Experiences on AROME forecasting fog and low clouds for Nordic conditions

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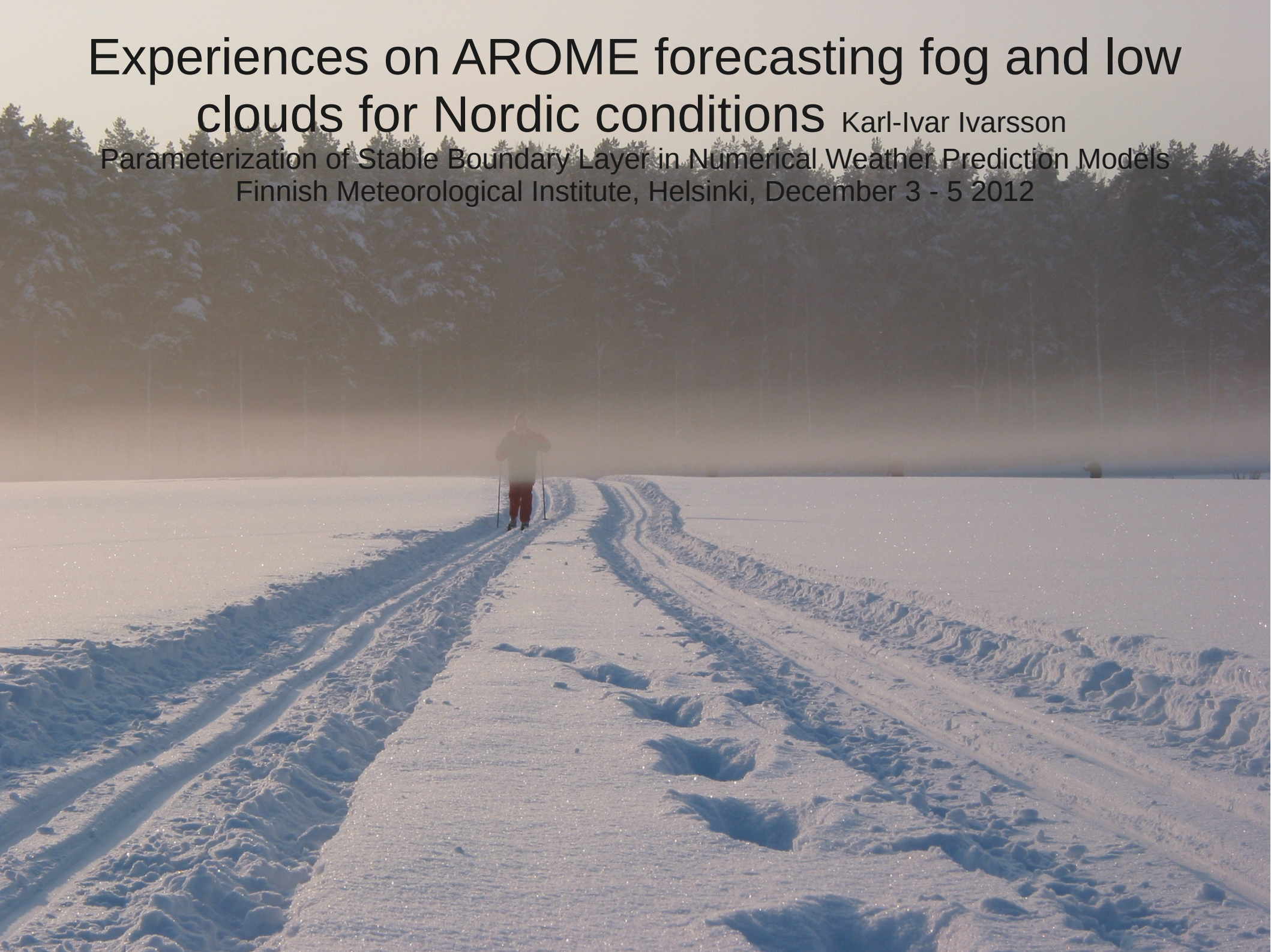
Parameterization of Stable Boundary Layer in Numerical Weather Prediction Models
Finnish Meteorological Institute, Helsinki, December 3 - 5 2012



Outline

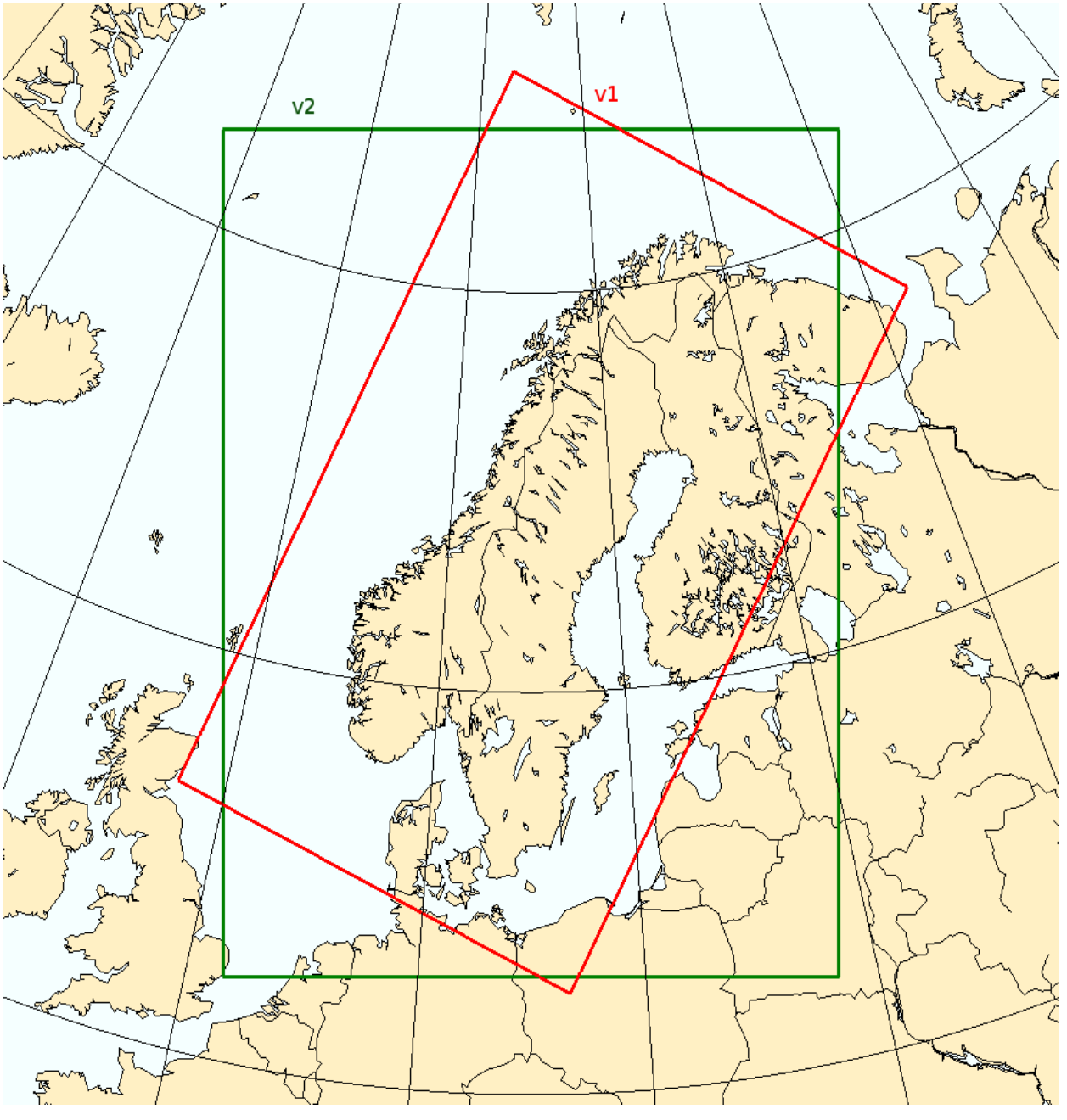
- Short about the MetCoop project
- Current model running
- Spring (36h1.4) results
- Autumn results (37h1.1)
- Winter (36h1.4, 37h1.1) results
- Summary

Short about the MetCoop project

- Cooperation between Norway and Sweden on running limited area models
- Common model and domain
- Common computer(s)
- Computer(s) also for 'individual' runs
- Operational in March 2014

Current model running (green borders)

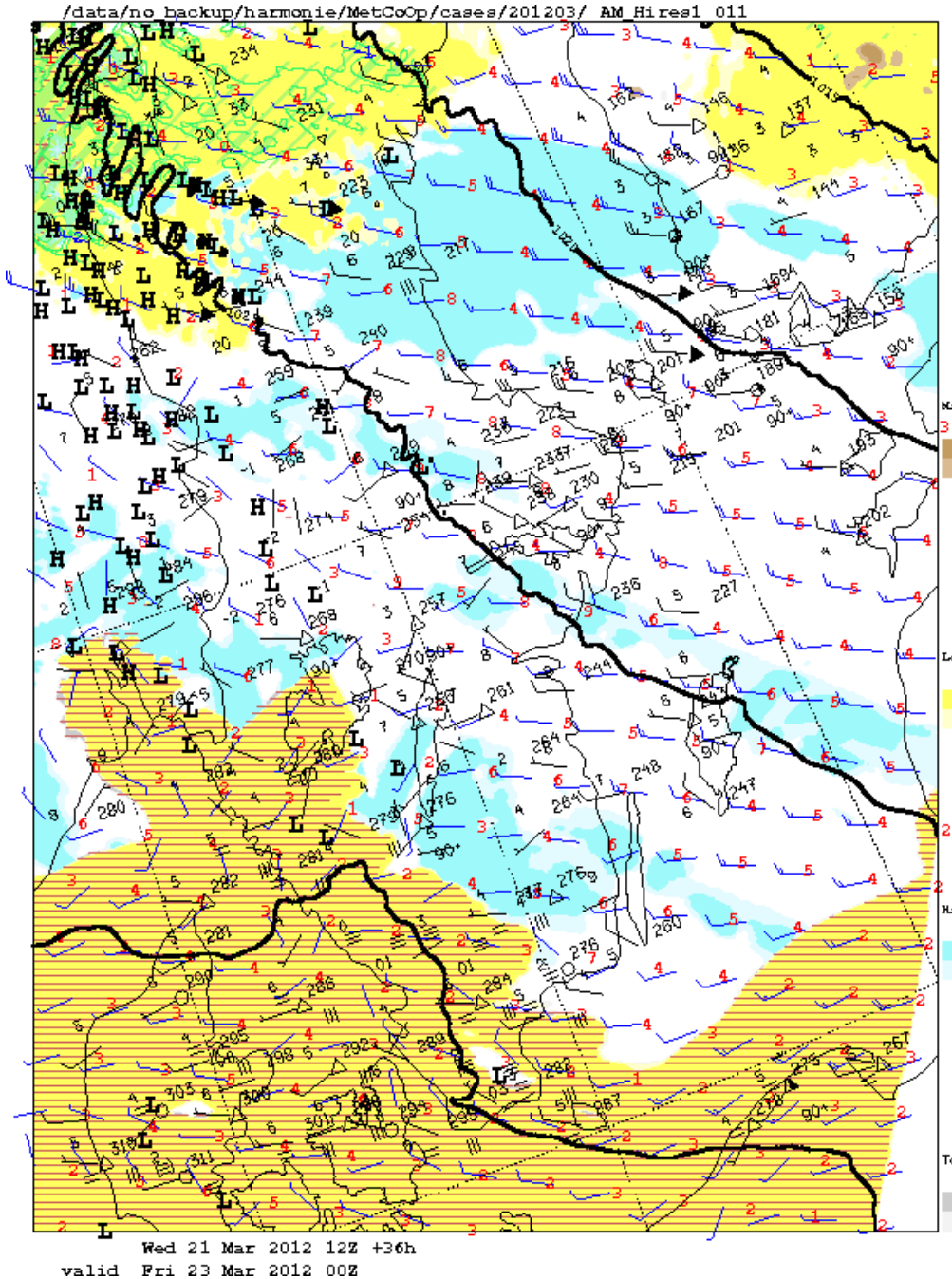
- Arome 2.5km
- 739x949x65
- 3DVAR,OI-main
- 37h1.1

