Lagged Average Forecast

- Perturbations at boundaries is one main issue of LAM ensembles.
- Not many different methods have been examined in the literature.
- Due to small domains the influence of boundaries in mesoscale LAMs (and mesoscale LAM EPS) is moving quickly to the interest area of the domain.
- Downscaling lower resolution global ensembles is the most common method used.

# Downscaling global EPS

- Global EPS don't have spread enough in the short term.
- Lot of communication to get full model level data from the global EPS at home.
- Long delay to wait for Global EPS available for BCs.

# SLAF

- Cheap method based in the deterministic global model.
- Good representation of the errors of the day based in deviations of past operational runs.
- Very few communication to get full model level data from the global deterministic model at home.
- Less delay to wait for BCs (better availability).
- Good possibility of several different global models for BCs (multiboundaries).

# SLAF II

- $SLAF = FC_{REF} \pm \sum_{HH} K_{HH} \cdot (FC_{REF} - FC_{HH})$ ,  $K_{HH} = ctes$
- Testing different delays:
  - FCHH from 06, 12, 18 and 24
  - FCHH from 12, 24, 36 and 48
- Testing different values of K:
  - 0.25, 0.50, 0.75 and 1.00
  - 1.75, 1.50, 1.25 and 1.00
  - 1.50, 1.00, 0.75 and 0.50
- Tests Periods (Martin Leutbecher):
  - 2011102312 - 2011110718 — FCINT = 6 / LL = 36
  - 2012061000 - 2012062818 — FCINT = 6 / LL = 36
- Comparison with downscaling ECMWF EPS

# Experiments

- Good implementation in HarmonEPS (thanks to Ulf)
- Domain IBERIA\_2.5 - Physics AROME - 9 members (8 + control)
- Pure downscaling: ANAATMO=none - ANASURF=none
- Experiments:
  - **H2538H11** – Downscaling High Resolution ECMWF EPS (Det. Model resolution)
  - **L2538H11** – Downscaling Low Resolution ECMWF EPS (Opr EPS resolution)
  - **S2538H11** –
    - 'SLAFLAG' => [ 0, 6, 6, 12, 12, 18, 18, 24, 24] ,
    - 'SLAFK' => ['0.0','0.25','-0.25','0.50','-0.50','0.75','-0.75','1.0','-1.0'],
  - **S3538H11** -
    - 'SLAFLAG' => [ 0, 6, 6, 12, 12, 18, 18, 24, 24] ,
    - 'SLAFK' => ['0.0','1.75','-1.75','1.50','-1.50','1.25','-1.25','1.0','-1.0'],
  - **S4828H11** –
    - 'SLAFLAG' => [ 0, 12, 12, 24, 24, 36, 36, 48, 48] ,
    - 'SLAFK' => ['0.0','1.5','-1.5','1.0','-1.0','0.75','-0.75','0.5','-0.5'],

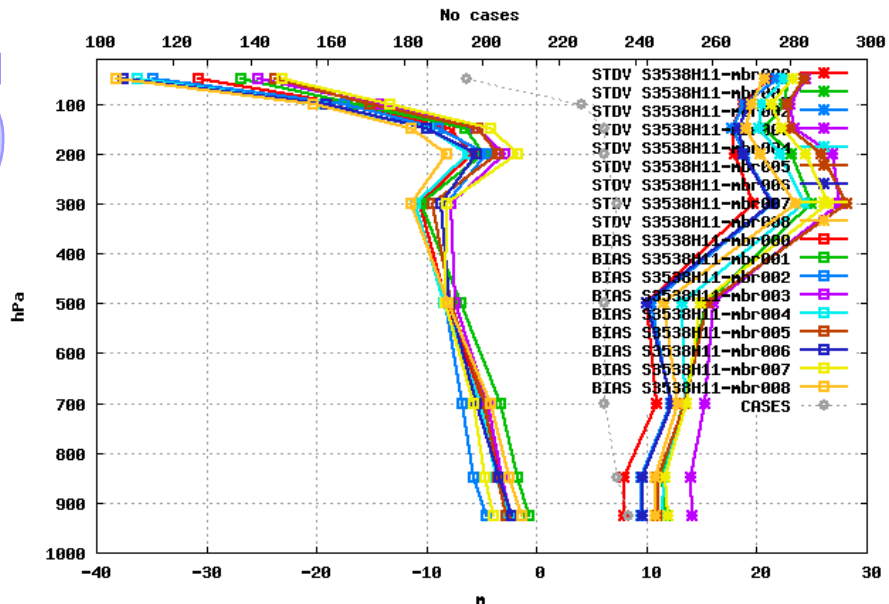
# Exercise goals

- Objective verification against observations:
  - To show the skill of the different members of each ensemble.
  - To compare with the skill of the downscaling ensembles.
    - Bias and RMSE surface and upper air
- Probabilistic verification against observations:
  - Rank Histograms.
  - Spread-skill of the ensemble.
  - Reliability diagrams.

# Results Det - GPROF

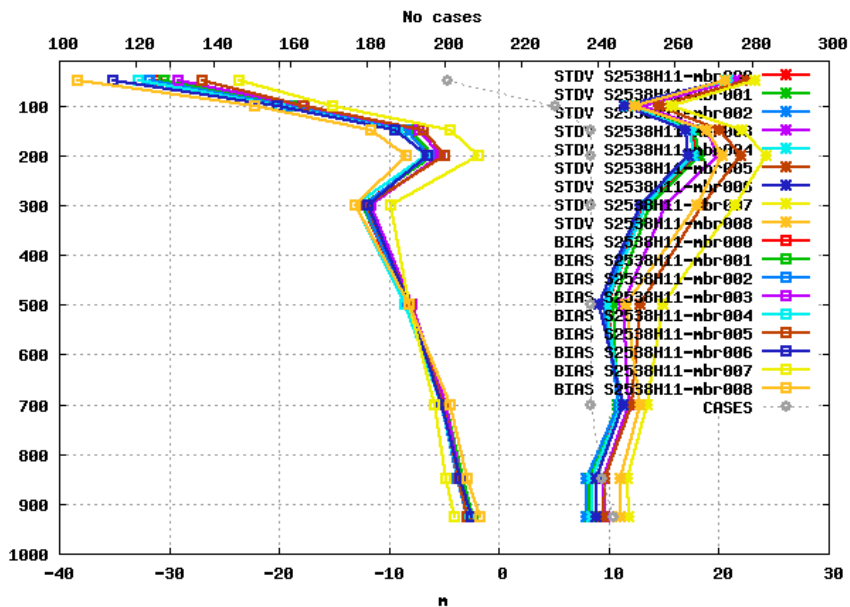
6 stations Selection: ALL  
 Height Period: 20111023-20111107  
 Statistics at 00 UTC Used {00,12} + 12 24 36

S35



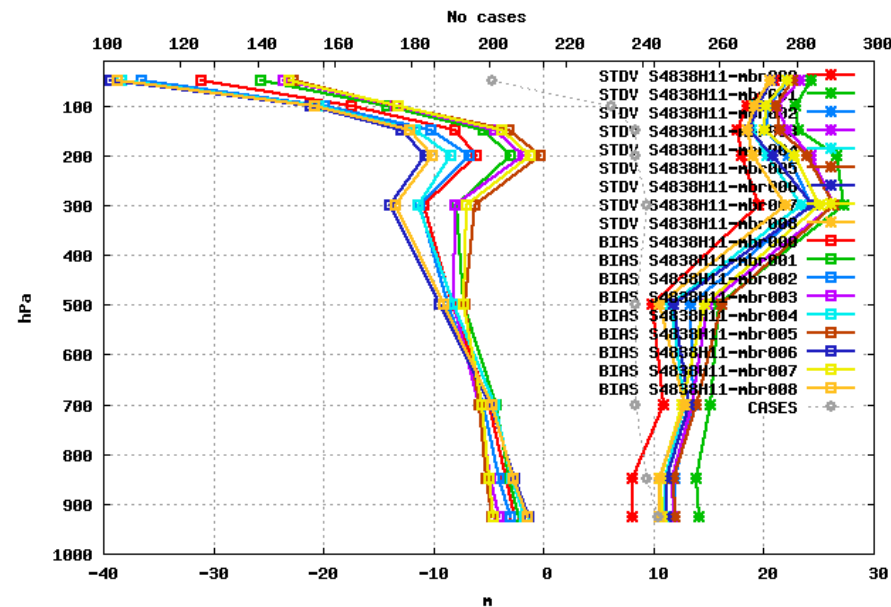
S25

6 stations Selection: I  
 Height Period: 20111023-20111107  
 Statistics at 00 UTC Used {00,12}



