ILMATIETEEN LAITOS
METEOROLOGISKA INSTITUTET
FINNISH METEOROLOGICAL INSTITUTE

HIRLAM diagnostics for operations and experiments

HIRLAM-ALADIN-MF miniworkshop on mesoscale physics and diagnostic tools

Met.No , 12-13 December 2005

Carl Fortelius, FMI

HIRLAM diagnostics

- **Purpose and methodologies of diagnostics**
- **Diagnostic utilities in the Hirlam NWP system**

Purose and methodologies

- **Is your experiment doing what you think it is?**
  - Monitoring
- **How well is your system performing?**
  - Comparative verification, d/a feedback statistics
- **Reasons or mechanism of for good or bad performace**
  - Analysis of verificatioin data and model output, special observations, case studies

HIRLAM diagnostic utilities

- **D/A monitoring and feedback**
- **Verification system**
- **Diagnostic output**

D/A monitoring 1:

Overview of the HIRLAM RCR online monitoring facility

Observation coverage maps
- soundings
- surface observations
- aircraft and buoys

Analysis increments
- 925 hPa
- 700 hPa
- 500 hPa
- 250 hPa
- 100 hPa
- surface

Observation first-guess/analysis statistics
- TEMP
- PILOT
- AIREP
- SURFACE

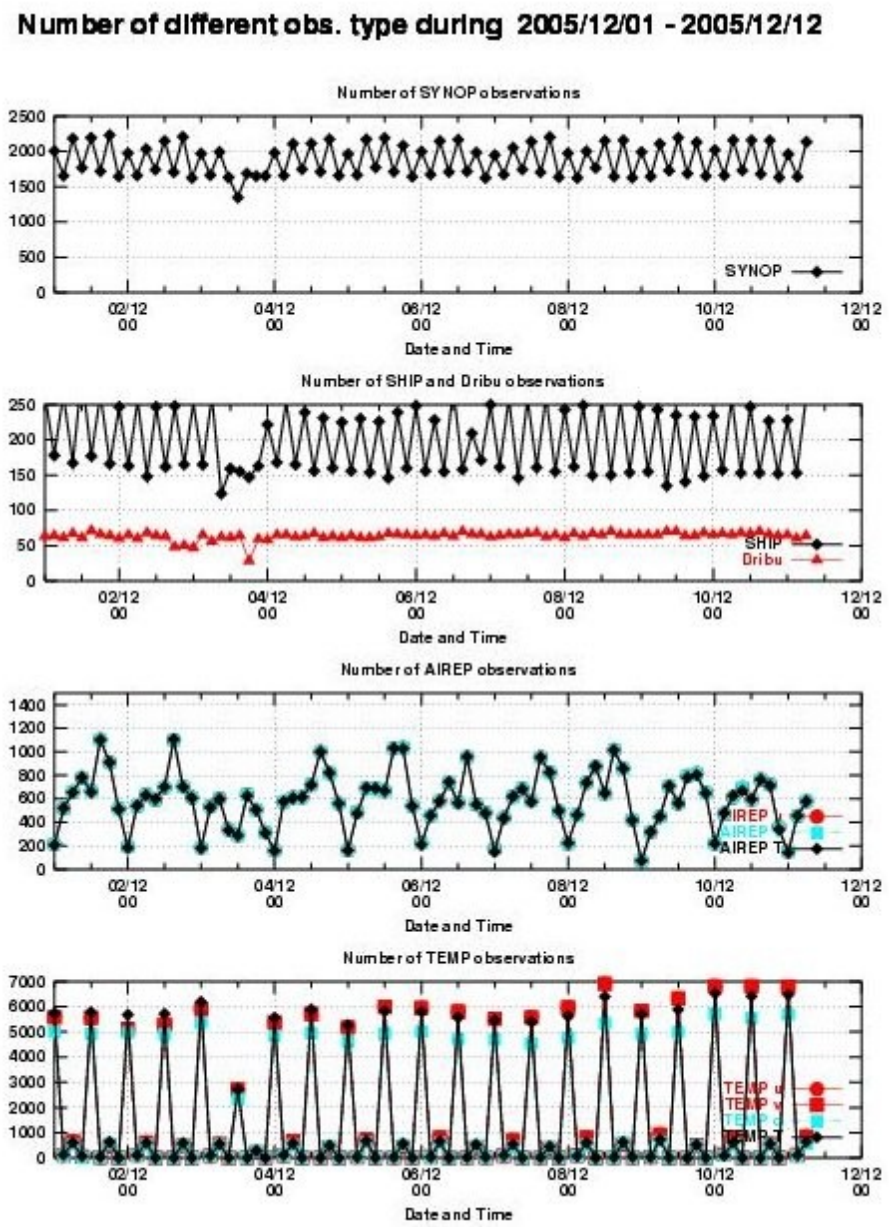
Surface analysis : observations
- snow : Scandinavia
- snow : Europe
- 2m temperature : Scandinavia
- 2m temperature : Europe
- sea surface temperature : Baltic Sea
- sea surface temperature : Atlantic

Surface analysis : fields
- Ice and snow

Environmental maps
- Precipitation, snow etc.
- Snow covered area
- Sea surface temperature

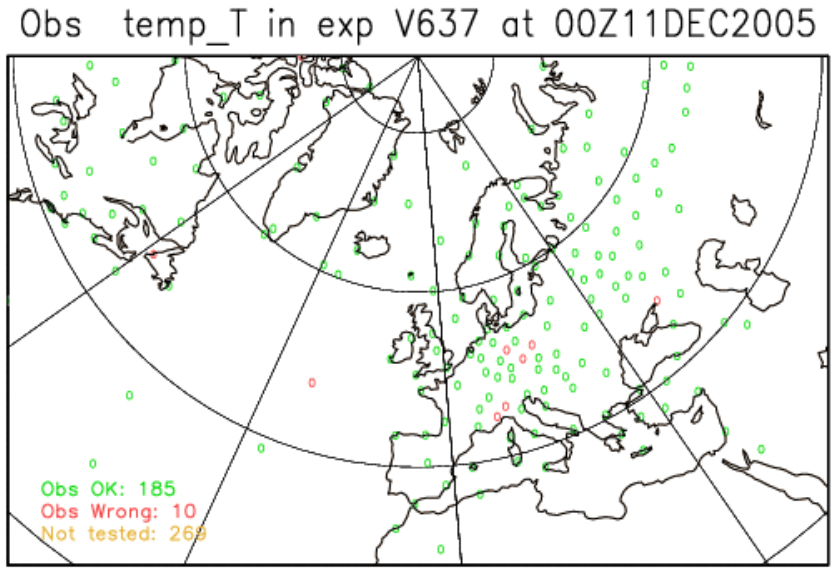
D/A monitoring 2:

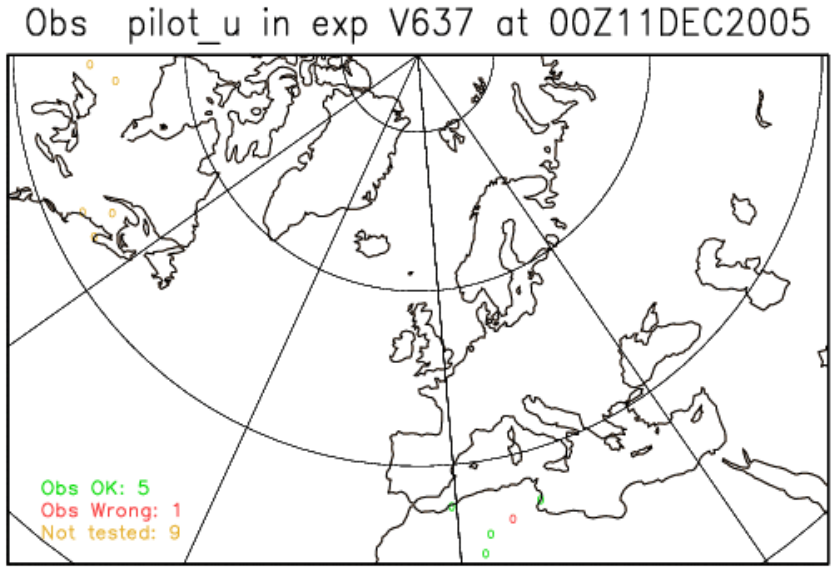
Number of available observations according to type



D/A monitoring 3:

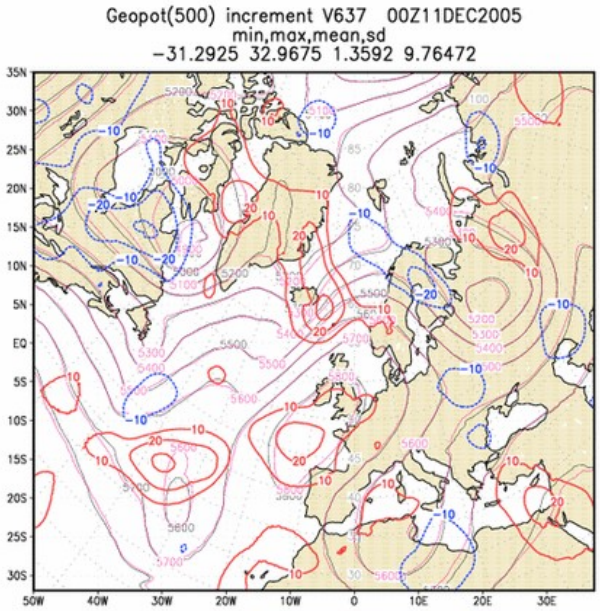
Observation coverage according to type

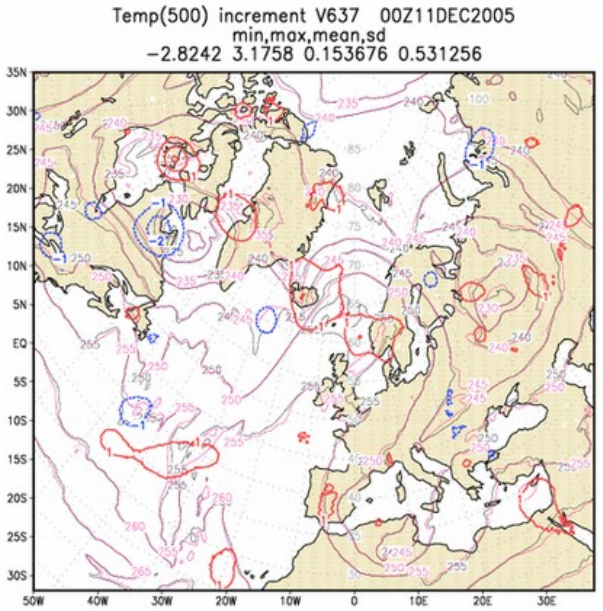


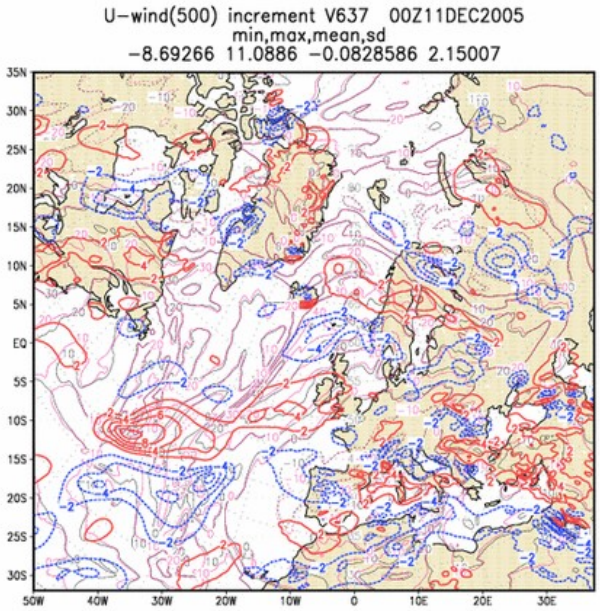


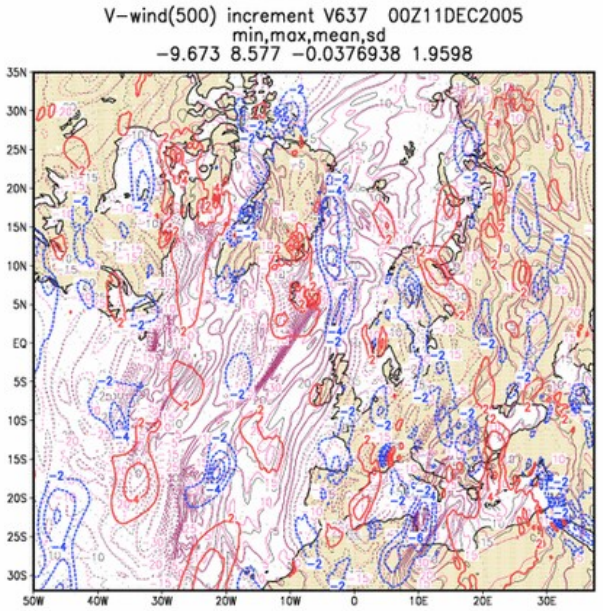
D/A mon. 4:

Increment maps



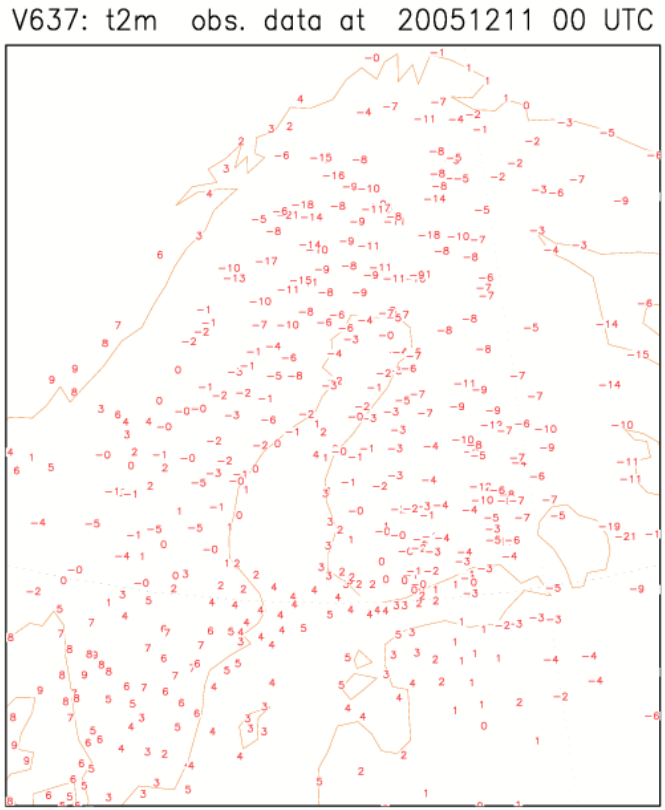


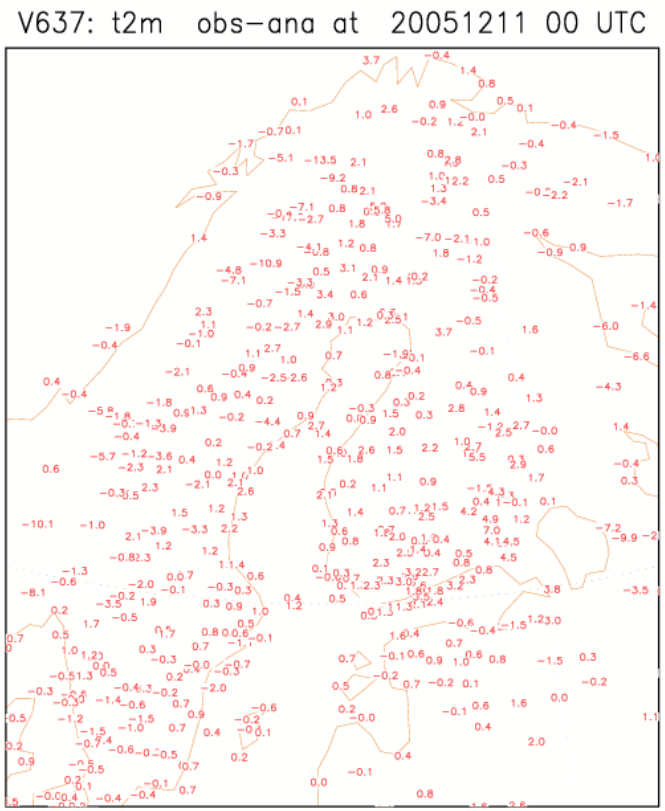




D/A monitoring 5:

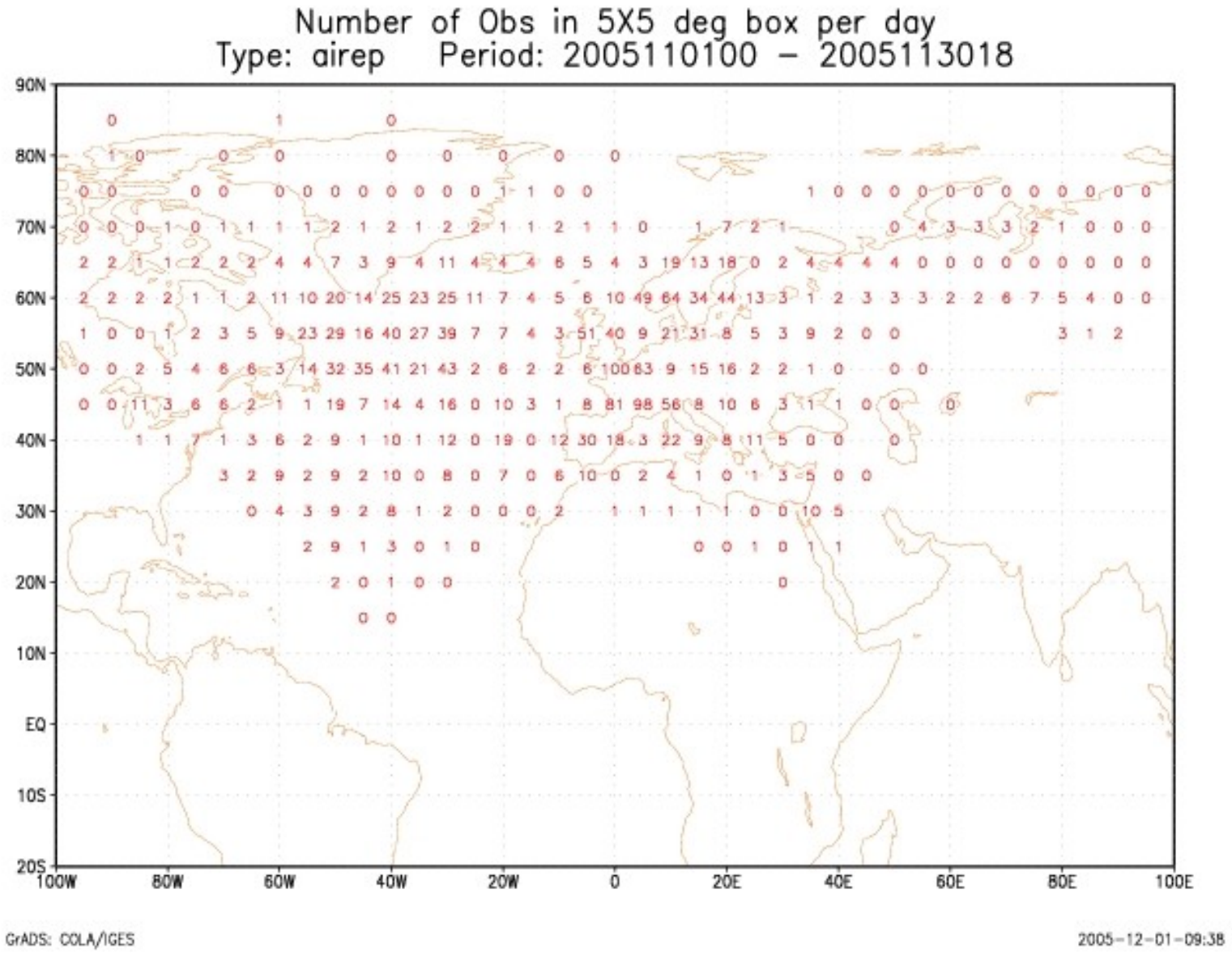
Surface analysis





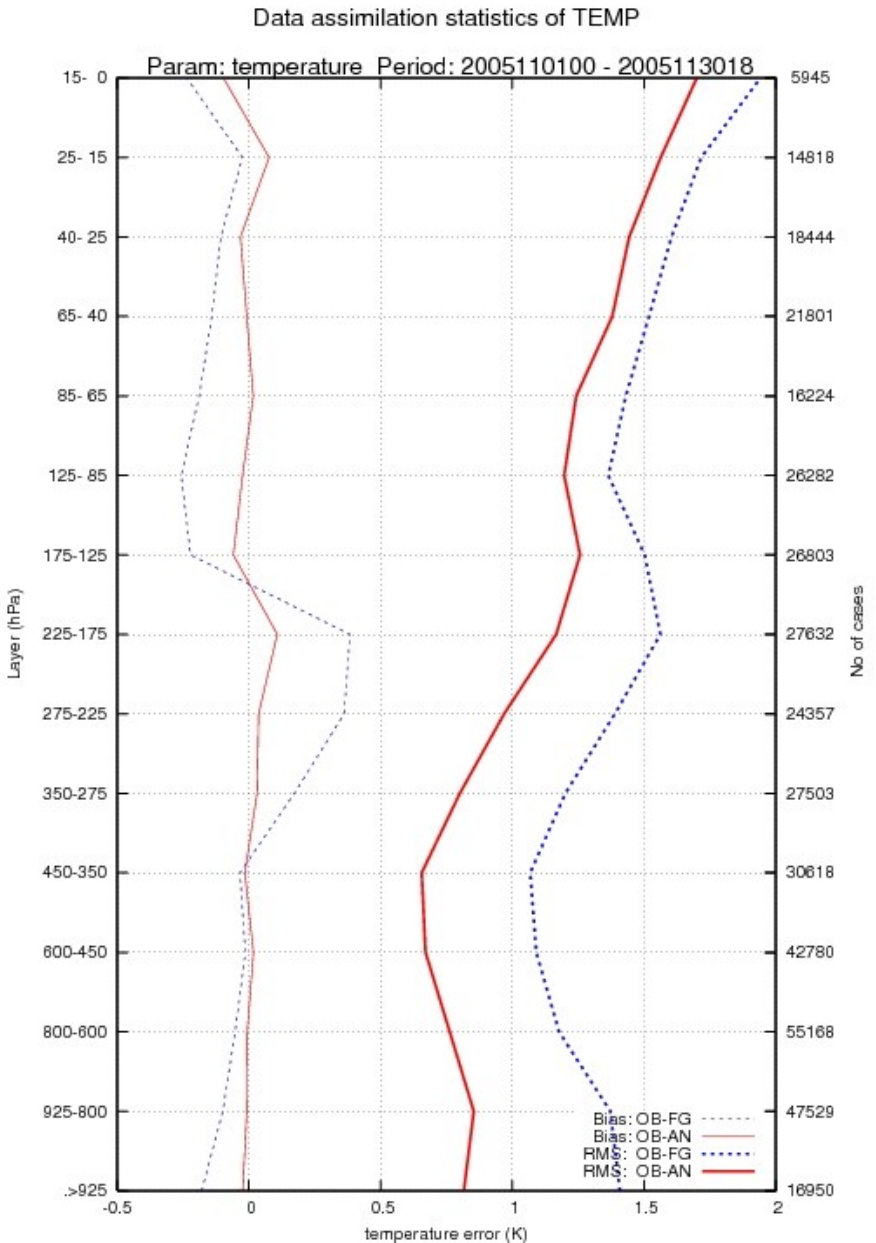
D/A 6:

Obs cov


Number of Obs in 5X5 deg box per day
Type: airep Period: 2005110100 – 2005113018
90N
80N
70N
60N
50N
40N
30N
20N
10N
EQ
10S
20S
100W
80W
60W
40W
20W
0
20E
40E
60E
80E
100E
GrADS: COLA/IGES
2005-12-01-09:38

D/A monitoring 7

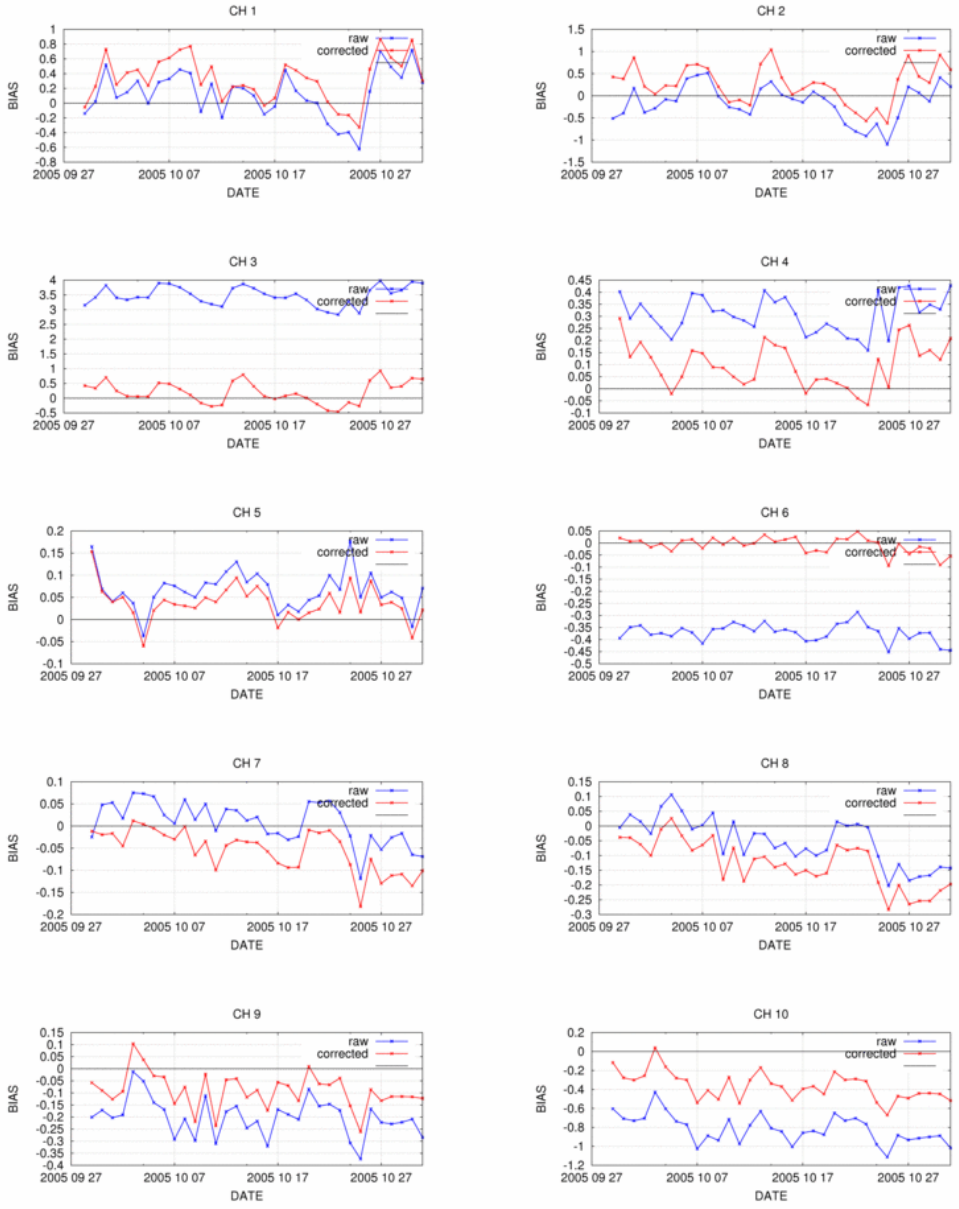
Feedback statistics



D/A monitoring 8:

Satellite data bias correction monitoring

(NOAA 16 AMSU-A)



Verification 1

- **Joint distribution of forecast vs. observation pairs**
  - The “ZOB-files”
- **Clever aggregation and stratification of the joint distributions according to**
  - Time
  - Lead time
  - Geography
  - Values of parameters
  - Etc

Verification 2: field verification

- **Joint distribution of forecast vs. analysis pairs**
- **Clever aggregation and stratification of the joint distributions**
  - Handy, comprehensive, and dangerous

Verification against observations EXP: RCRa

Time: 2005110100 - 2005113018 Domain: LWG | orecast from 00

Monthly Report

HIRLAM RCR

2004
- June
- July
- August
- September
- October
- November
- December

2005
- January
- February
- March
- April
- May
- June
- July
- August
- September
- October
- November