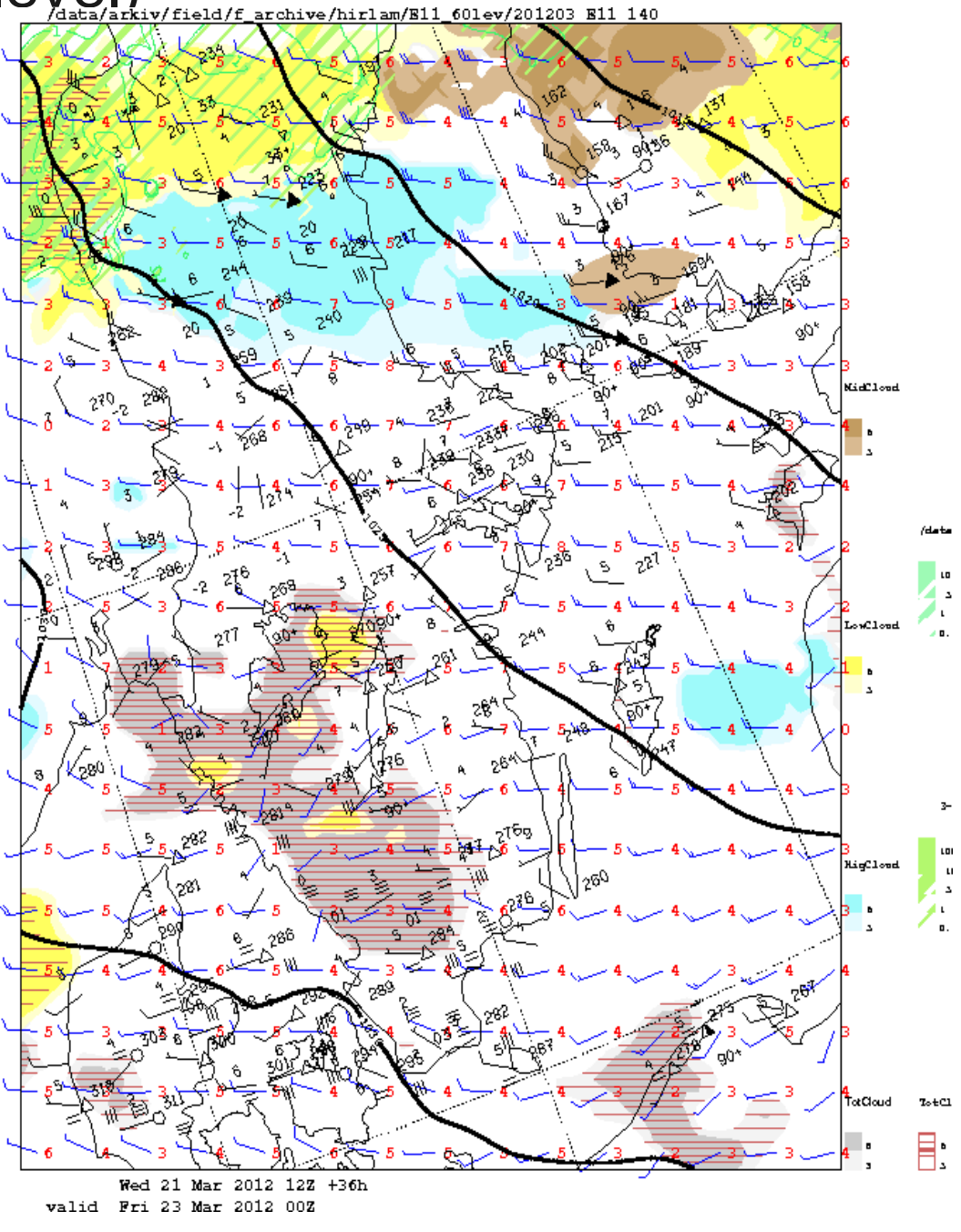


Spring (36h1.4) results

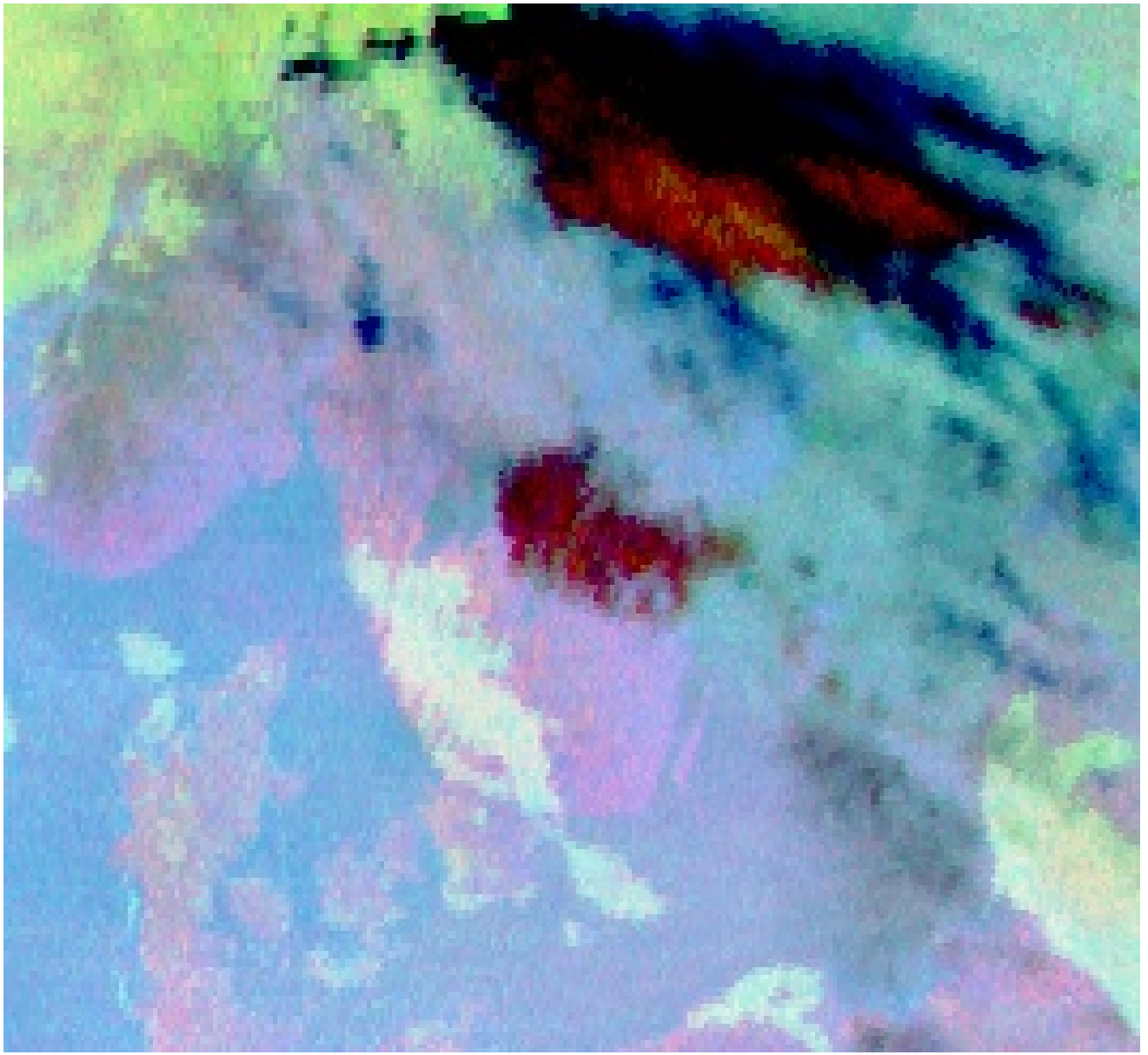
- Too much fog at times (Example)
- Low clouds verification ('good' automatic stations)
- Cloud base >2 octas ('good' automatic stations)
- 'good' automatic stations sees up to 7.5 km, all cloud bases > 7.5km including cloud free set to 7.5km

Too much fog at times (March 23-2012) Yellow=low clouds, brown horizontal lines = fog (Forecast fog = clouds on lowest level)