S48

6 stations Selection: ALL  
 Height Period: 20111023-20111107  
 Statistics at 00 UTC Used {00,12} + 12 24 36

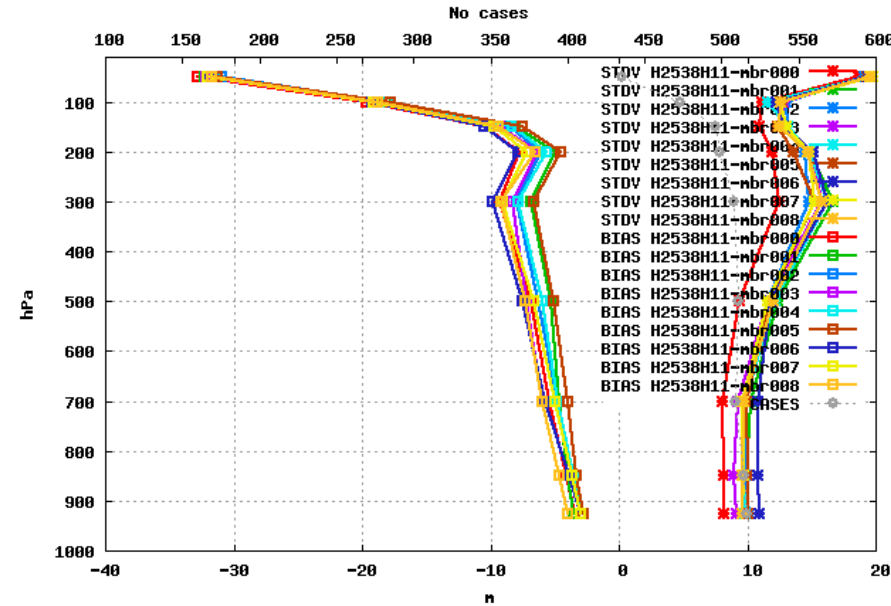
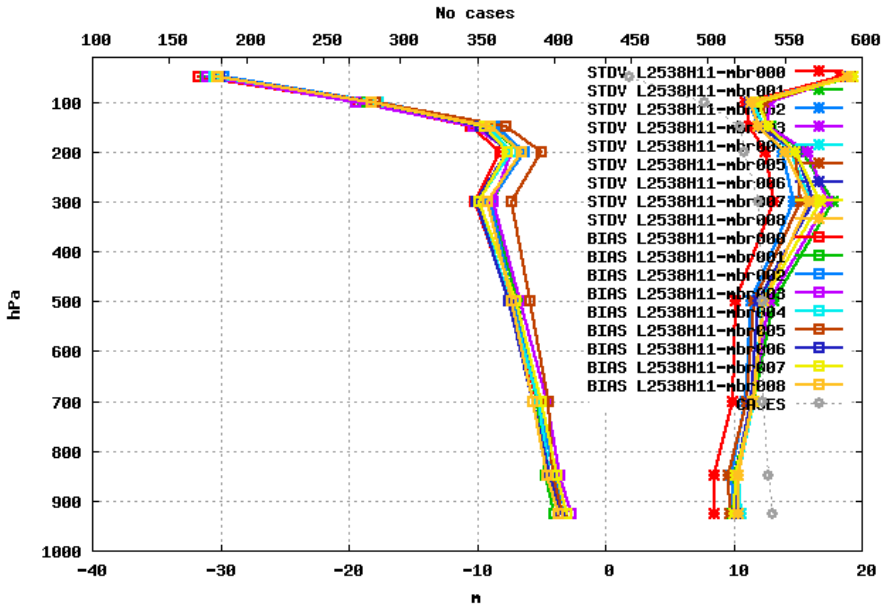




# Results Det - GPROF

6 stations Selection: ALL  
 Height Period: 2011023-20120628  
 Statistics at 00 UTC Used {00,12} + 12 24 36

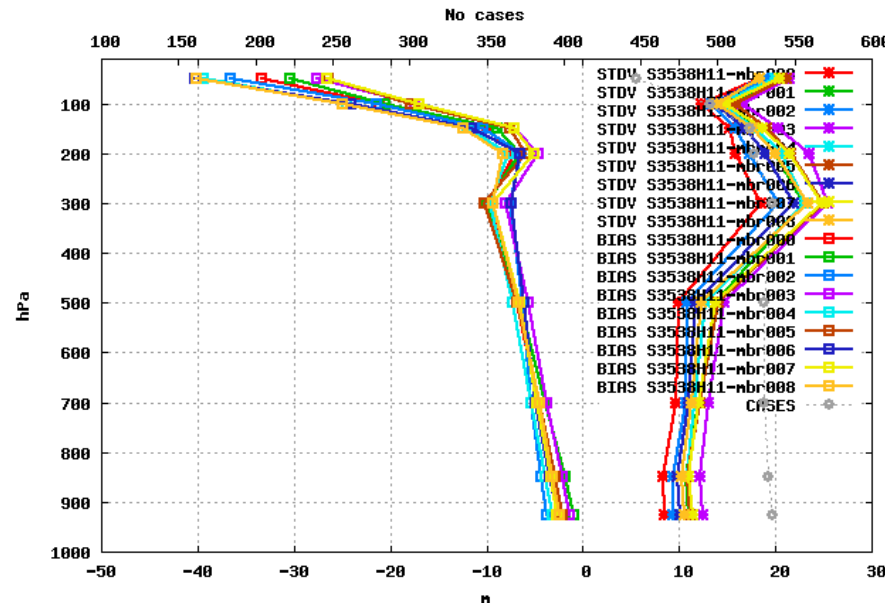
6 stations Selection: ALL  
 Height Period: 2011023-20120628  
 Statistics at 00 UTC Used {00,12} + 12 24 36



L25

H25

S35



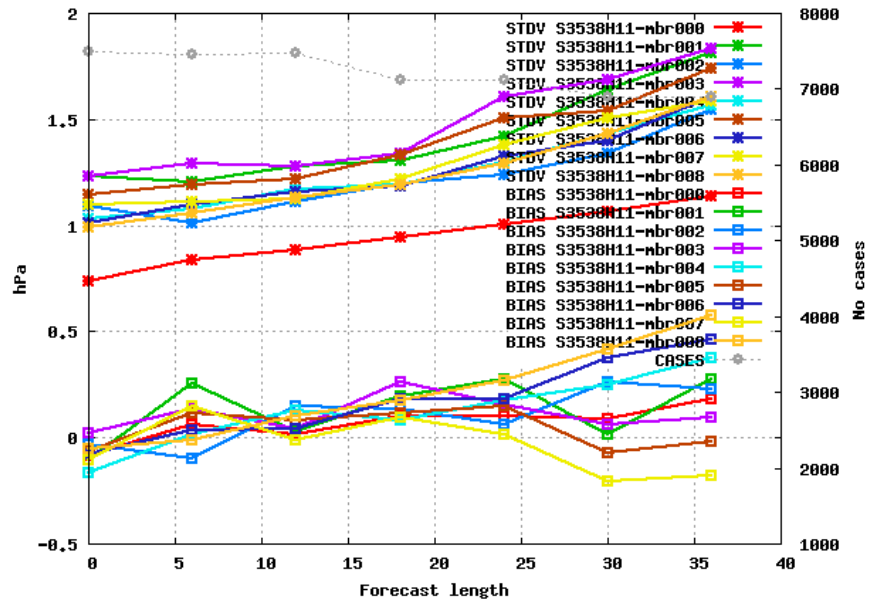
# Results Det - MSLP

Selection: ALL using 140 stations  
 Mslp Period: 20111023-20111107  
 Hours: {00,06,12,18}