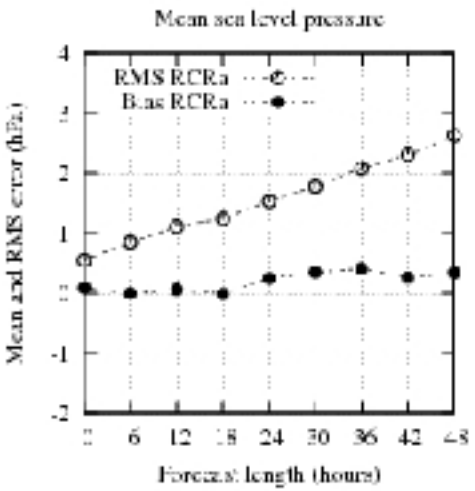
Obs.Statistics

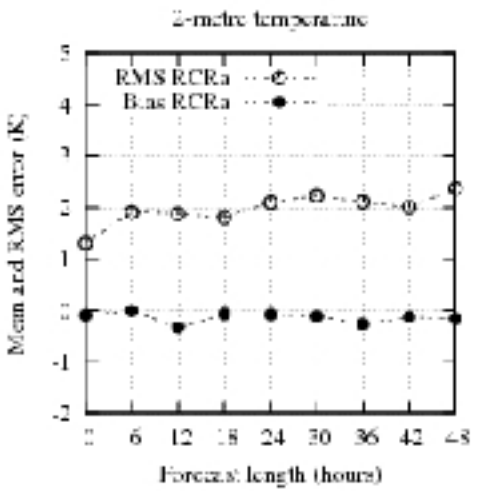
Obs.Verification

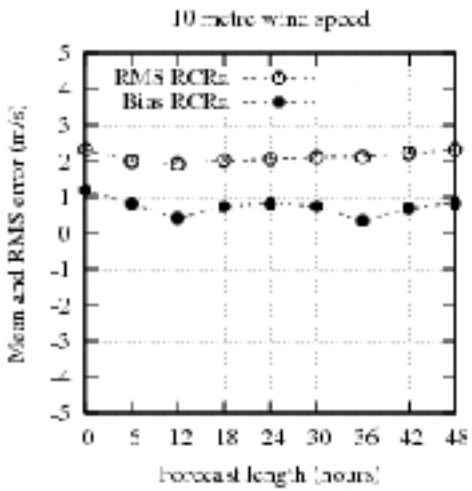
Field Verification

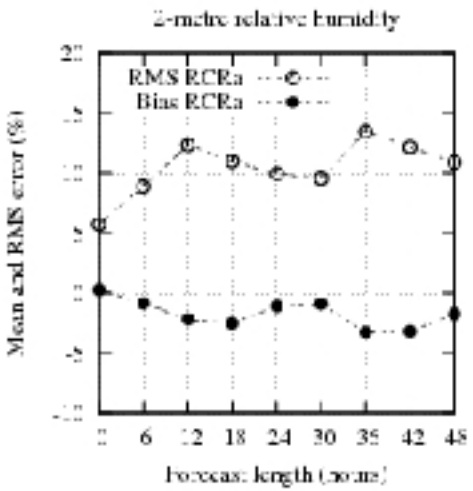
Obs.Coverage

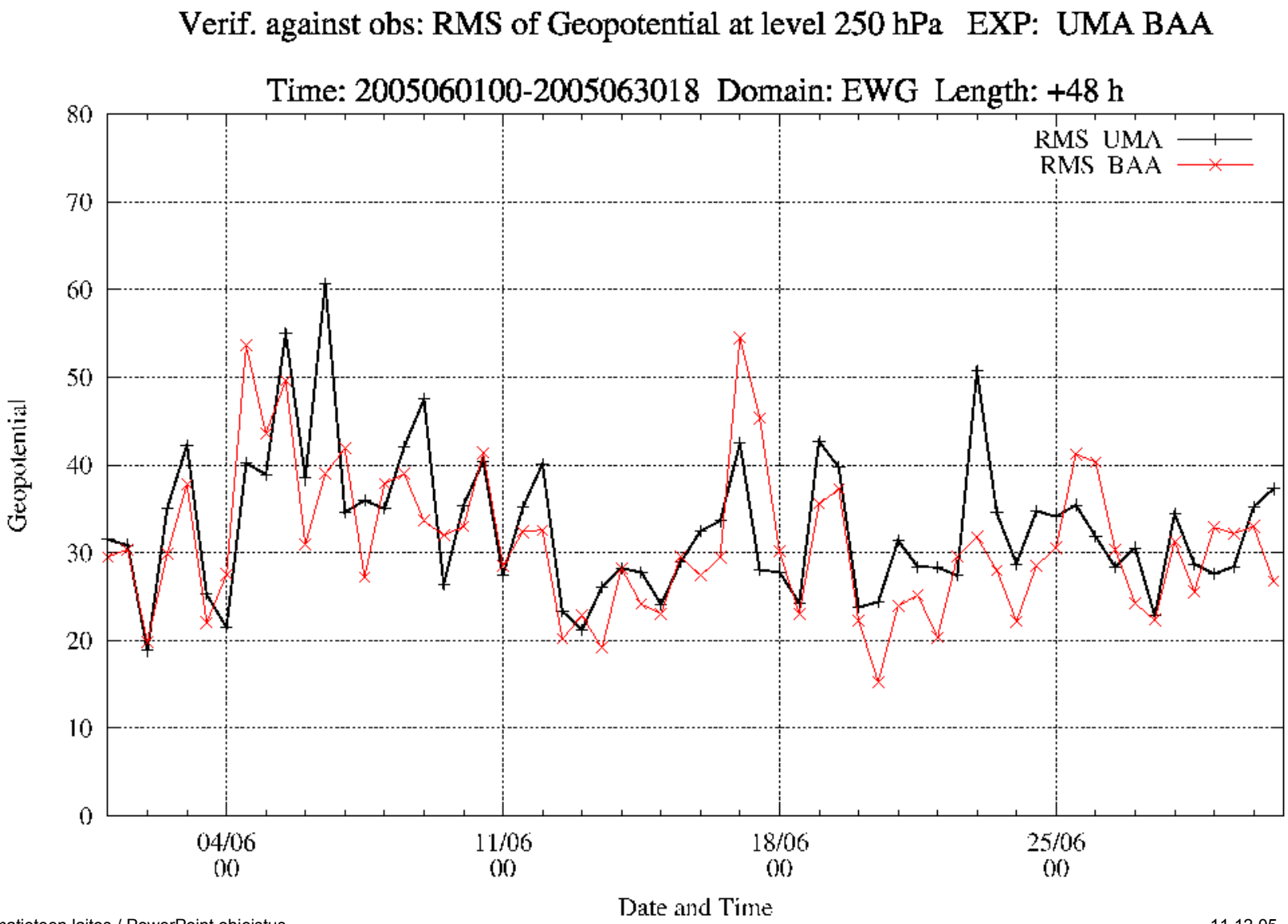
T2mBias Verification





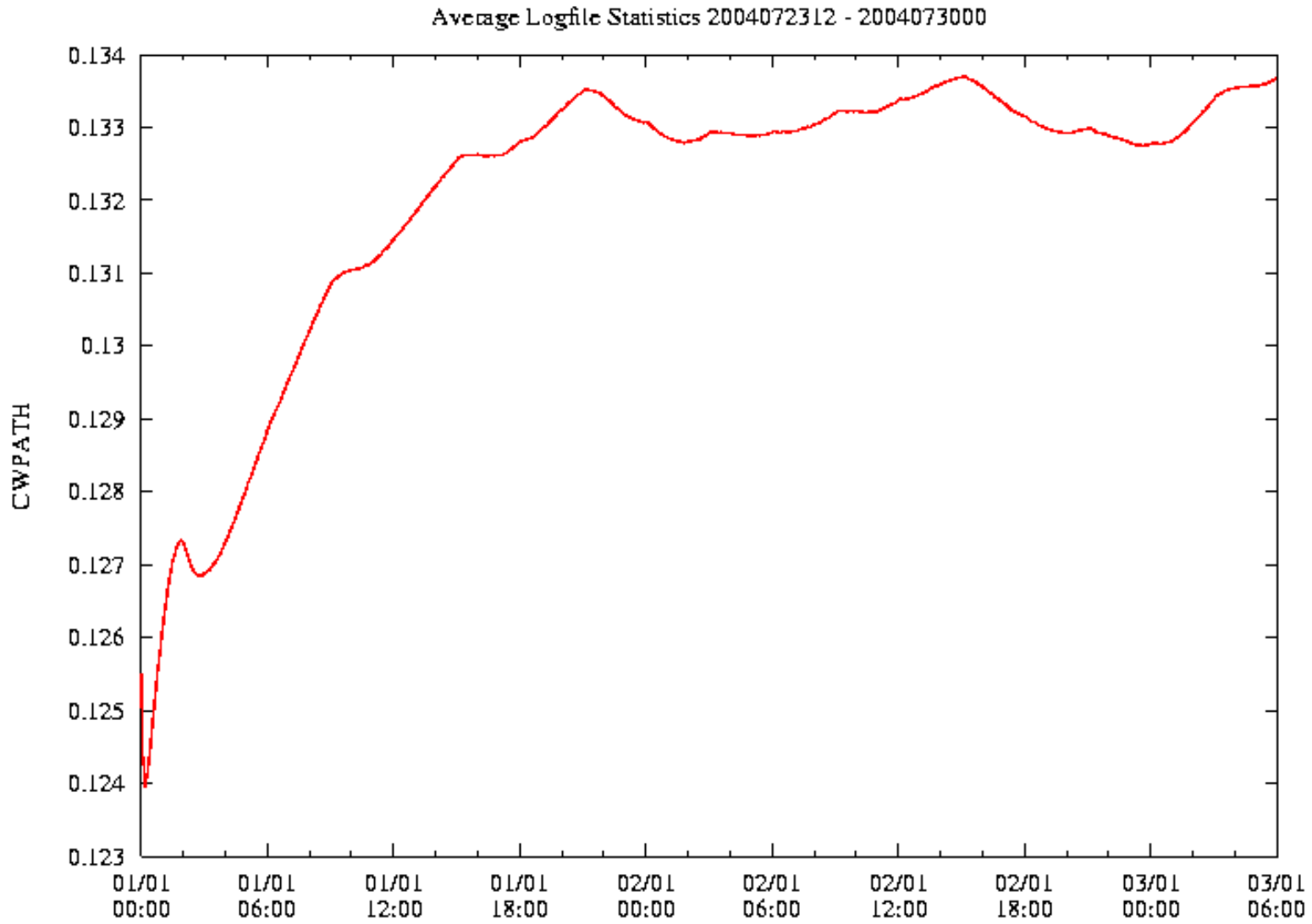





Verif. against obs: RMS of Geopotential at level 250 hPa EXP: UMA BAA
Time: 2005060100-2005063018 Domain: EWG Length: +48 h
RMS UMA
RMS BAA
Geopotential
80
70
60
50
40
30
20
10
0
04/06
00
11/06
00
18/06
00
25/06
00
Date and Time

Diagnostic output 1

- **Log files**