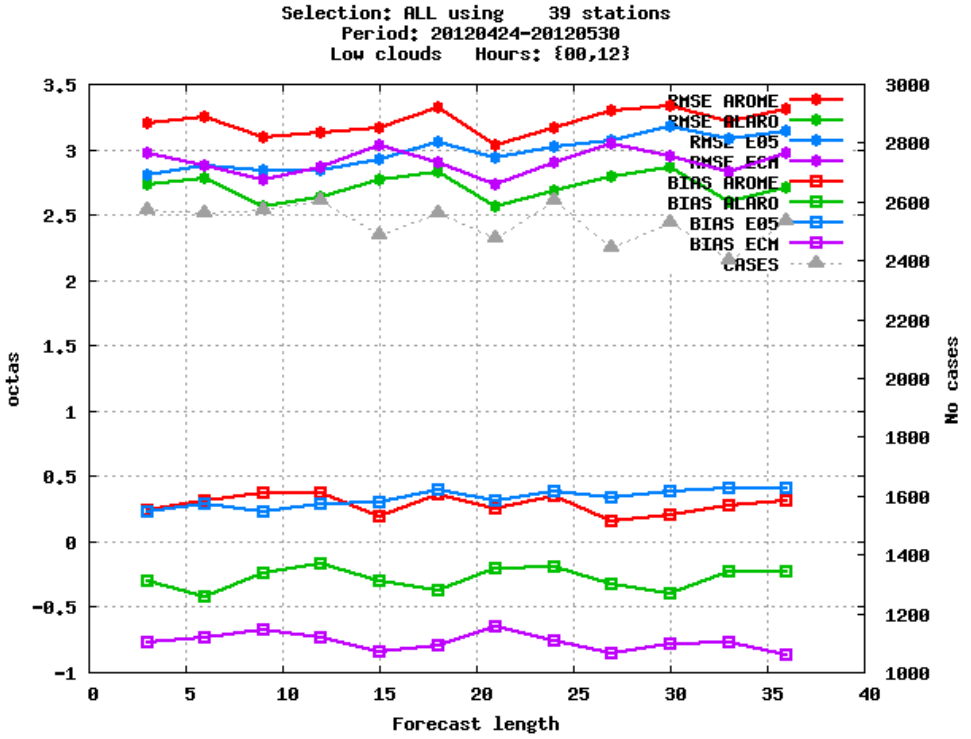


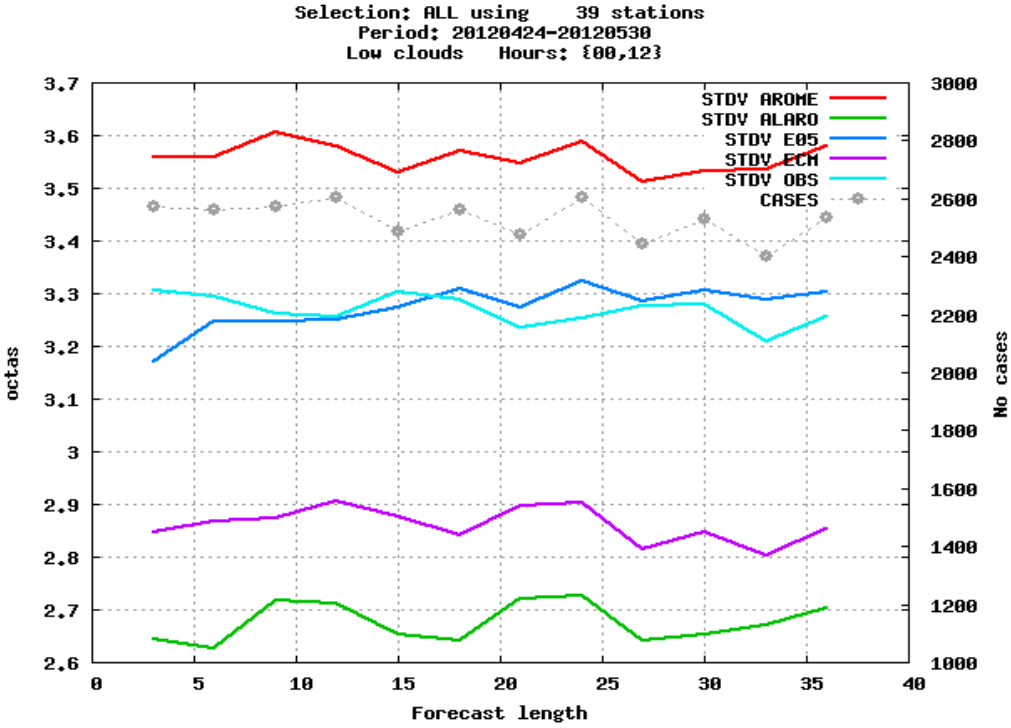


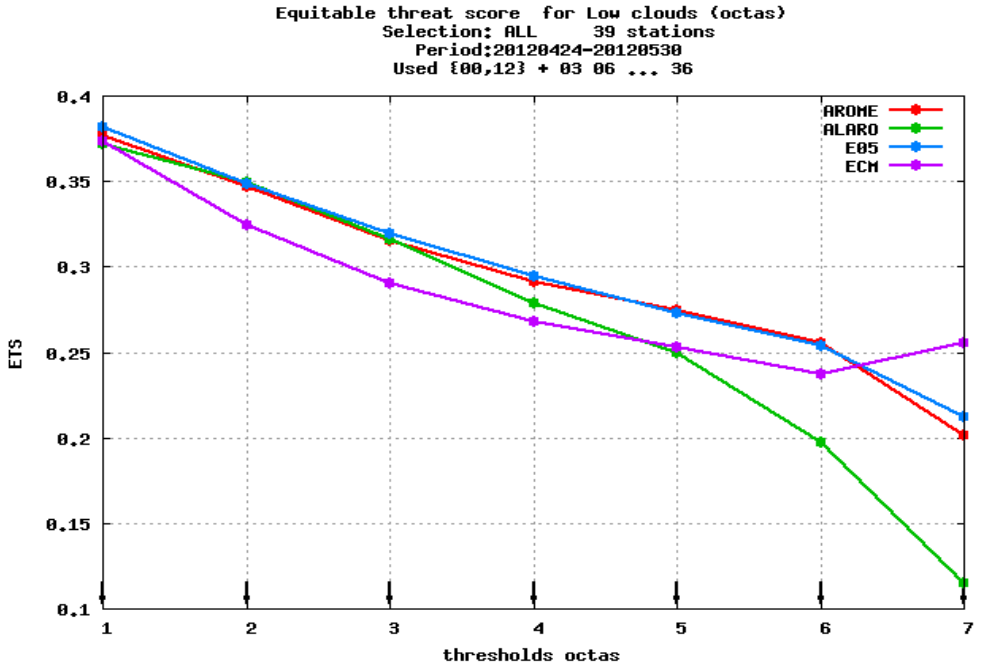
Satellite picture

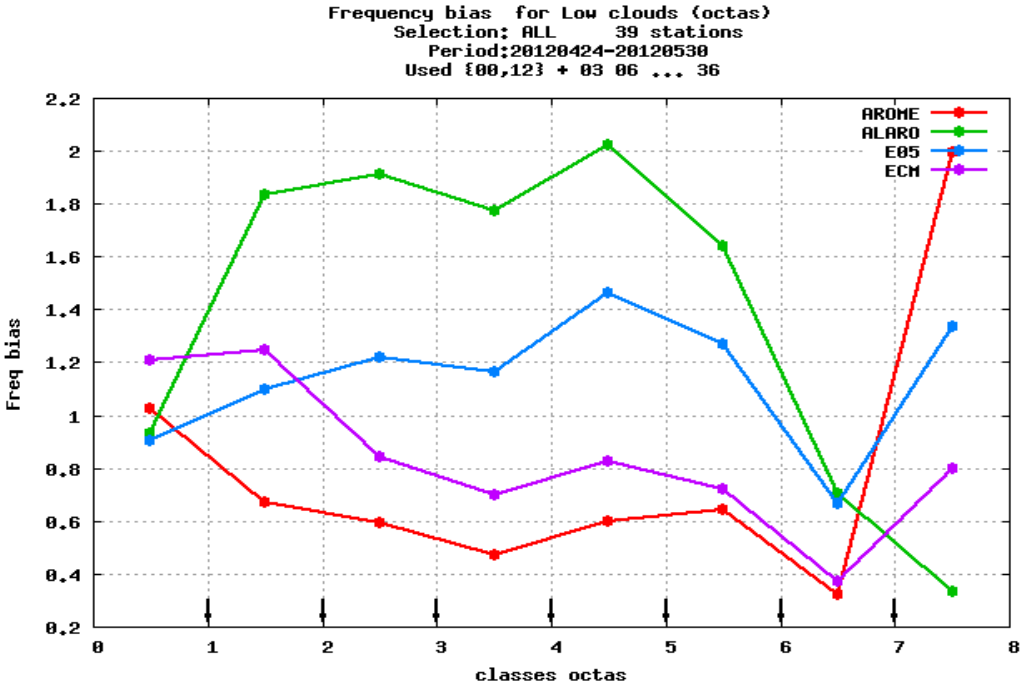


Low cloud verification

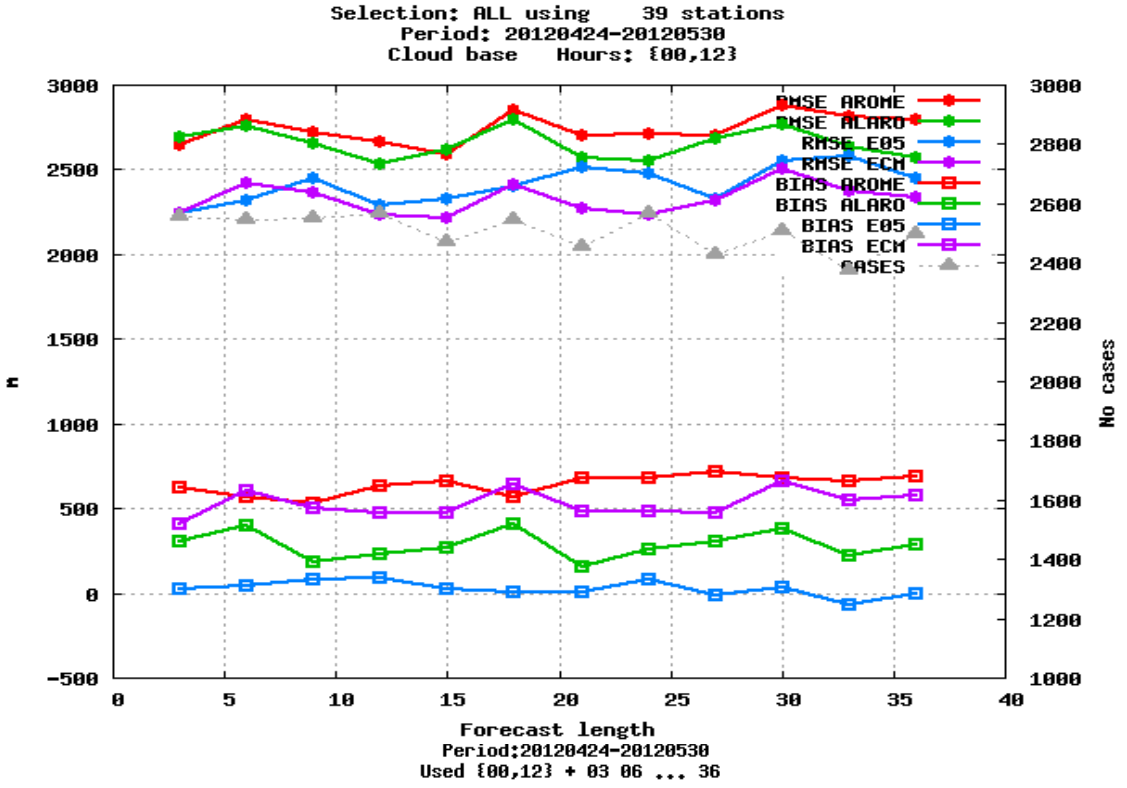


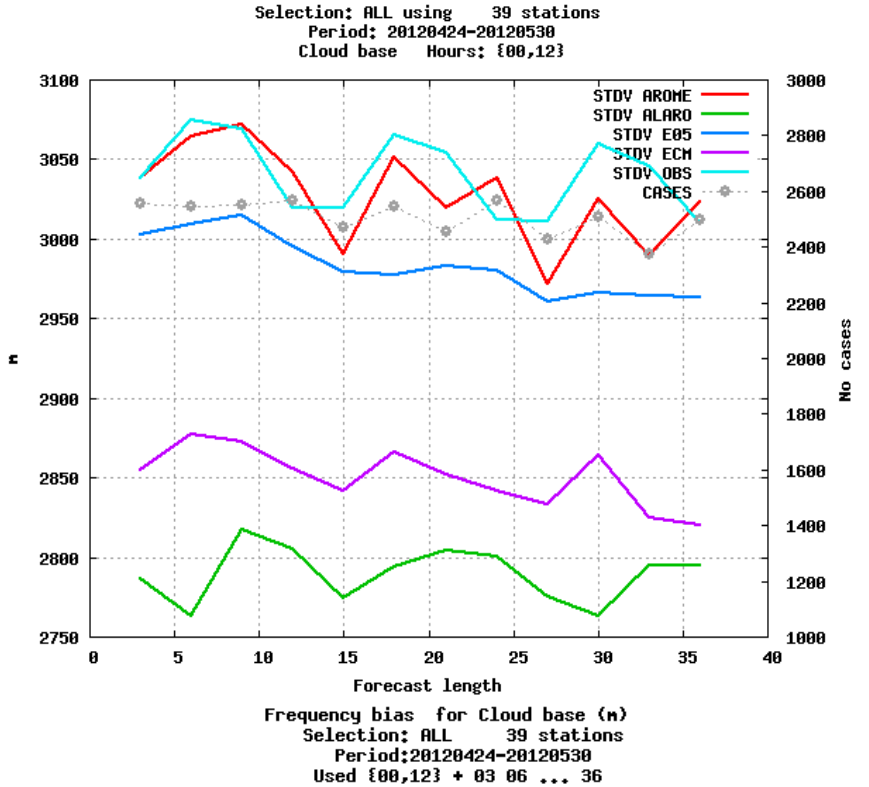


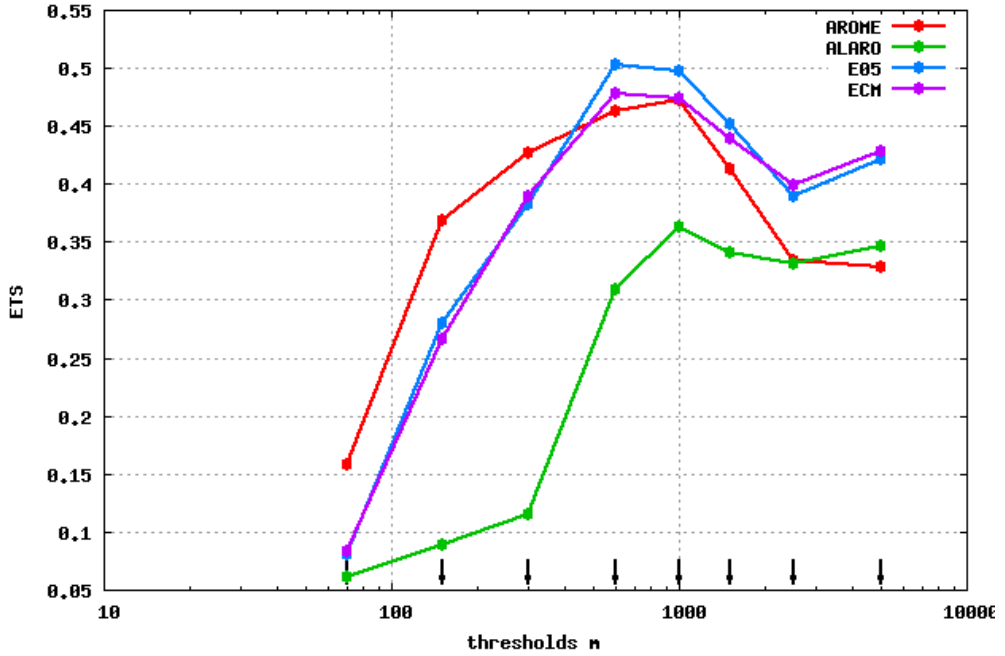


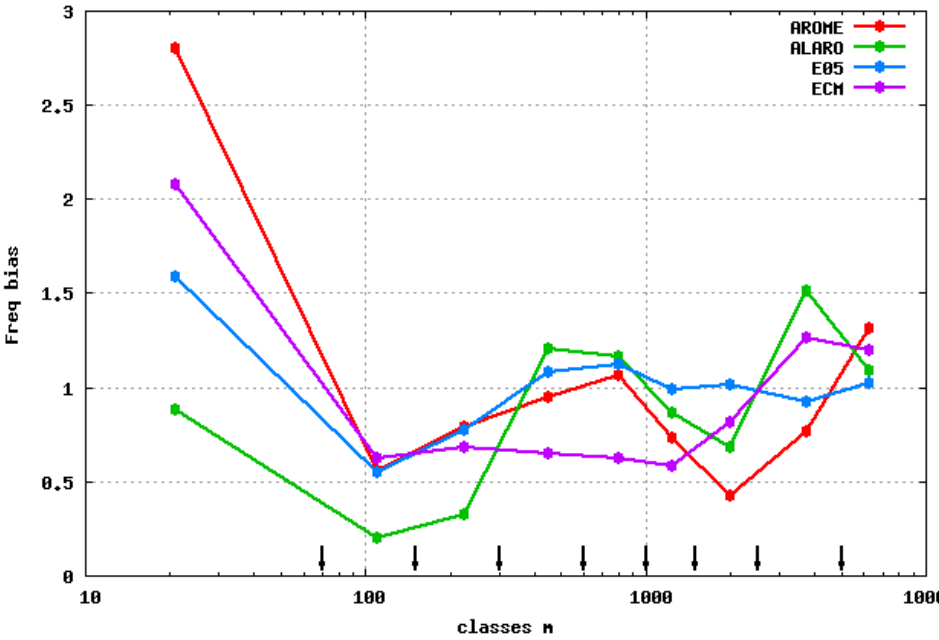


Cloud base verification