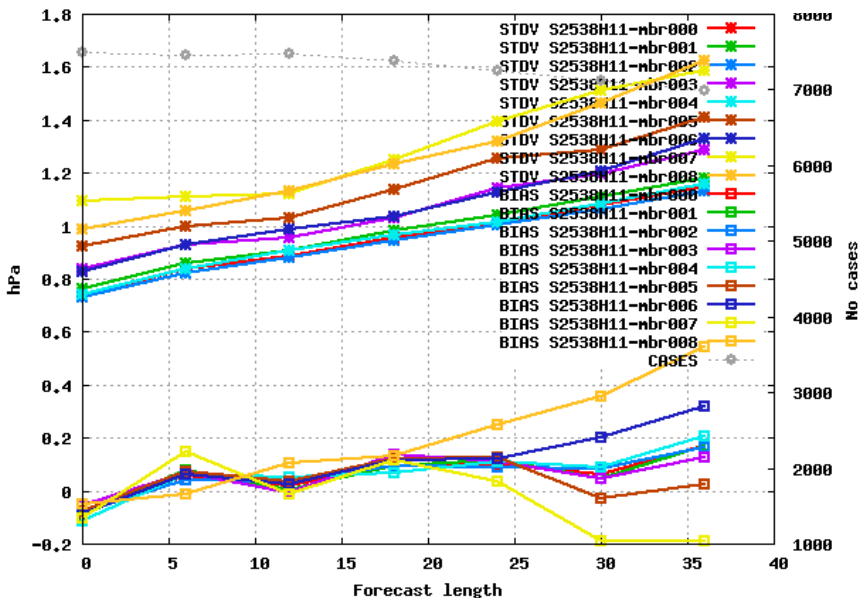
S35

S25

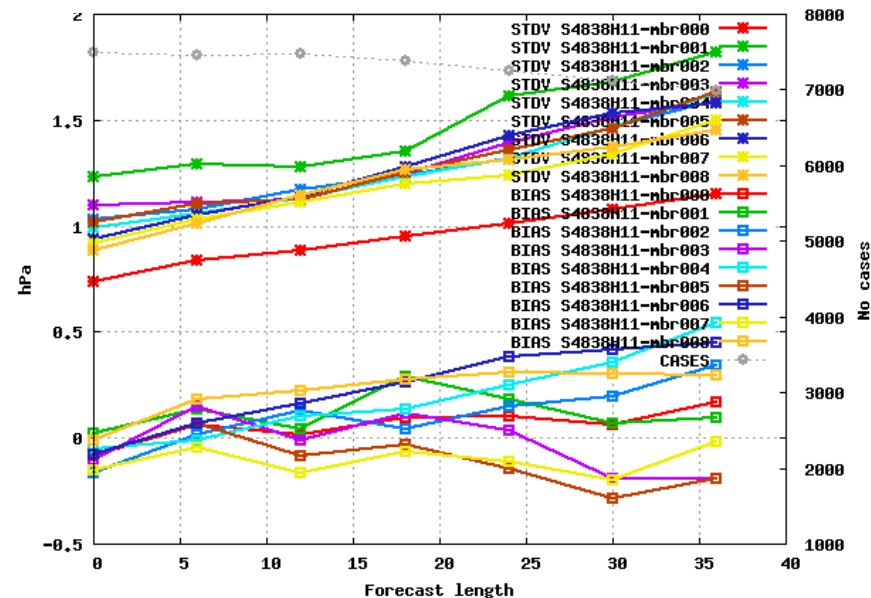
S48



ALL using 140 stations  
 period: 20111023-20111107  
 hrs: {00,06,12,18}

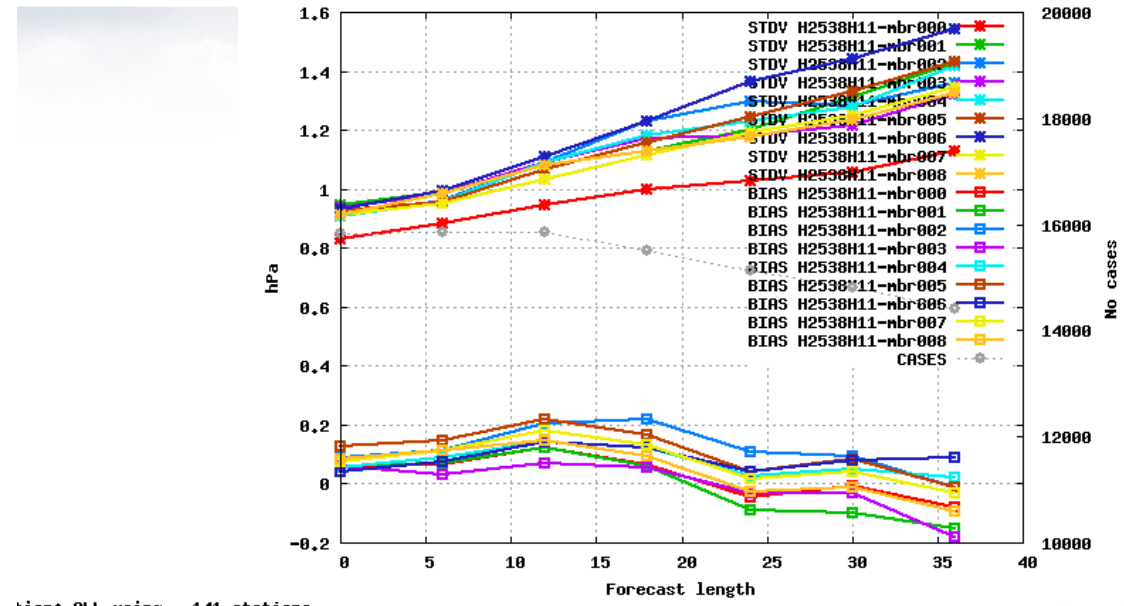
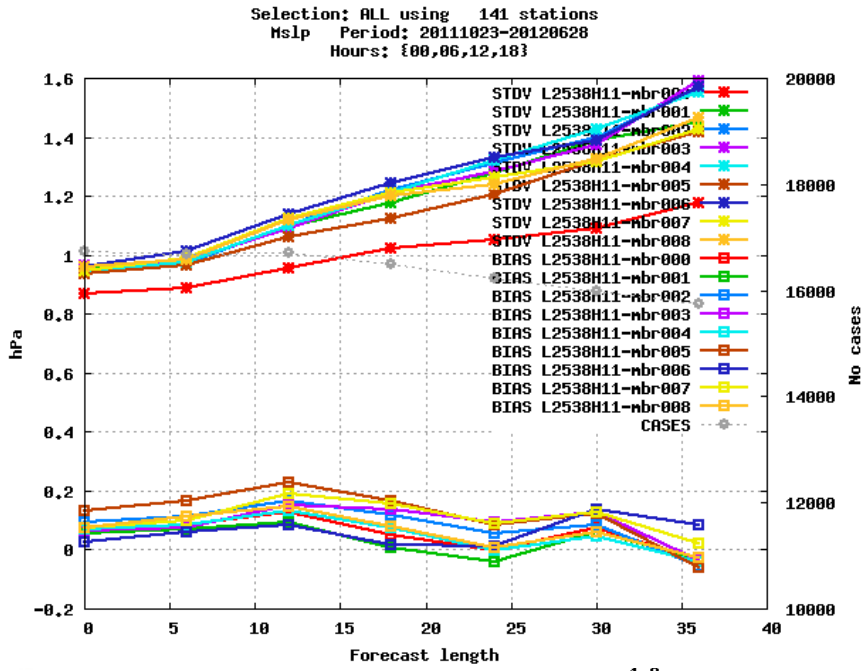


Forecast length



# Results Det – MSLP

Selection: ALL using 141 stations  
 Mslp Period: 20111023-20120628  
 Hours: {00,06,12,18}