  - Average time step values:
    - Pressure,
    - Total, potentital, and kinetic energy
    - Speific humdity, cloud water content, cloud water path
    - Low, medium, high clouds
    - Cloud base, cloud top
    - Total, grid-scale, and sub grid-scale rain rate
    - Turbulent surface fluxes: sensible and latent heat, scalar momentum flux

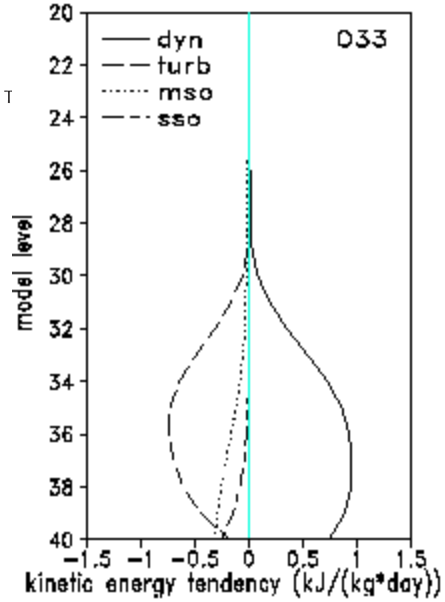

Average Logfile Statistics 2004072312 - 2004073000
CWPATH
0.134
0.133
0.132
0.131
0.13
0.129
0.128
0.127
0.126
0.125
0.124
0.123
01/01 00:00
01/01 06:00
01/01 12:00
01/01 18:00
02/01 00:00
02/01 06:00
02/01 12:00
02/01 18:00
03/01 00:00
03/01 06:00