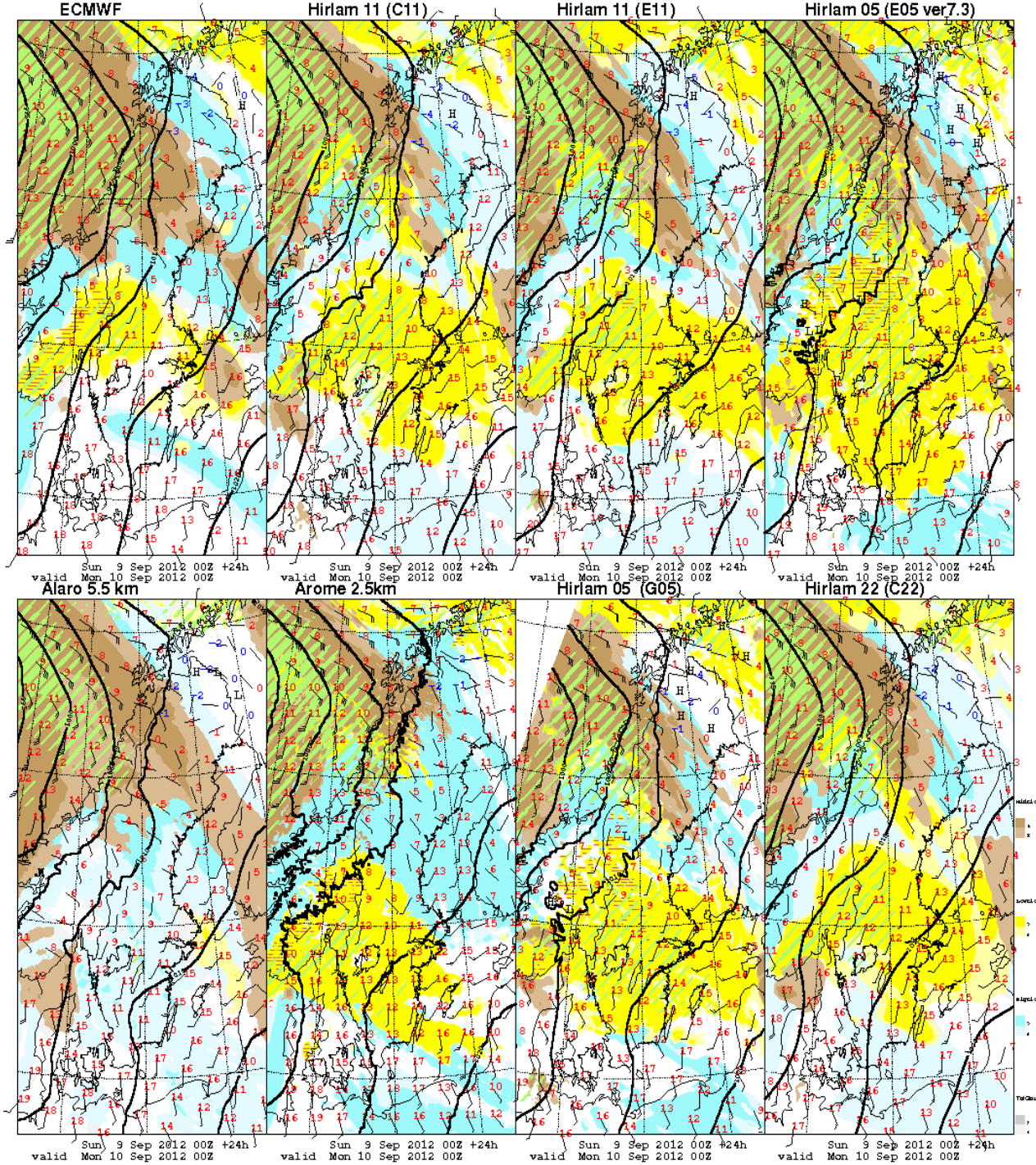


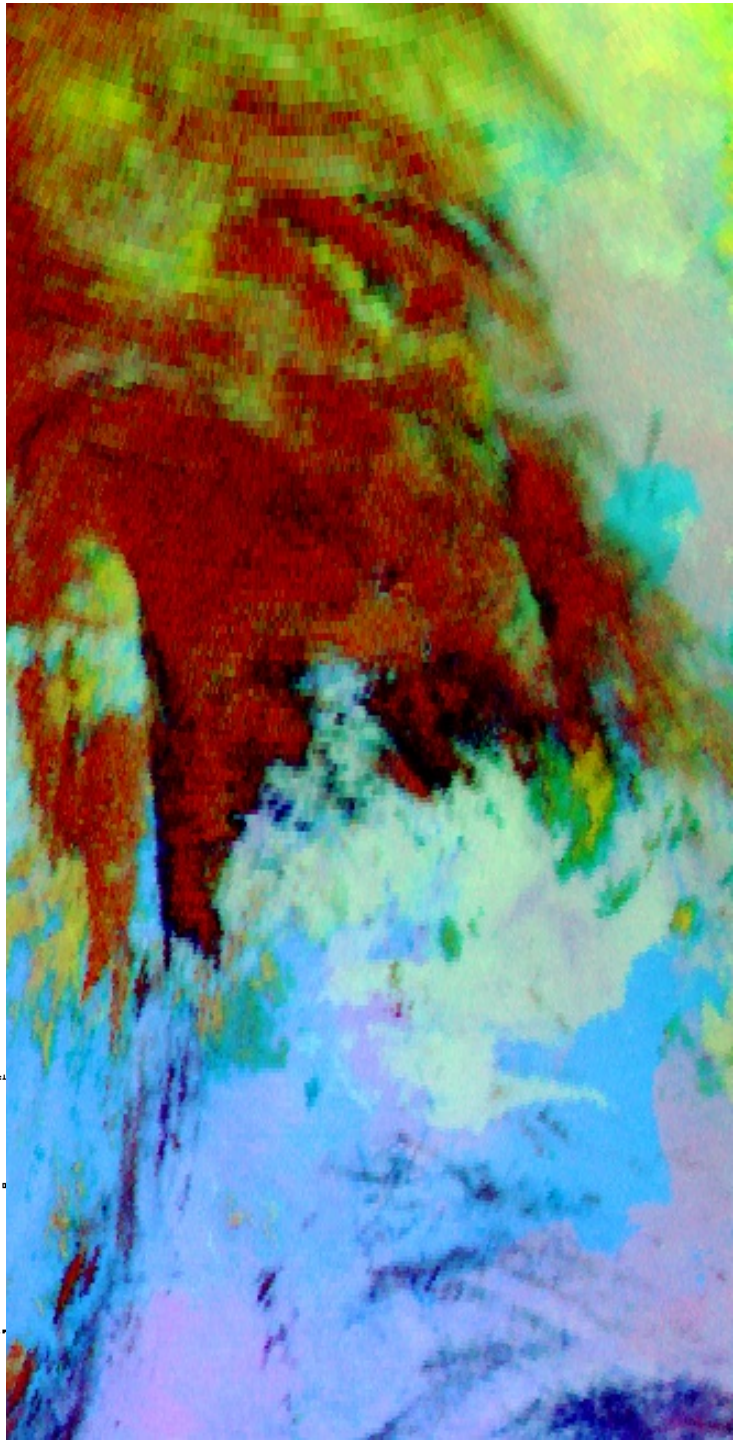




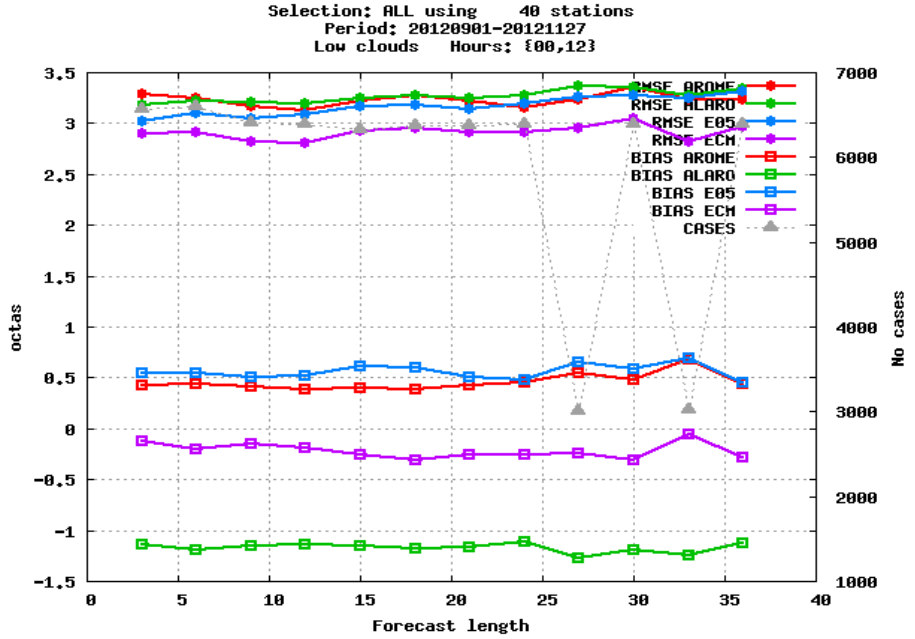
Autumn results (37h1.1)

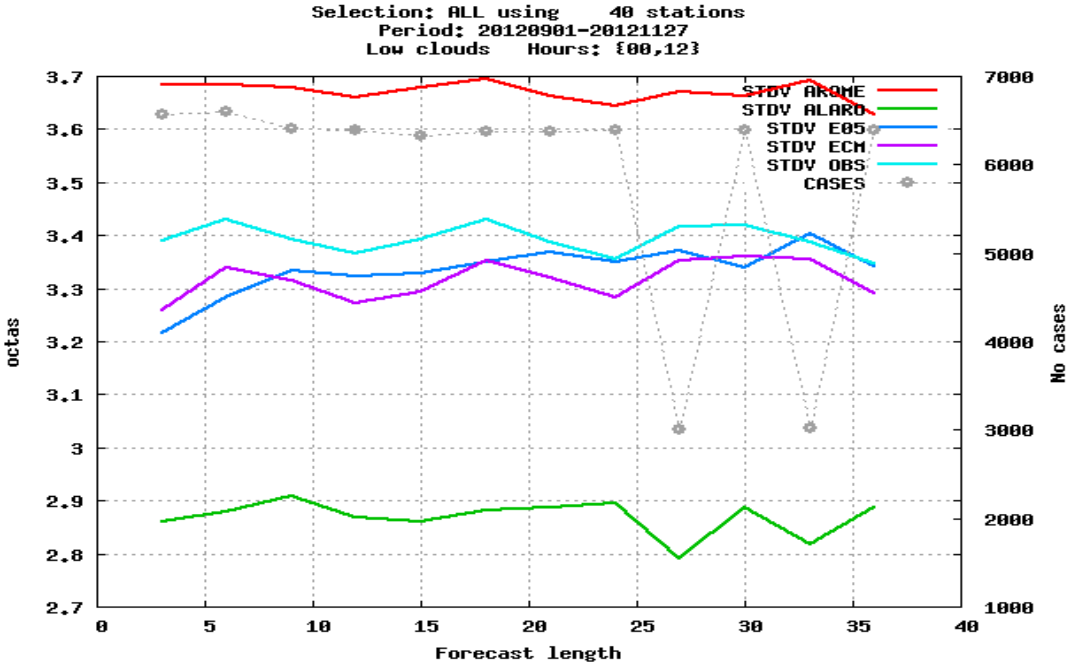
- Example
- Low clouds
- Cloud base

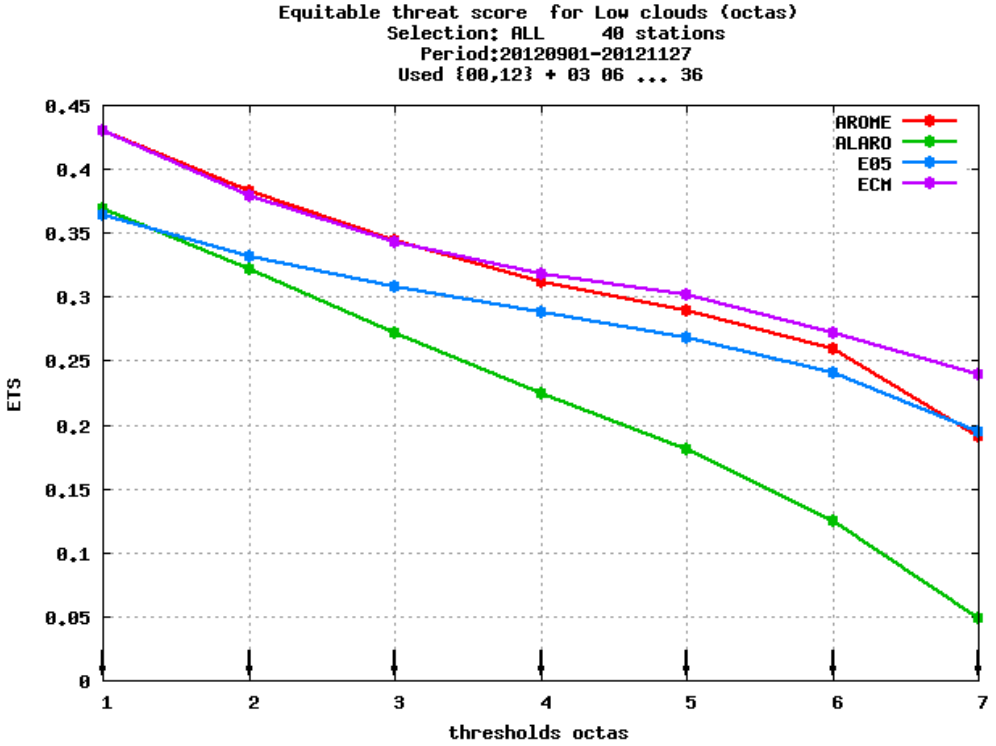

ECMWF
Hirlam 11 (C11)
Hirlam 11 (E11)
Hirlam 05 (E05 ver7.3)
Alaro 5.5 km
Arome 2.5km
Hirlam 05 (G05)
Hirlam 22 (C22)
Sun 9 Sep 2012 00Z +24h
valid Mon 10 Sep 2012 00Z