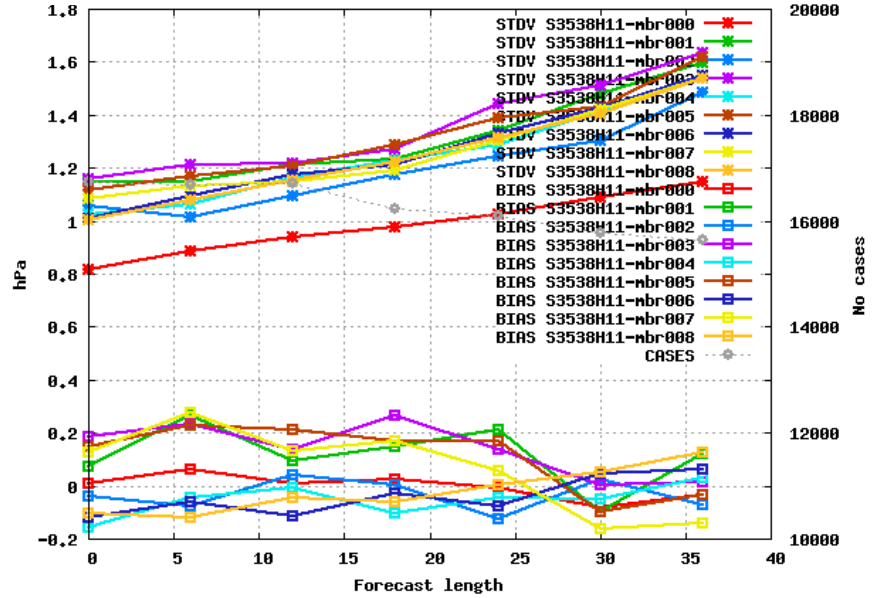


Selection: ALL using 141 stations  
 Mslp Period: 20111023-20120628  
 Hours: {00,06,12,18}

L25

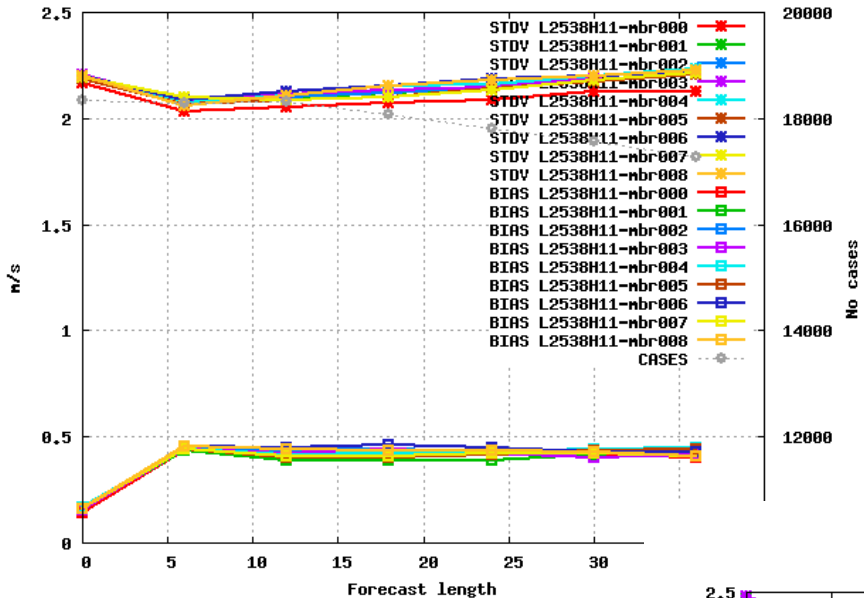
H25

S35

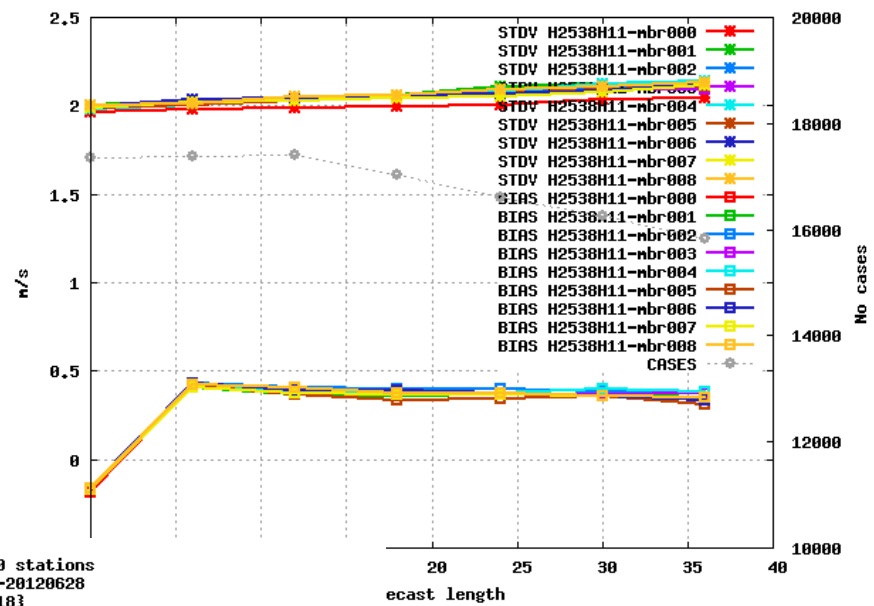


# Results Det – U10m

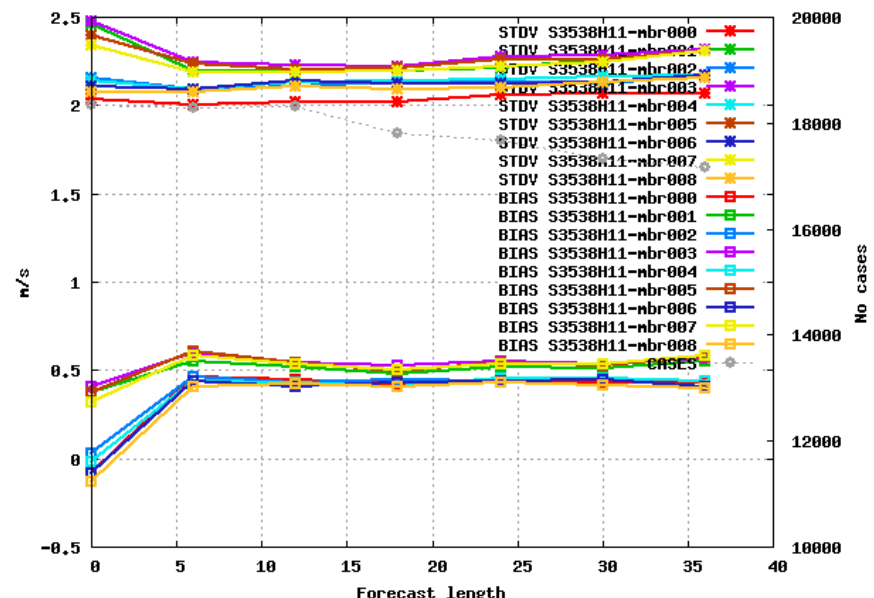
Selection: ALL using 160 stations  
 U10m Period: 20111023-20120628  
 Hours: {00,06,12,18}



Selection: ALL using 160 stations  
 U10m Period: 20111023-20120628  
 Hours: {00,06,12,18}



Selection: ALL using 160 stations  
 U10m Period: 20111023-20120628  
 Hours: {00,06,12,18}