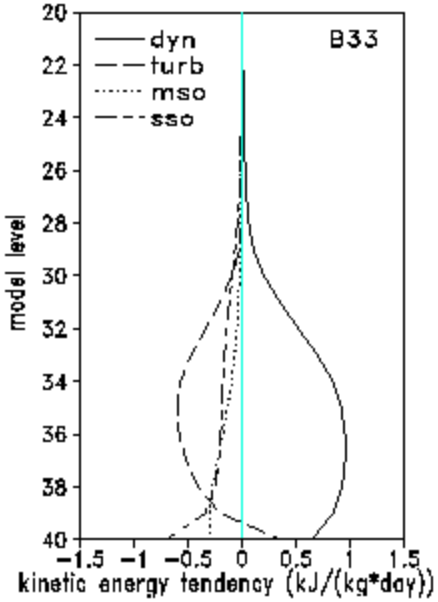
Diagnostic output 2

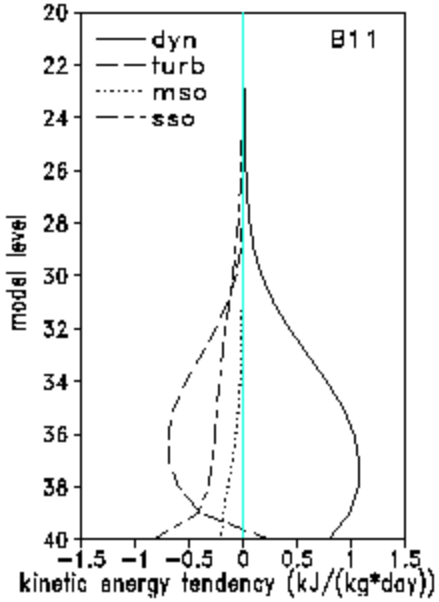
- **Selected forecast fields**
  - Cumulative fluxes
    - Surface: turbulent sensible and latent heat flux, up and down welling short and long wave radiation, turbulent flux of momentum
    - Outer boundary (“T.O.A”): up and down welling radiation
    - Total, grid-scale and sub grid-scale precipitation

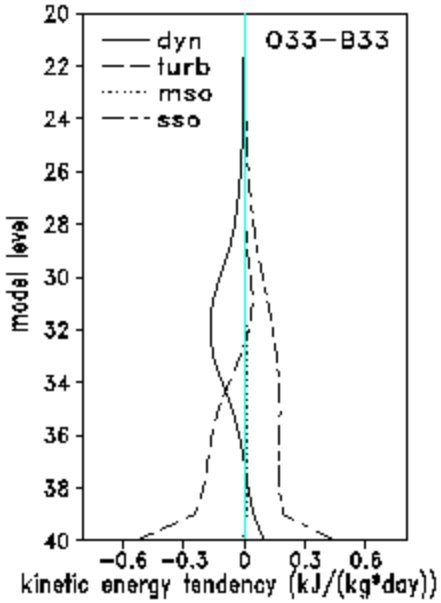
Diagnostic output 3

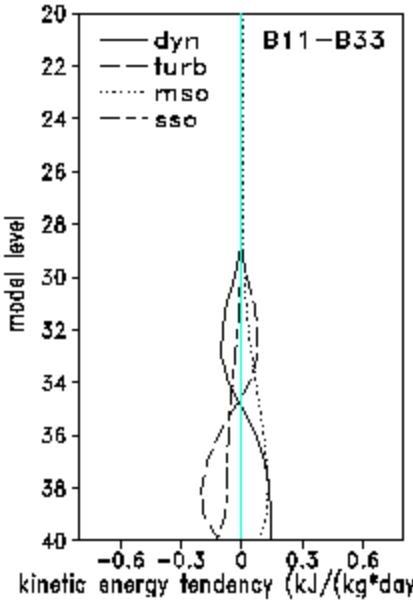
- **Selected forecast fields (continued)**
  - Cumulative 3D tendencies:
    - Temperature: total, radiation, v. diffn
    - Spec. hum: total, v. diffn
    - Cloud cds.: total, v. diffn
    - u and v : total, v. diffn, small scale orogr.
  - Closed and fairly detailed budgets of dry air, energy, water, and momentum are available


dyn
turb
mso
sso
O33
model level
kinetic energy tendency (kJ/(kg*day))


dyn
turb
mso
sso
B33
model level
kinetic energy tendency (kJ/(kg*day))


dyn
turb
mso
sso
B11
model level
kinetic energy tendency (kJ/(kg*day))


dyn
turb
mso
sso
O33−B33
model level
kinetic energy tendency (kJ/(kg*day))


dyn
turb
mso
sso
B11−B33
model level
kinetic energy tendency (kJ/(kg*day))

Conclusions

- **HIRLAM generates a wealth of diagnostic information**
- **It is up to the scientists to turn the information into knowledge**

Mallisivu,

Mikäli on välttämätöntä laittaa samalle sivulle enemmän tekstiä kuin on suositeltu, niin tekstin pistekoko valitaan tarpeen mukaan.

Huom! kovin pieni teksti ei ole hyvin luettavissa.

Mikäli haluat tekstin ilman pallukoita niin siirry pallukan oikealle puolelle ja poista merkki askelpalautin (backspace) näppäimellä. Seuraavat rivit tulevat ilman pallukkaa.

Vestibulum ut nunc non enim semper placerat. Integer in mauris a enim feugiat hendrerit.

Mallisivu, tekstiä ja kuvaa Arial 32 pt

Lorem ispsum sit dolor amet

Feas dorol ispum ester:

- Vestibulum ut nunc non enim semper placerat. Integer in mauris a enim feugiat hendrerit
- Vestibulum ut nunc non enim semper placerat. Integer in mauris a enim feugiat hendrerit

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Otsikko ja vapaa suunnittelusivu

Suositeltavat marginaalit

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