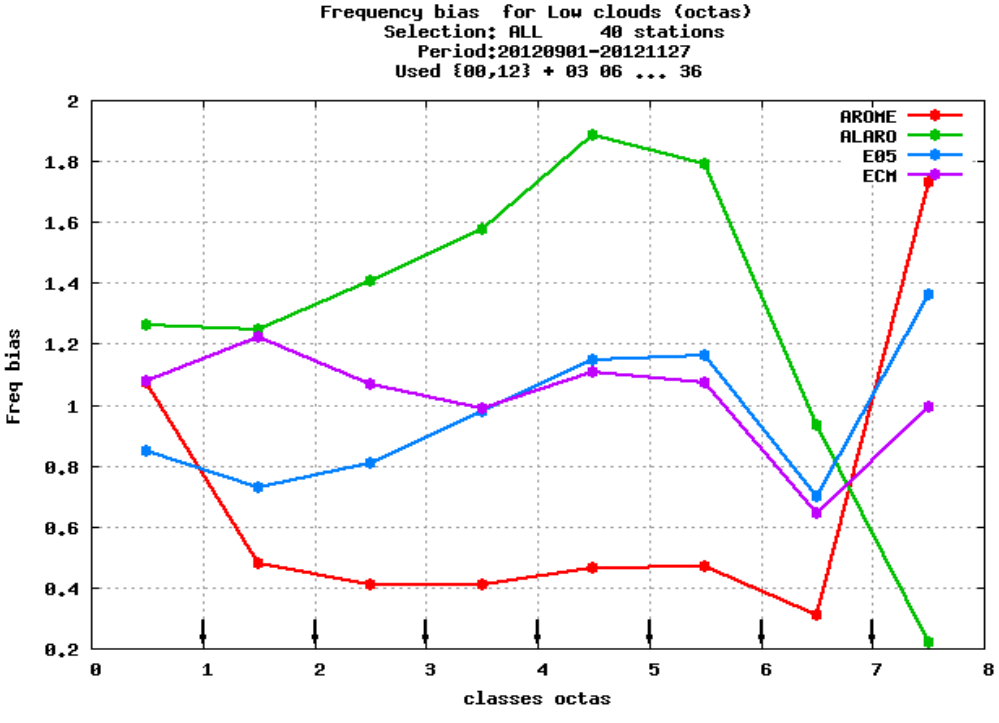


Low cloud verification

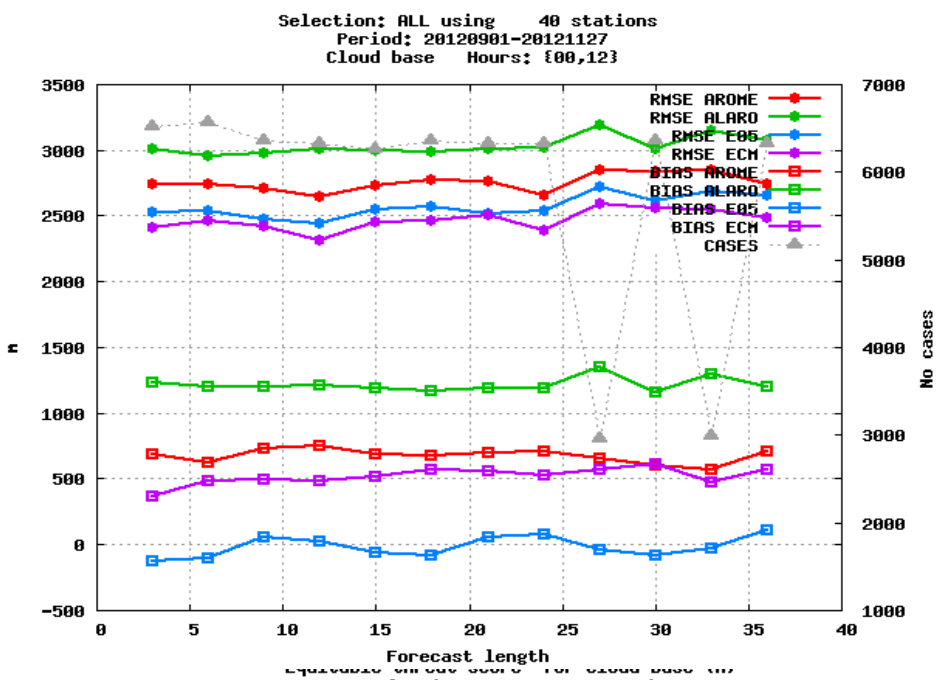


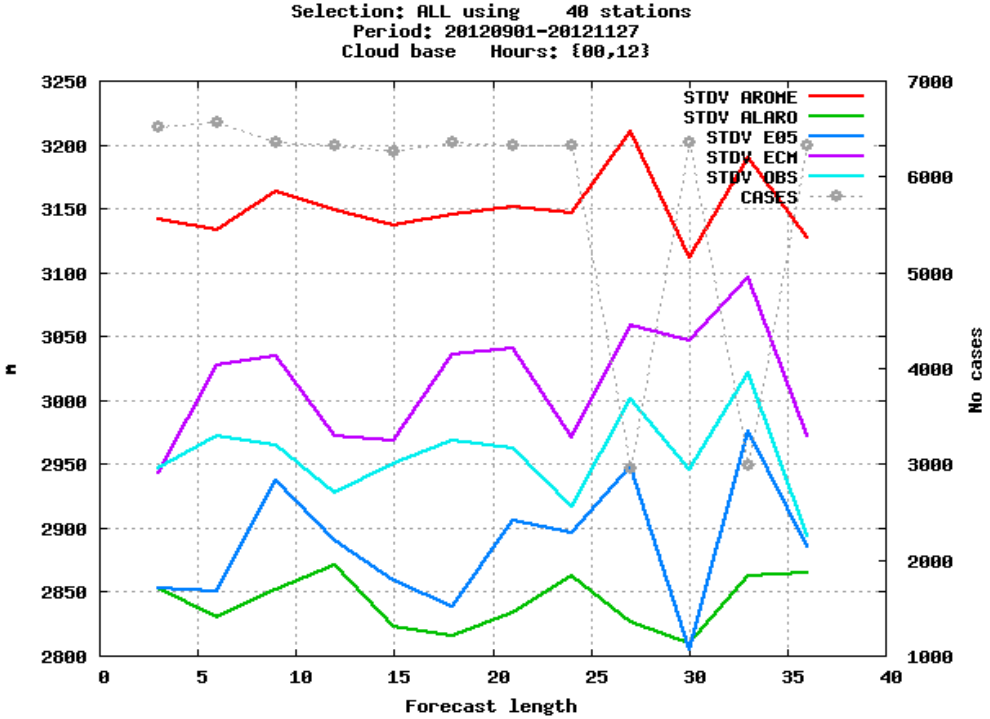


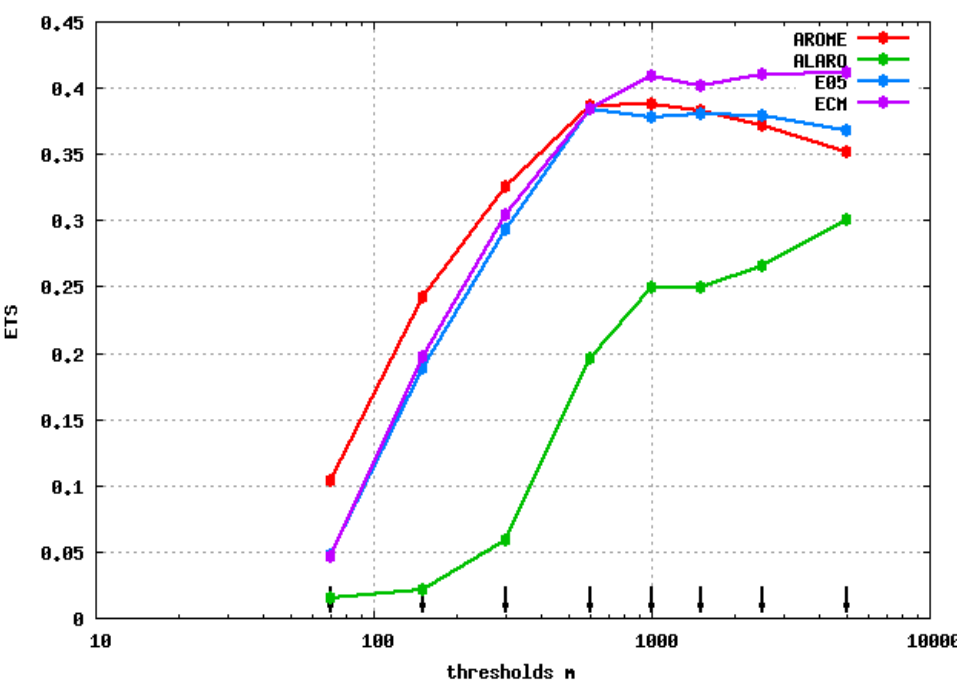


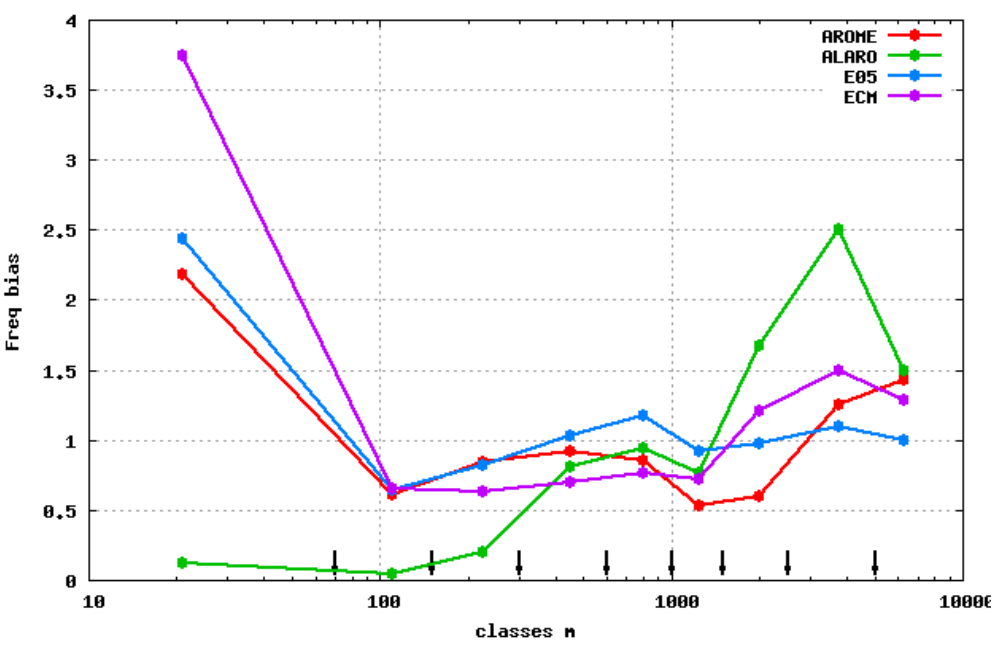


Cloud base verification





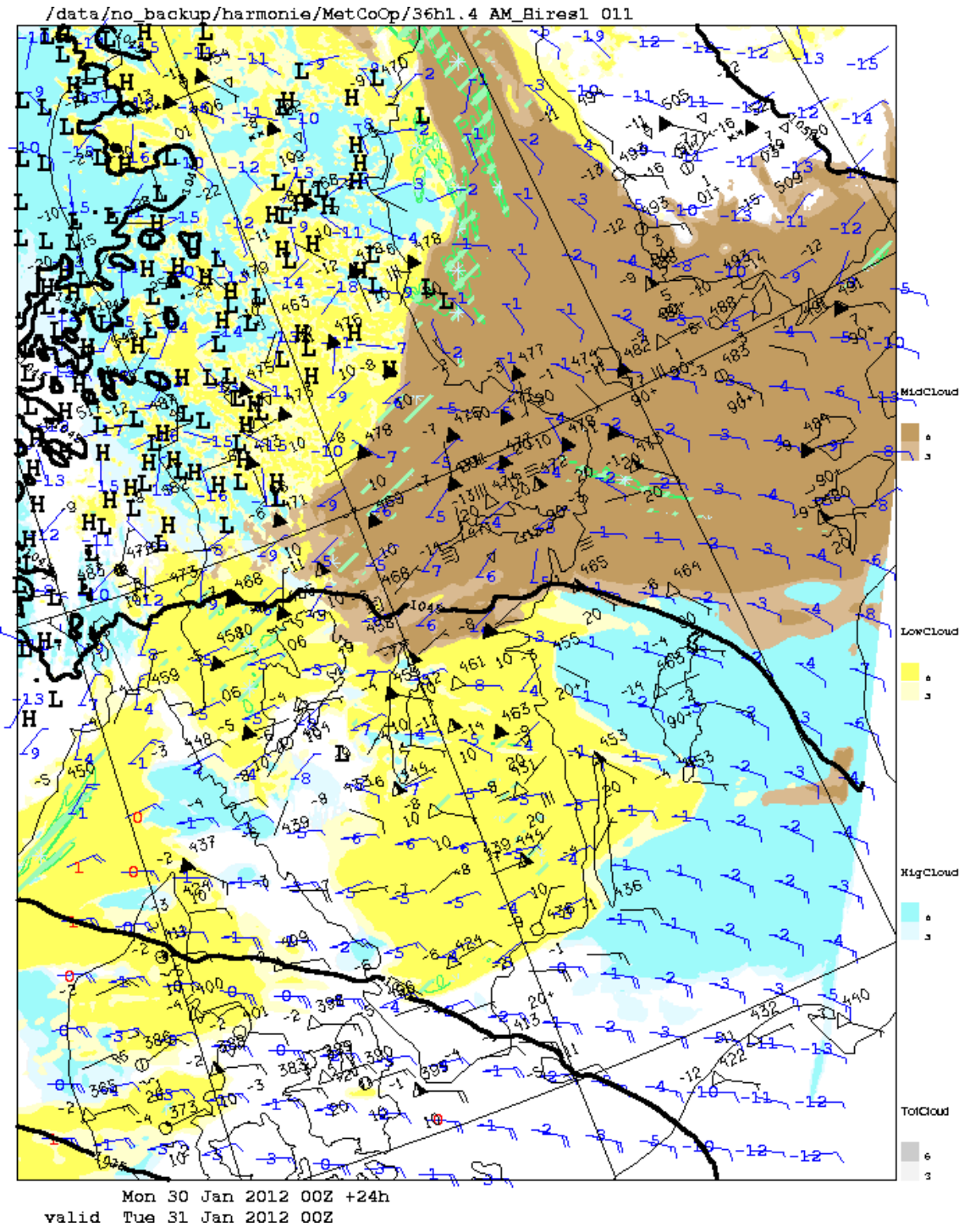


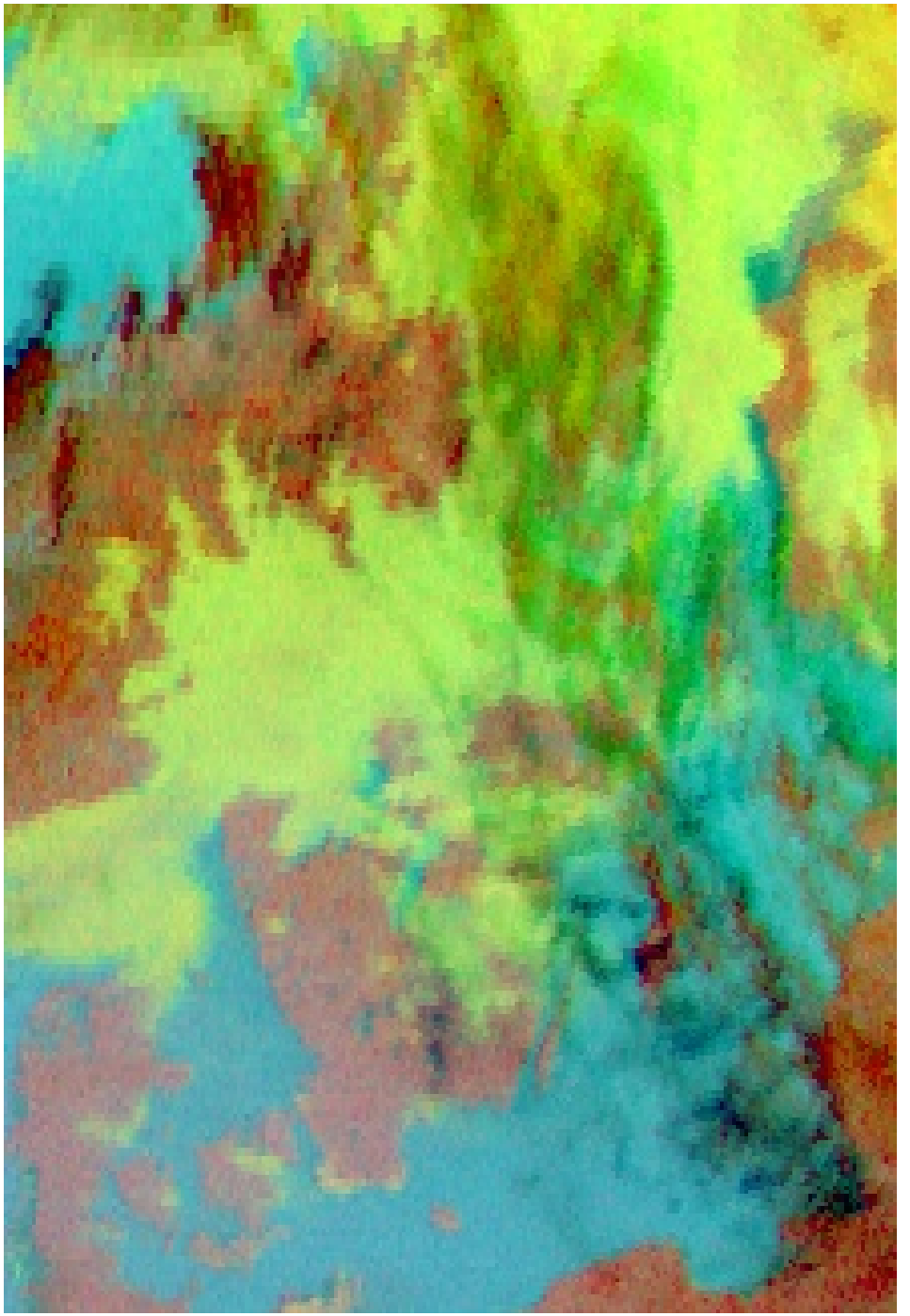