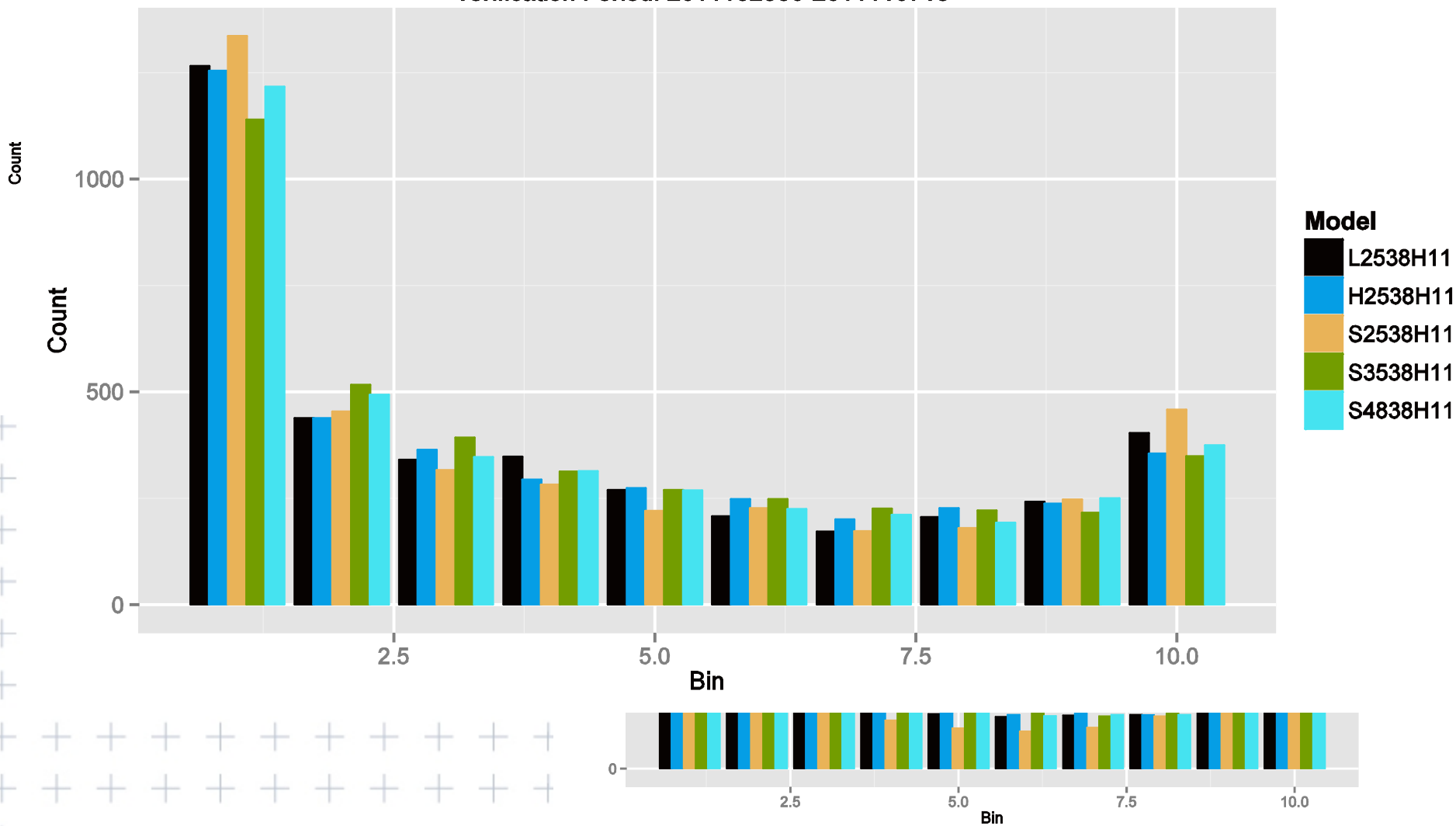
L25

H25

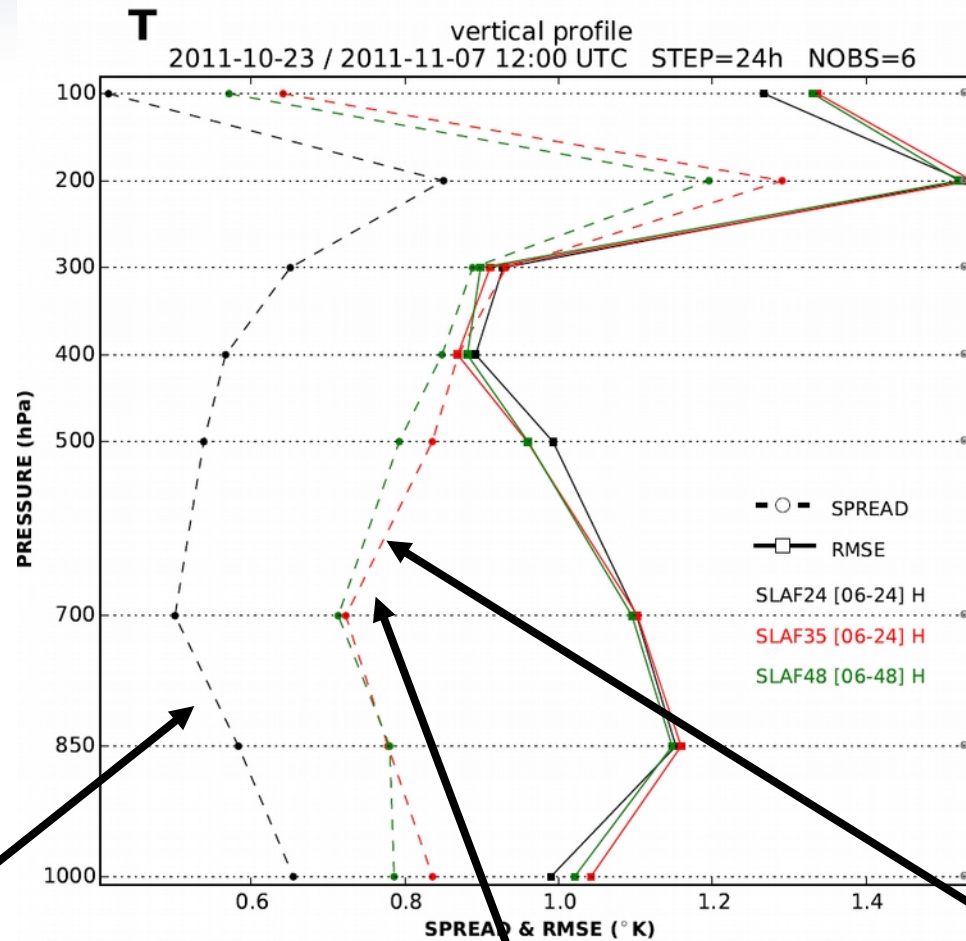
S35

# Results Prob – Rank

Rank histogram : AccPcp12h  
Lead Time: 36 hours  
Verification Period: 2011102300-2011110718



# Results Prob – Spread/Skill Upper Air H+24



H+24

S25

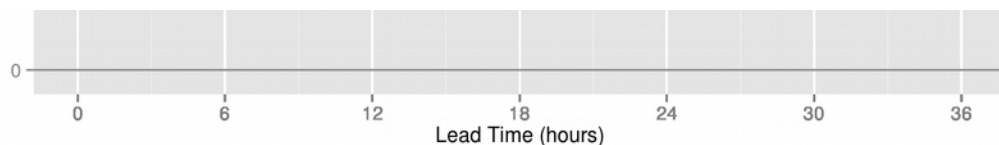
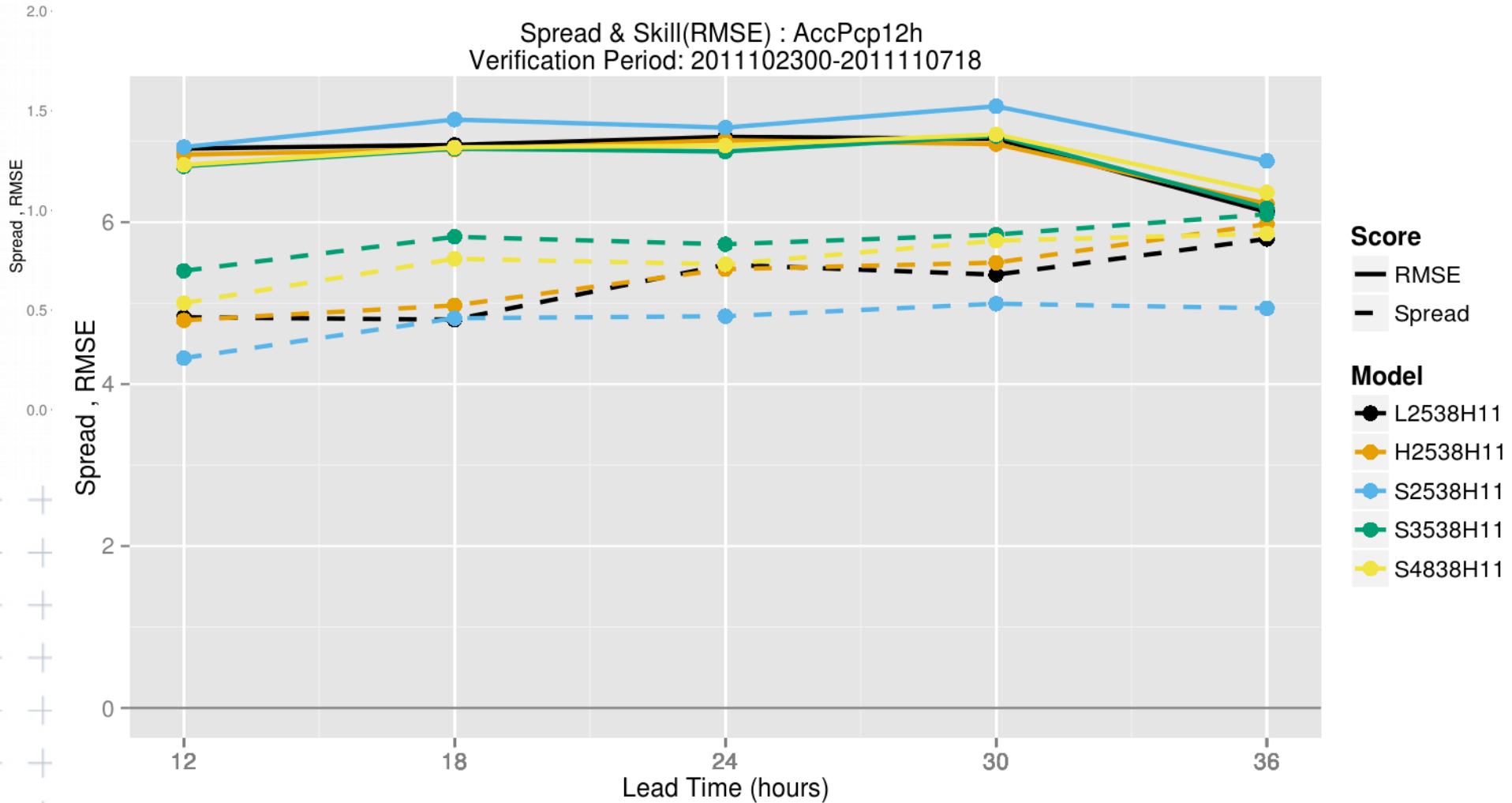
S35

S48

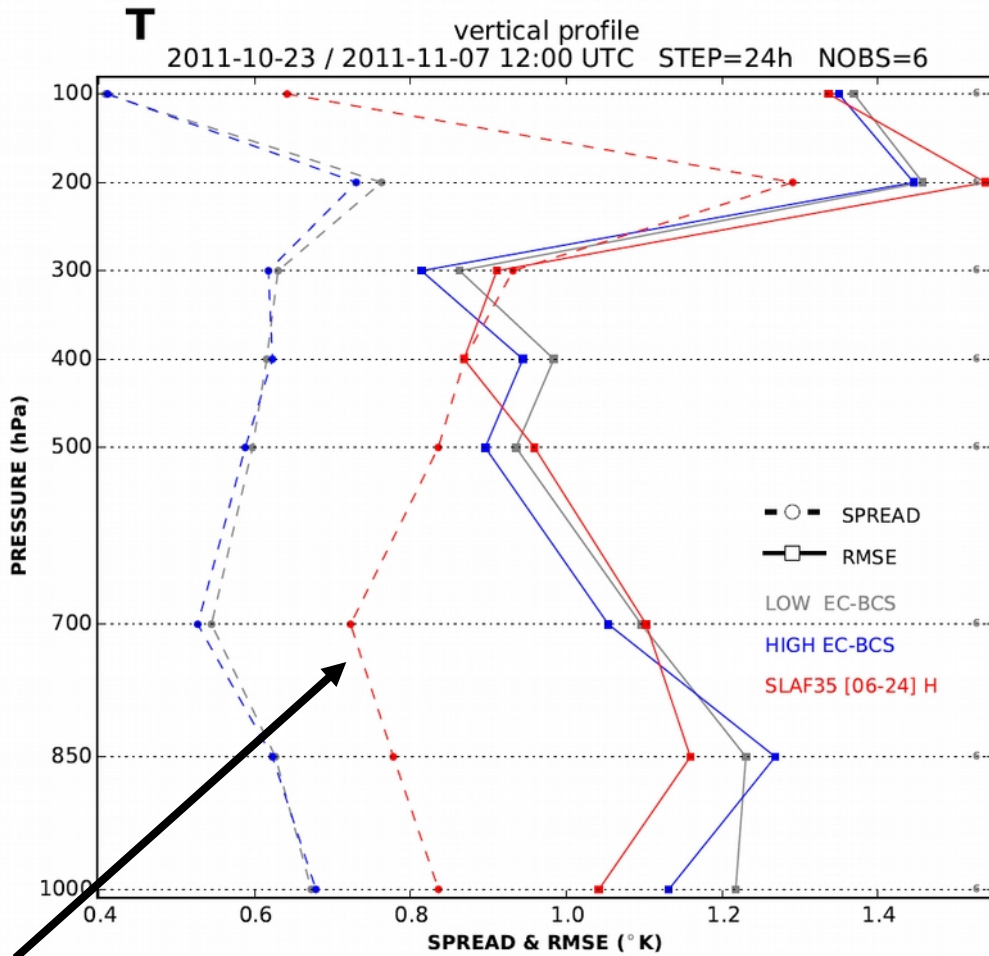
# Results Prob – Spread/Skill – Surface - H+36