Winter (36h1.4, 37h1.1) results

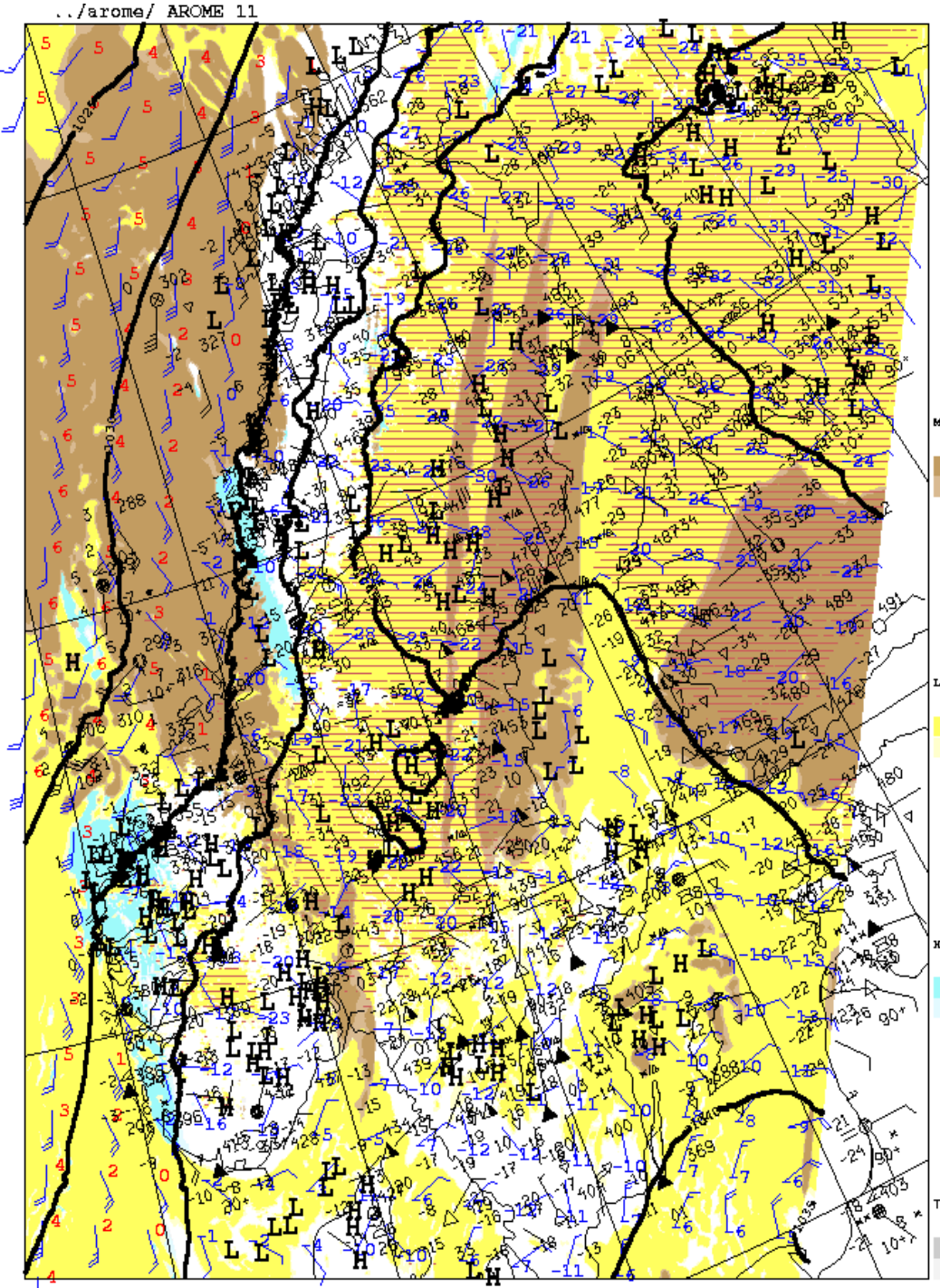
- Case studies
- Low clouds 2010-11-20 – 2010-12-09 (37h1.1)
- Cloud base 2010-11-20 – 2010-12-09 (37h1.1)

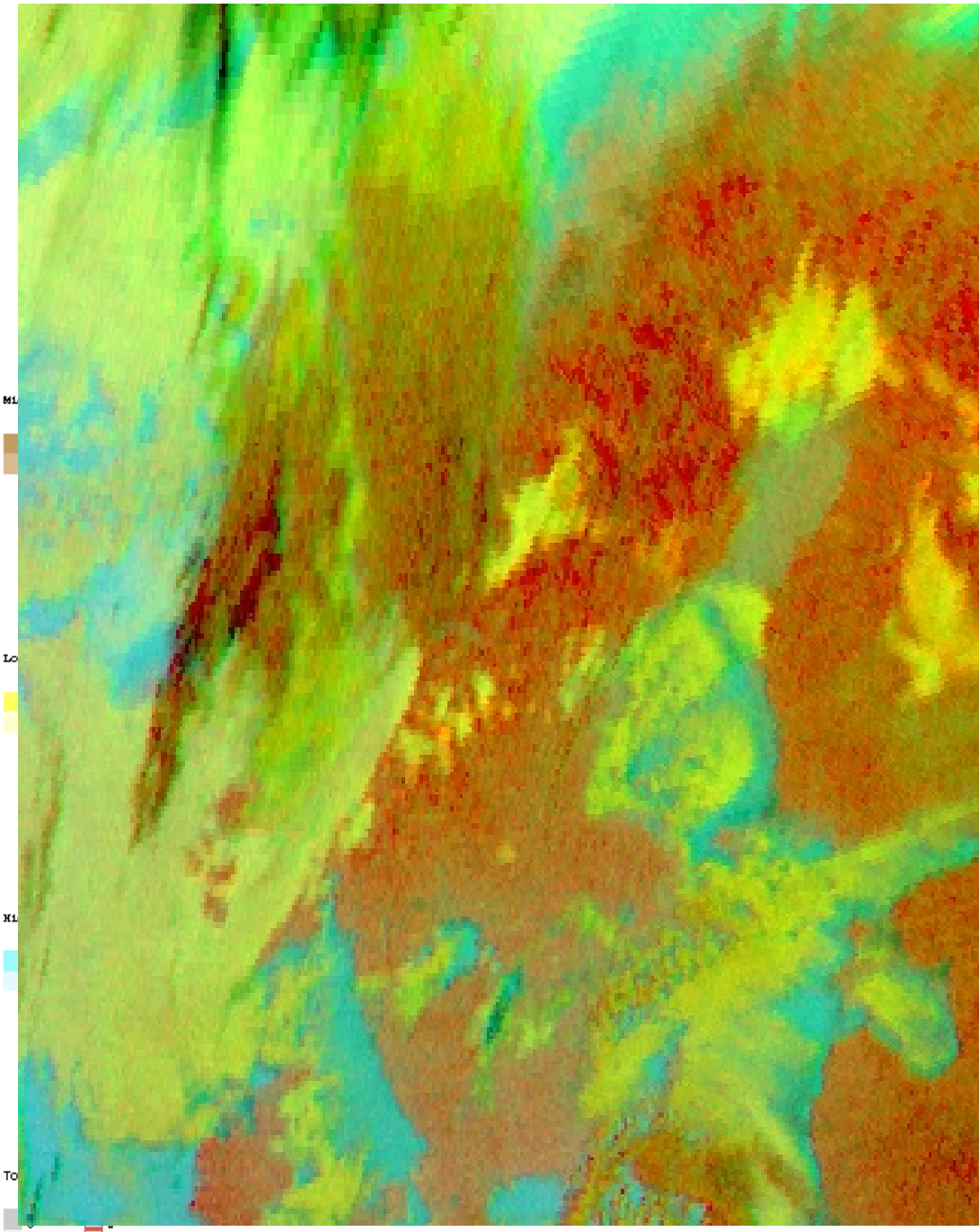
Moderate cold weather (Jan 31 2012, 36h1.4)



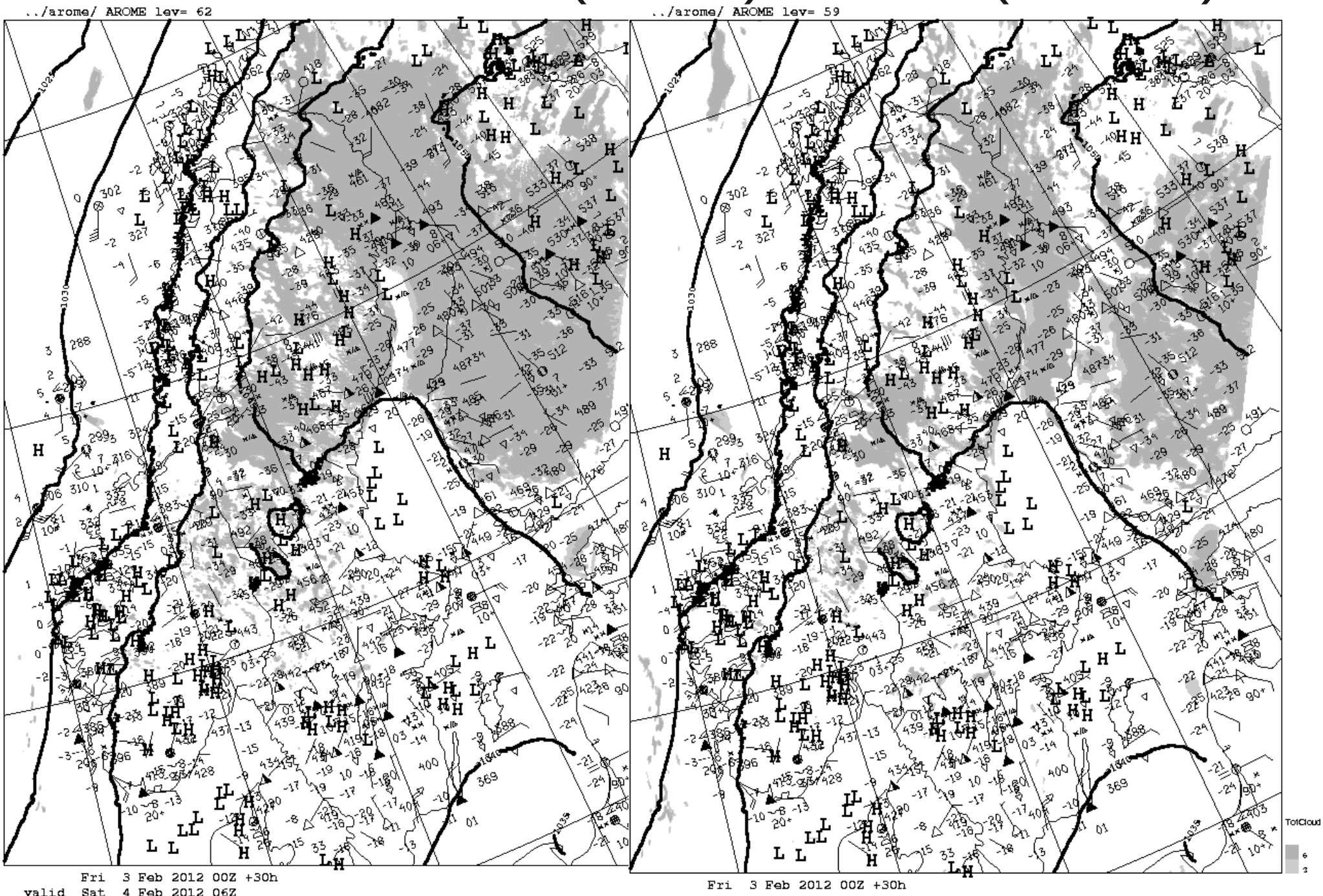


Servere cold weather (Feb 4 2012, h36h1.4)