Spread & Skill(RMSE) : T2m

Spread & Skill(RMSE) : AccPcp12h  
Verification Period: 2011102300-2011110718



# Results Prob – Spread/Skill Upper Air H+24



H+24

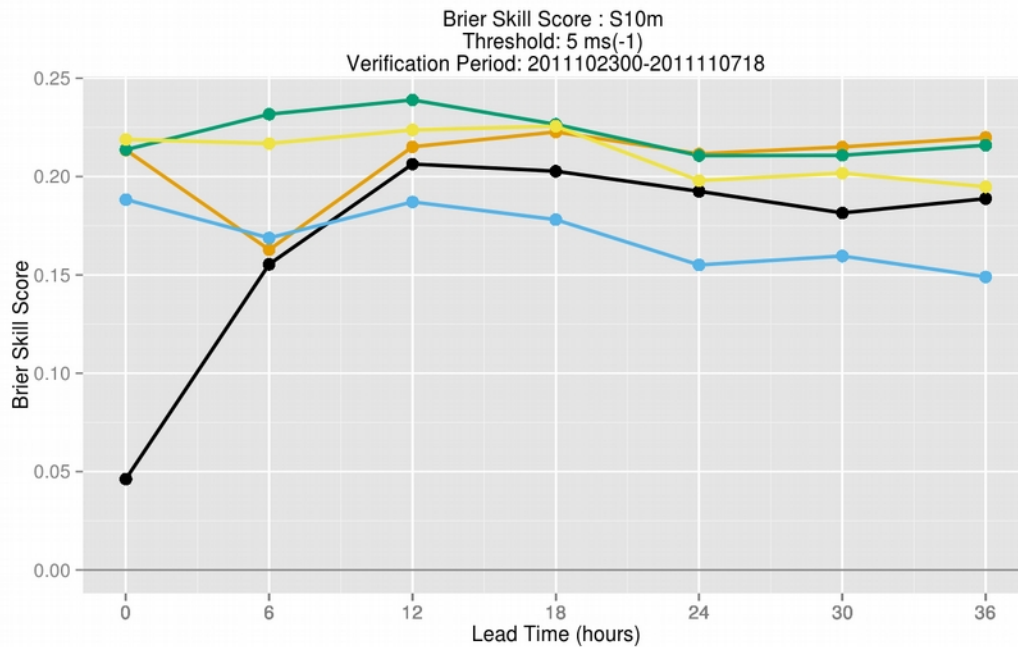
S35

L25

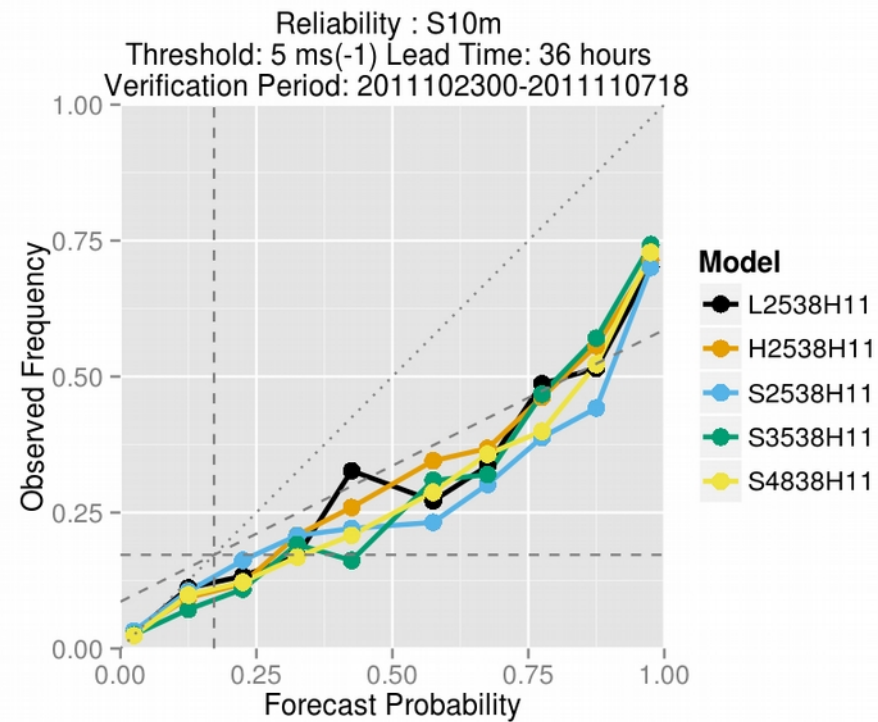
H25



# Results Prob – Brier Skill Score / Reliability – S10m



Model

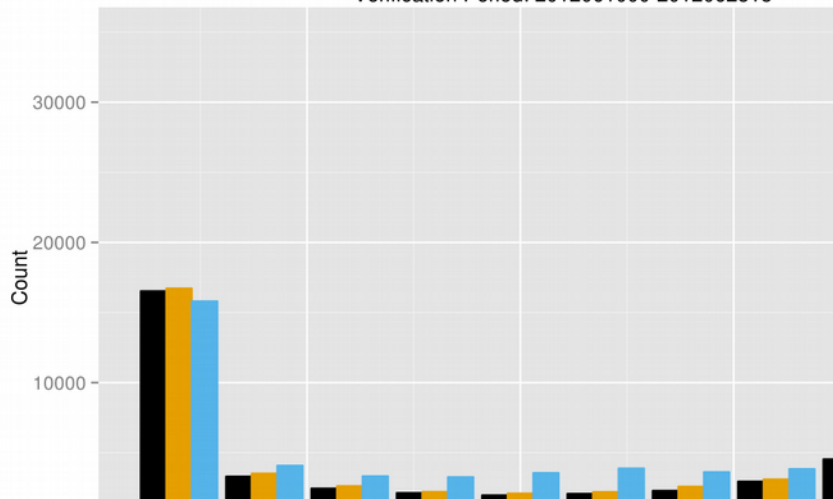


Model

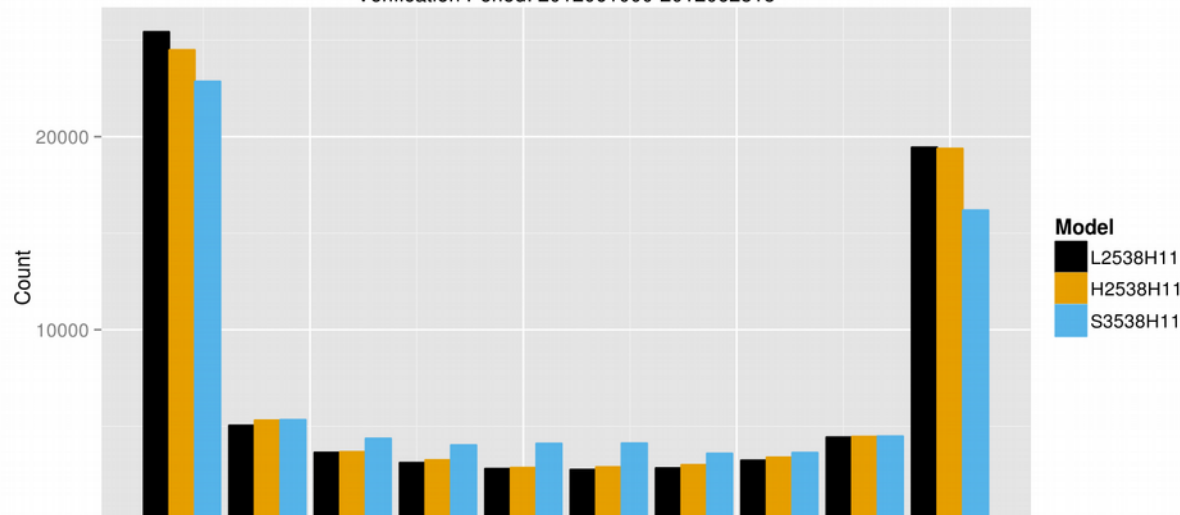
- L2538H11
- H2538H11
- S2538H11
- S3538H11
- S4838H11

# Results Prob – Spread/Skill – Surface - H+36 – Spring period

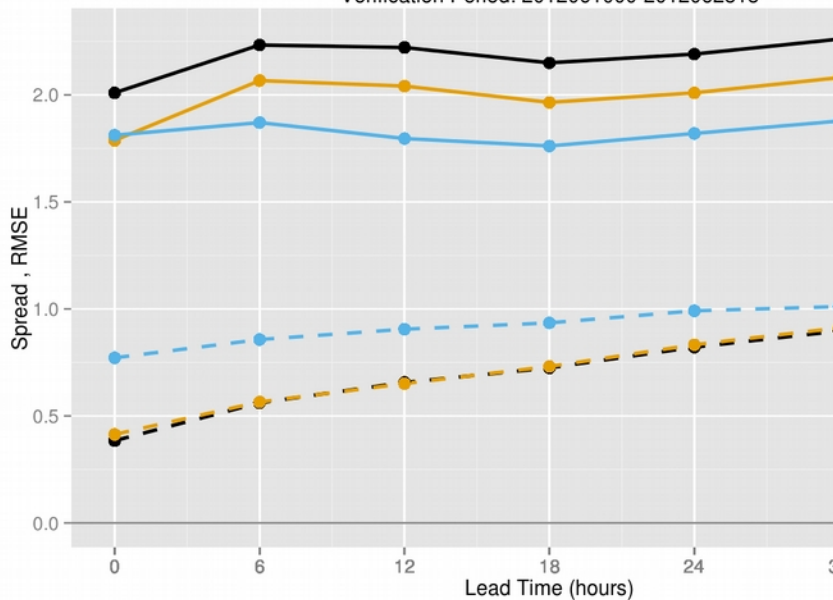
Rank histogram : T2m  
Verification Period: 2012061000-2012062818



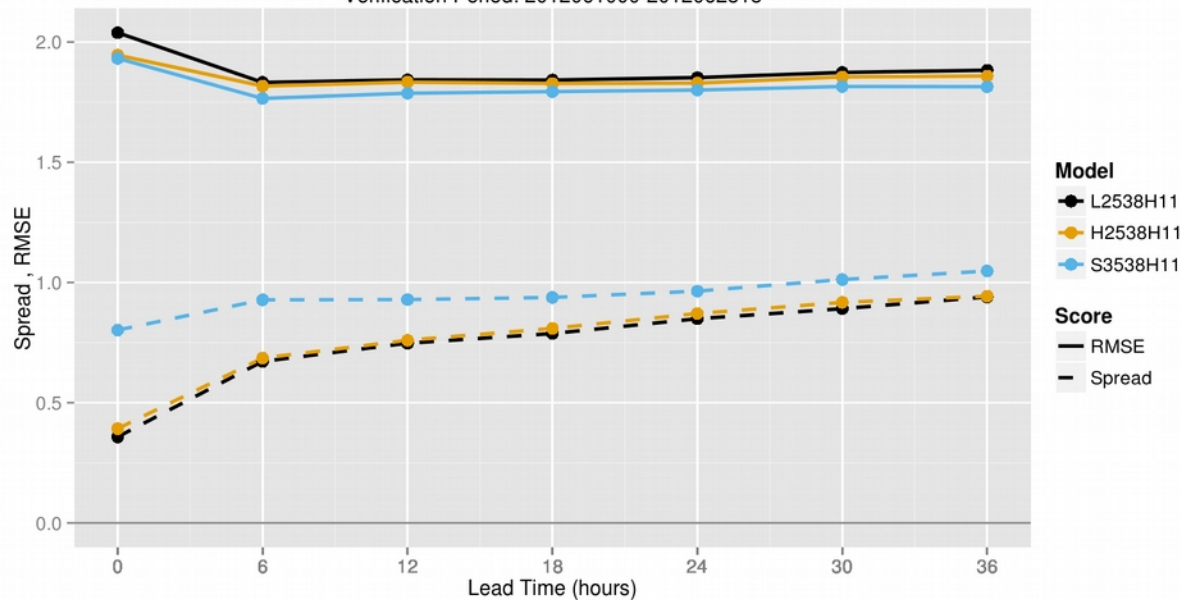
Rank histogram : S10m  
Verification Period: 2012061000-2012062818