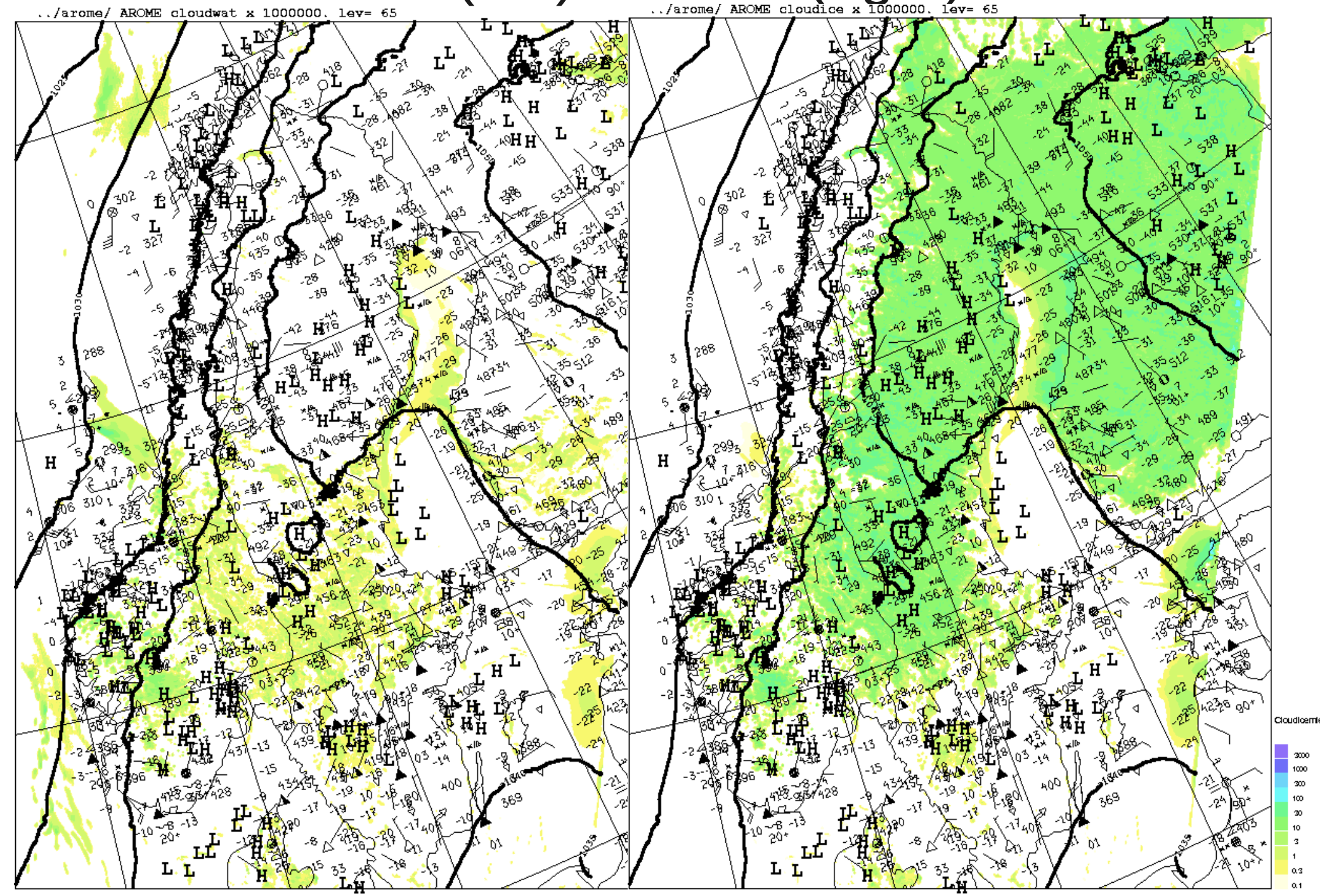




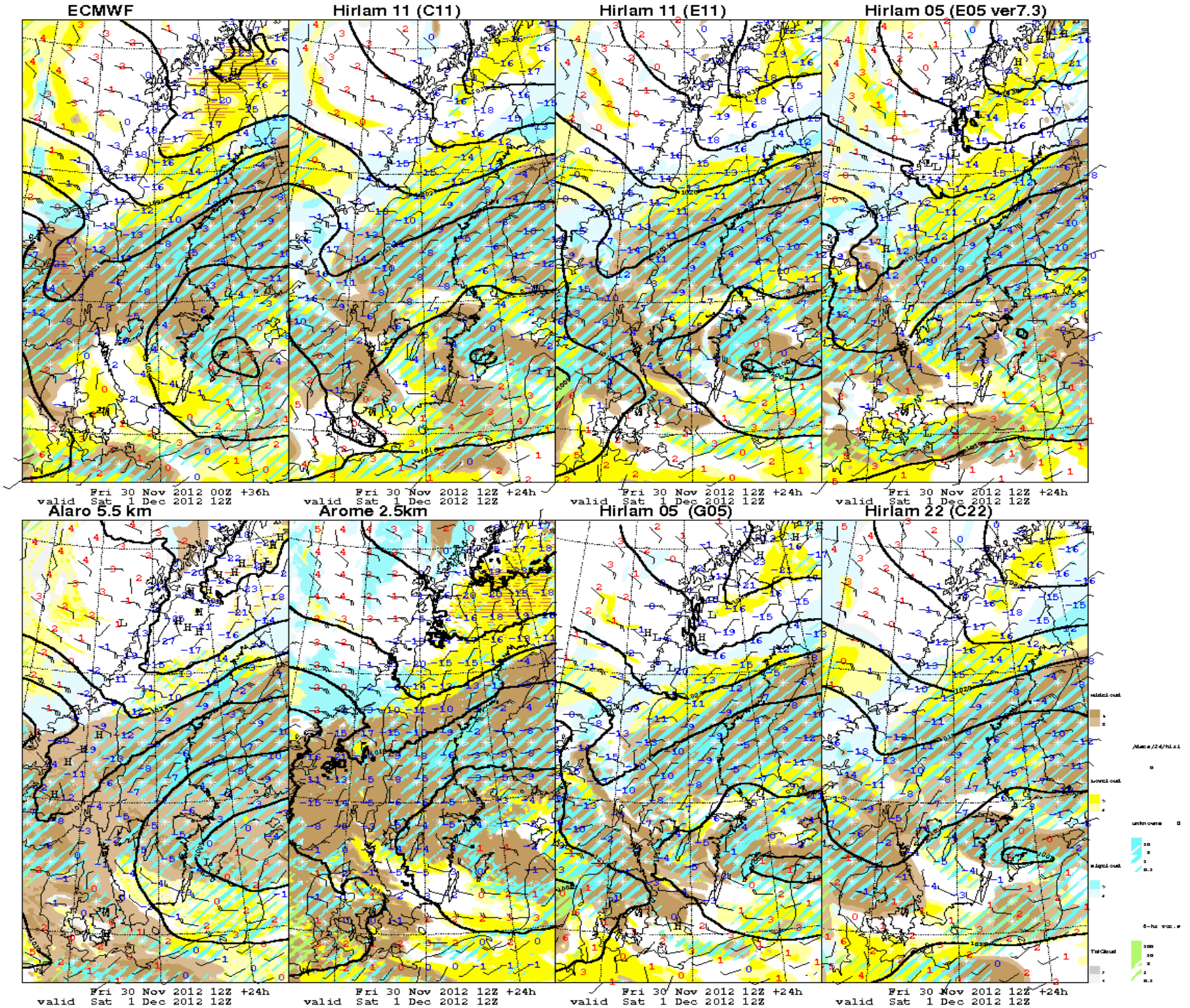
Clouds at lev 62 (~90m) and 59 (~180m)

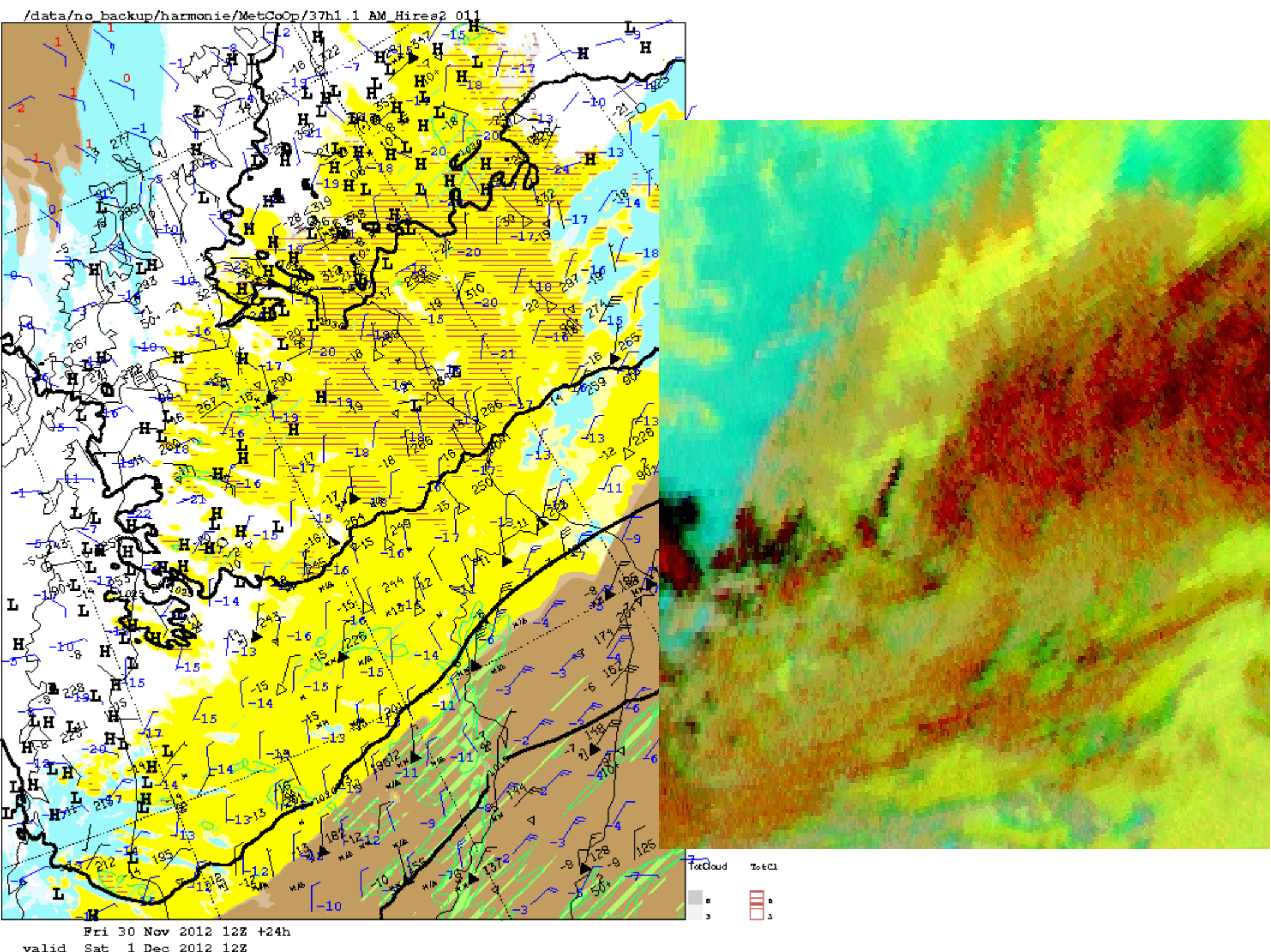


Cloud water(left) and ice (right) at lev 65

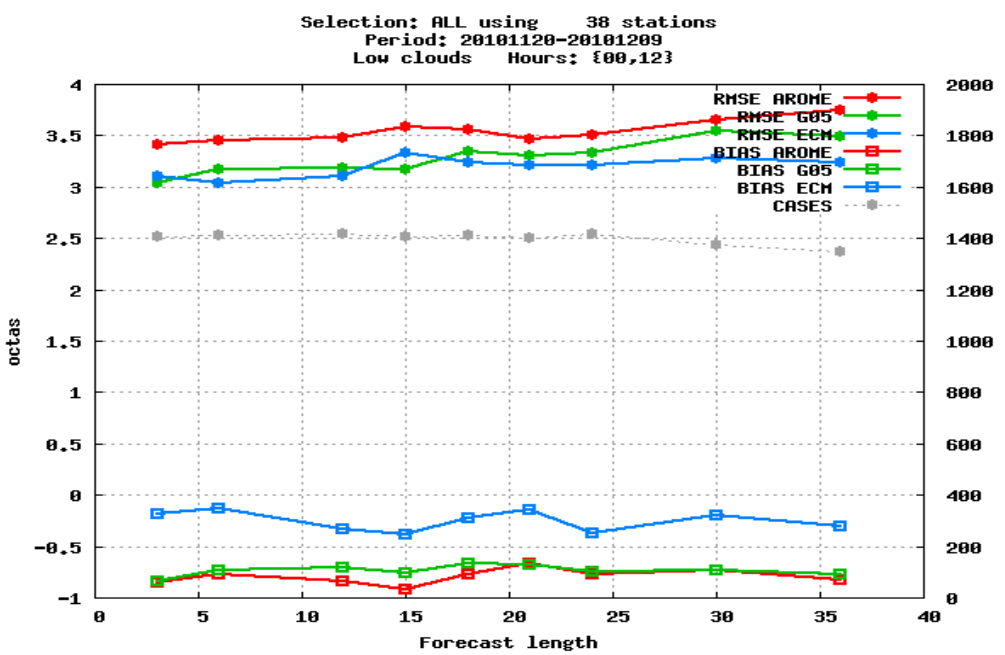


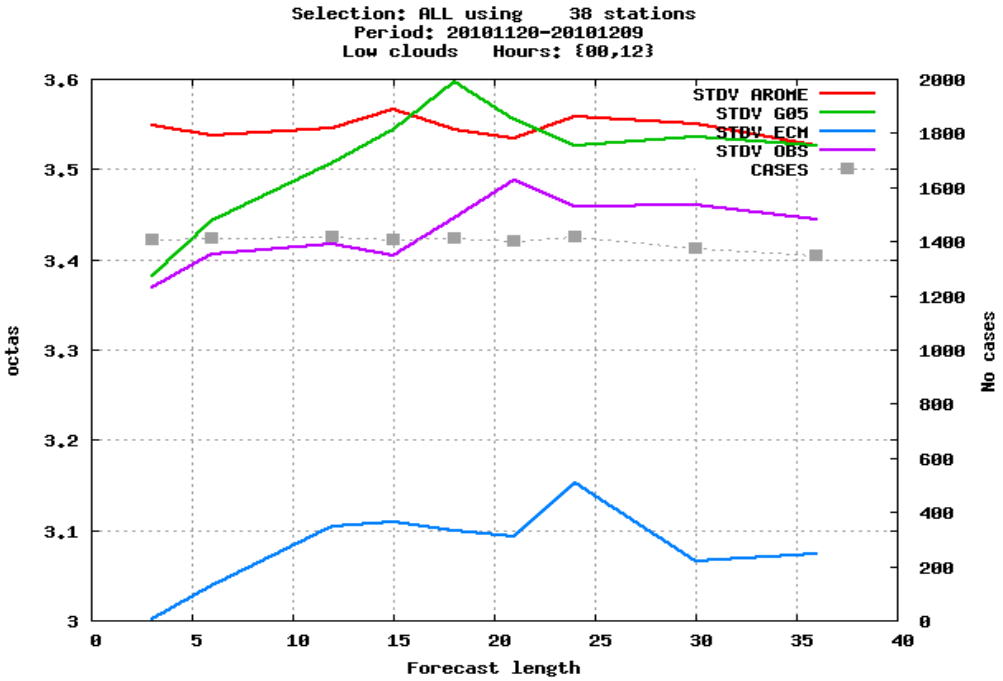
Dec 1 2012 (is 37h1.1 different from 36h1.4?)

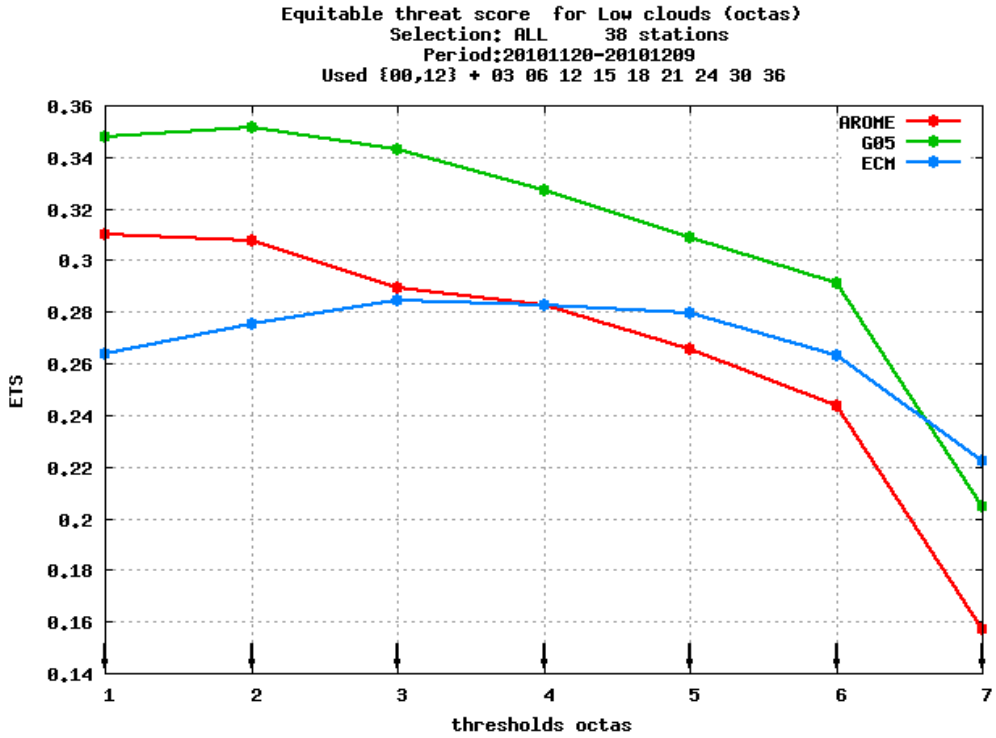


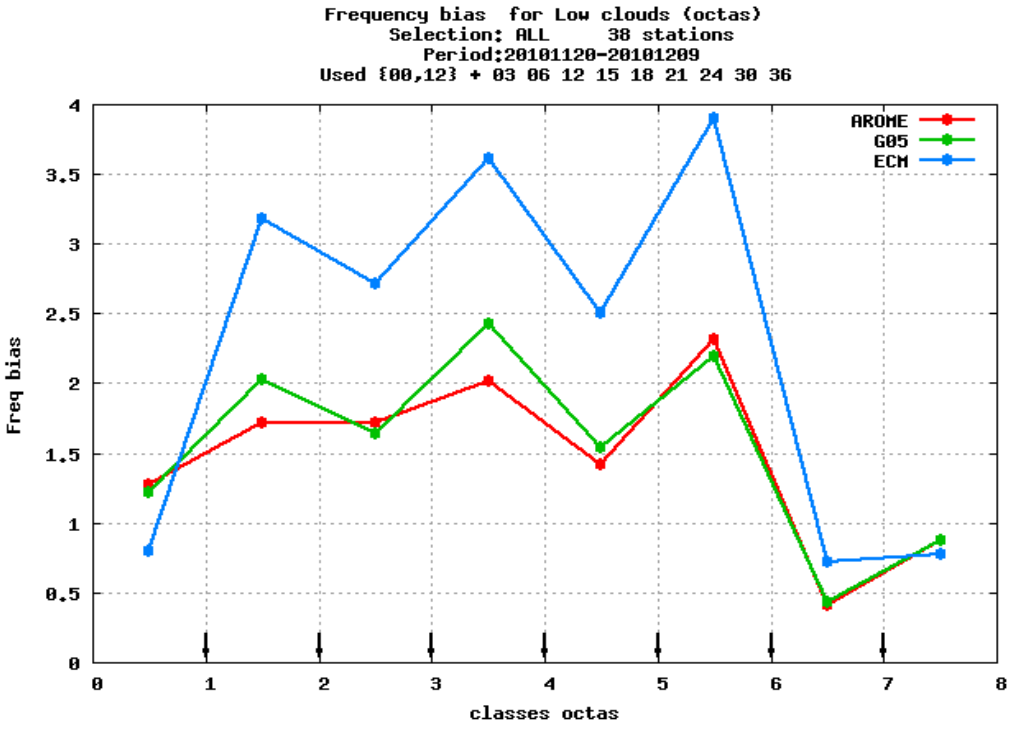

/data/no_backup/harmonie/MetCoOp/37h1.1 AM_Hires2 011
TotCloud
Fri 30 Nov 2012 12Z +24h
valid Sat 1 Dec 2012 12Z

Low clouds 2010-11-20 – 2010-12-09, 37h1.1

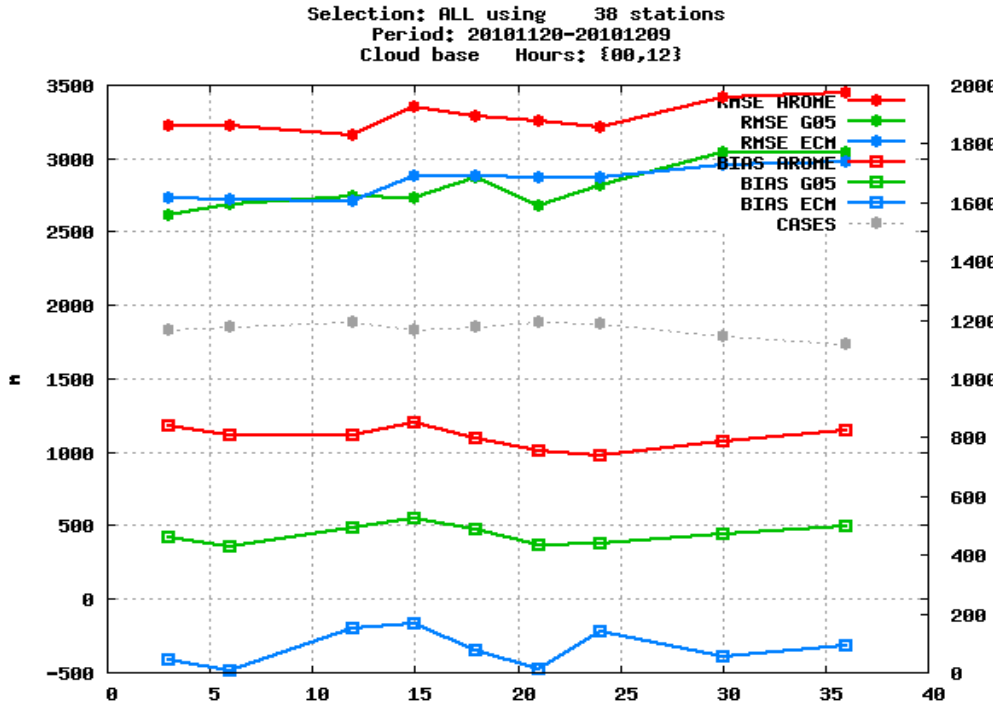


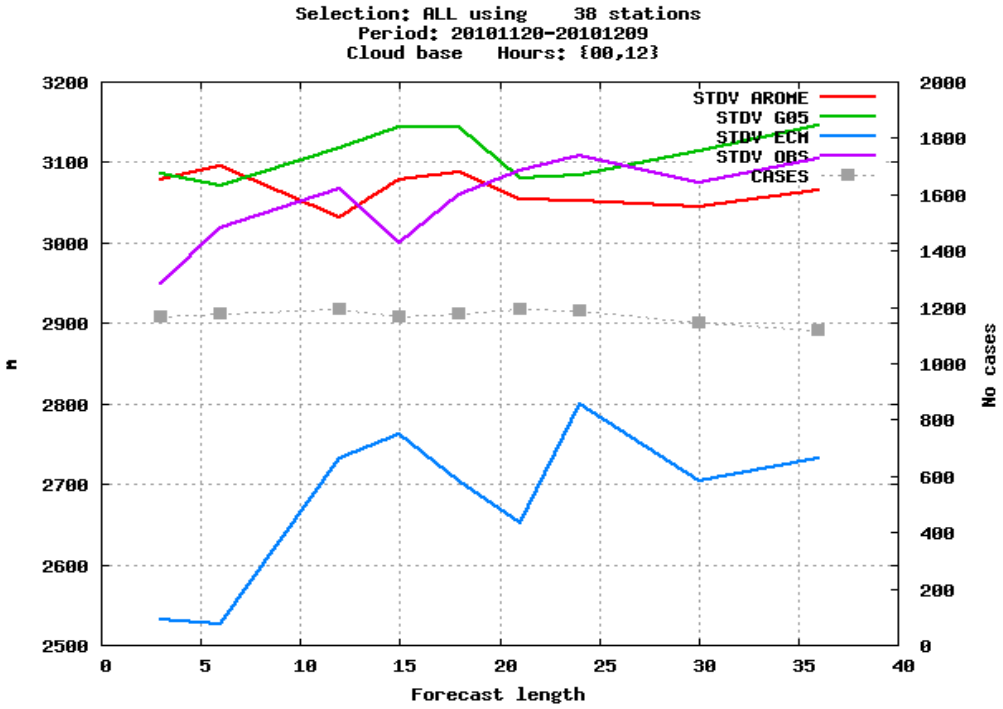


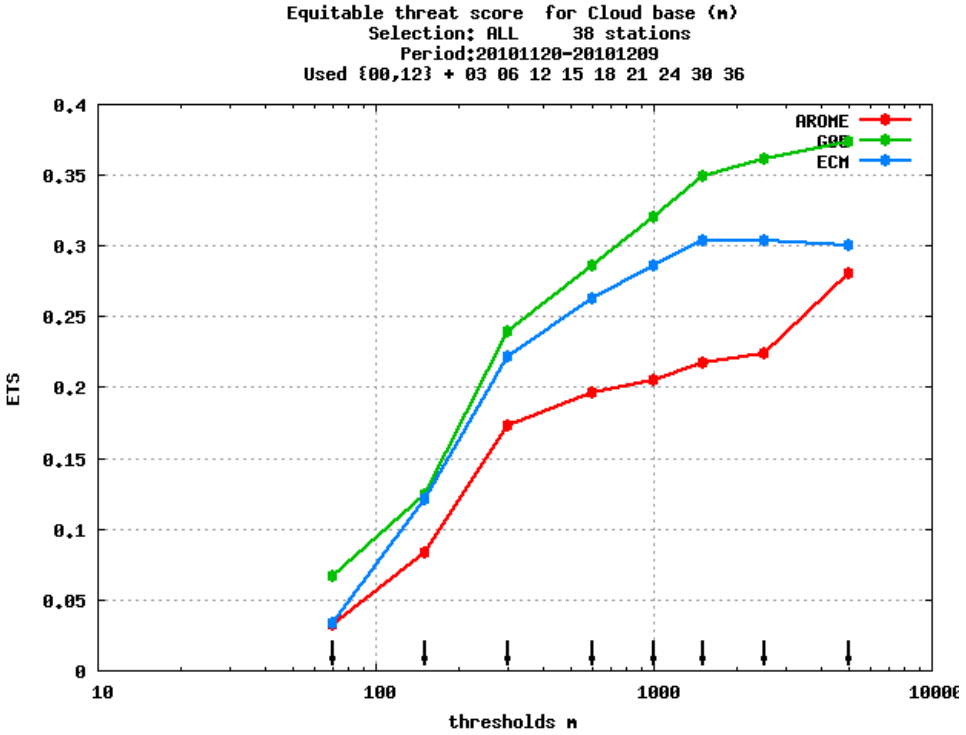


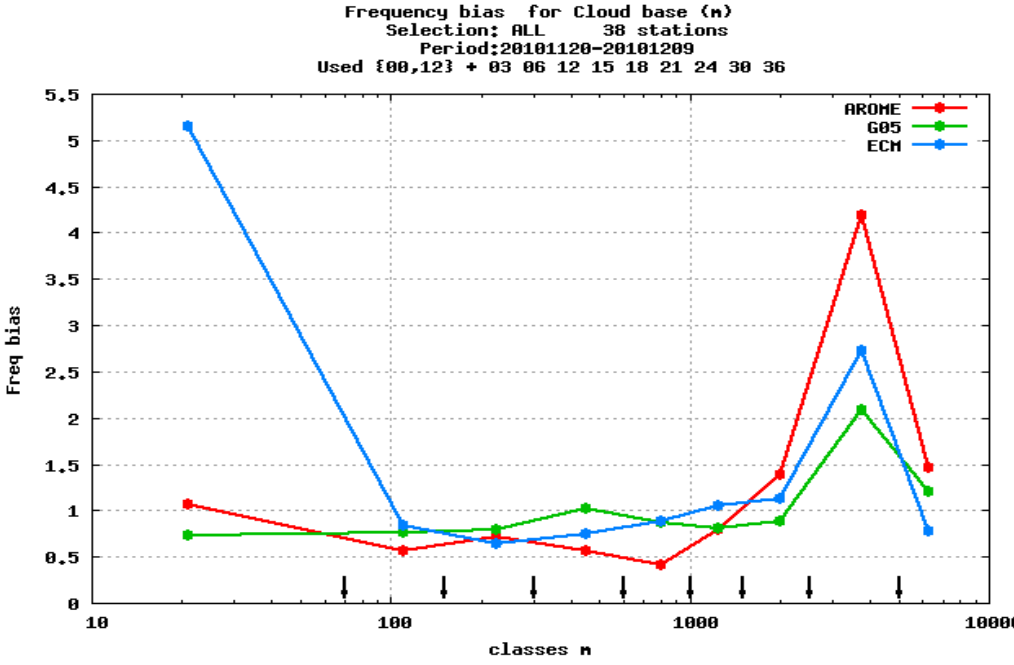


Cloud base 2010-11-20 – 2010-12-09, 37h1.1









Summary

- Arome works fairly well for Nordic SBL - conditions (Best skill of tested models for low cloud bases for non-winter conditions) ...
- ...but...
- Some overprediction of fog (springtime over water, cold inland surface < -20 C, spurious ice-fog)
- Too much low clouds over cold inland surface
- Less performance for cold weather