Spread & Skill(RMSE) : T2m  
Verification Period: 2012061000-2012062818

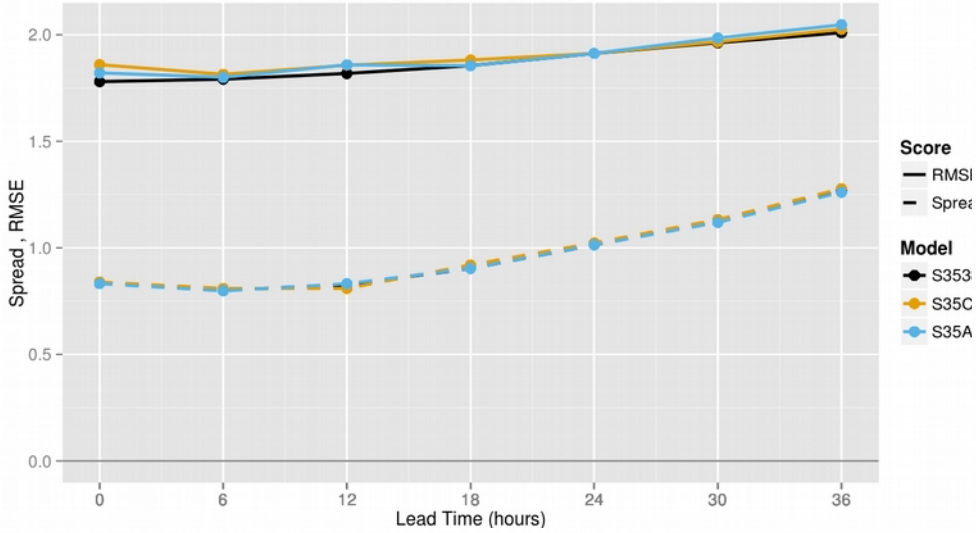


Spread & Skill(RMSE) : S10m  
Verification Period: 2012061000-2012062818

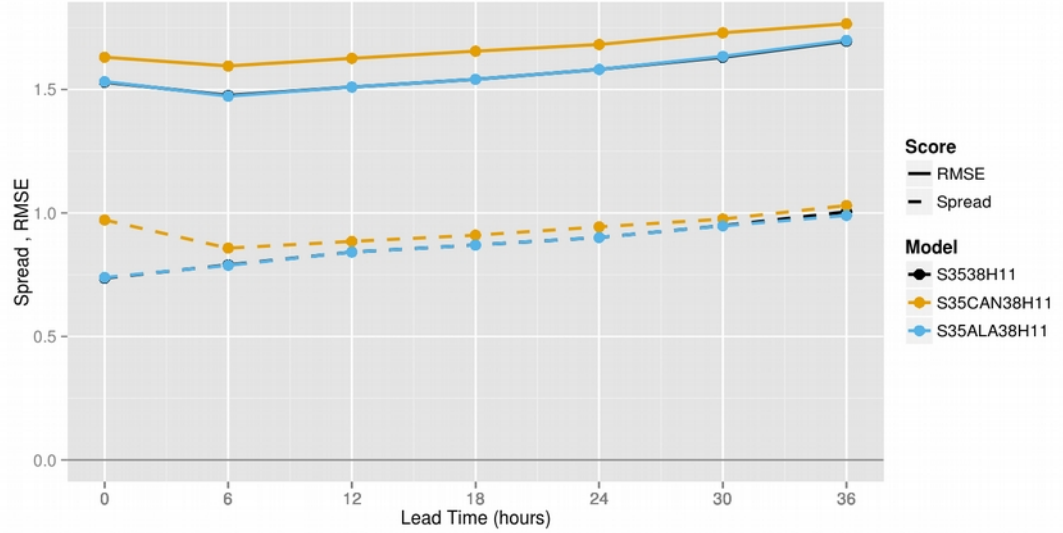


# Results Prob – Canary or ALARO Physics

Spread & Skill(RMSE) : Pmsl  
Verification Period: 2011102300-2011110718

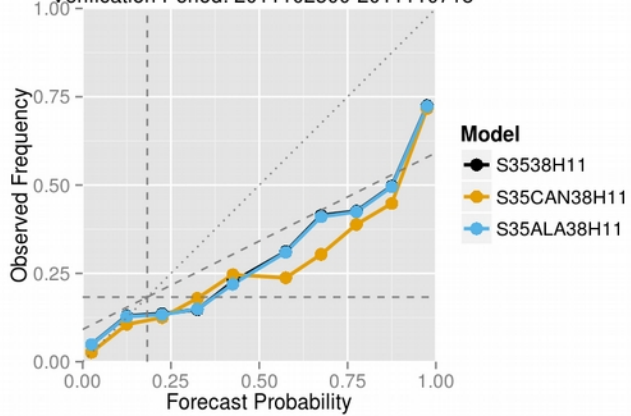


Spread & Skill(RMSE) : T2m  
Verification Period: 2011102300-2011110718

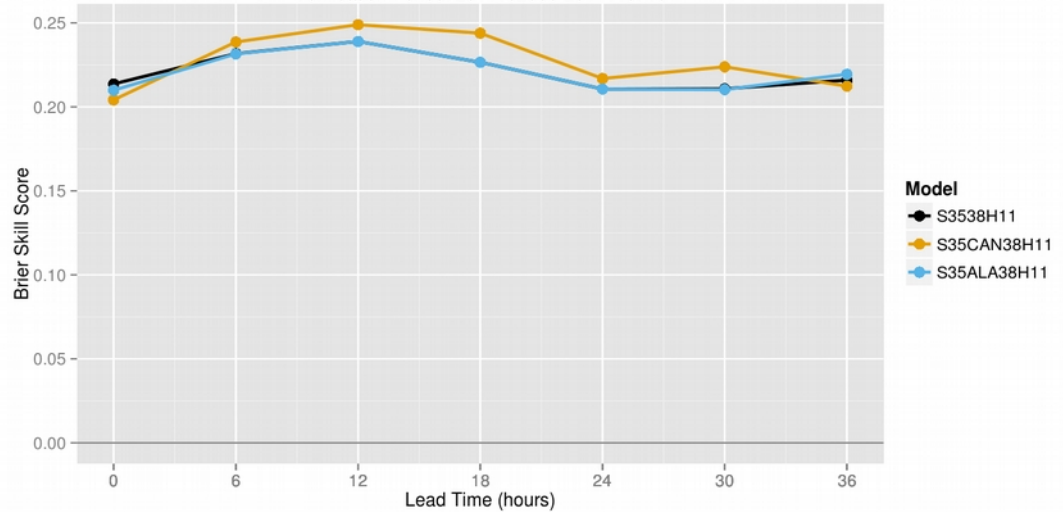


S35  
CAN  
ALA

Reliability : S10m  
Threshold: 5 ms(-1) Lead Time: 0 hours  
Verification Period: 2011102300-2011110718



Brier Skill Score : S10m  
Threshold: 5 ms(-1)  
Verification Period: 2011102300-2011110718



# Conclusions

- SLAF is a technically cheap tool to generate perturbations at the boundaries for a LAM EPS.
- It simulates the errors of the day through the deviations of former runs of the deterministic numerical model.
- It has the advantage to get the highest possible resolution for boundaries.
- It can be mixed easily with different global models to make the EPS multiboundaries.
- The different members have a similar deterministic skill
- **Comparing with downscaling ECMWF EPS, at resolutions operational and deterministic, SLAF gives better probabilistic verification scores at surface and upper air.**