HIRLAM-A: some highlights and challenges

J. Onvlee

EWGLAM meeting Exeter, 20101004

Highlights and challenges (1): (Upper air) data assimilation

Algorithms:

- HARMONIE 3D-VAR: local ensDA-based structure functions, large extension zone, start with RUC experiments
- Continued development of HARMONIE 4D-VAR.
- HIRLAM 4D-VAR: Jk for blending large scale structure
- Development of ETKF, started study of hybrid ensemble DA techniques

Highlights and challenges (1): (Upper air) data assimilation

Algorithms:

- HARMONIE 3D-VAR: local ensDA-based structure functions, large extension zone, start with RUC experiments
- Continued development of HARMONIE 4D-VAR.
- HIRLAM 4D-VAR: Jk for blending large scale structure
- Development of ETKF, started study of hybrid ensemble DA techniques

Challenge:

- determine best DA setup for mesoscale

Highlights and challenges (1): (Upper air) data assimilation

Algorithms:

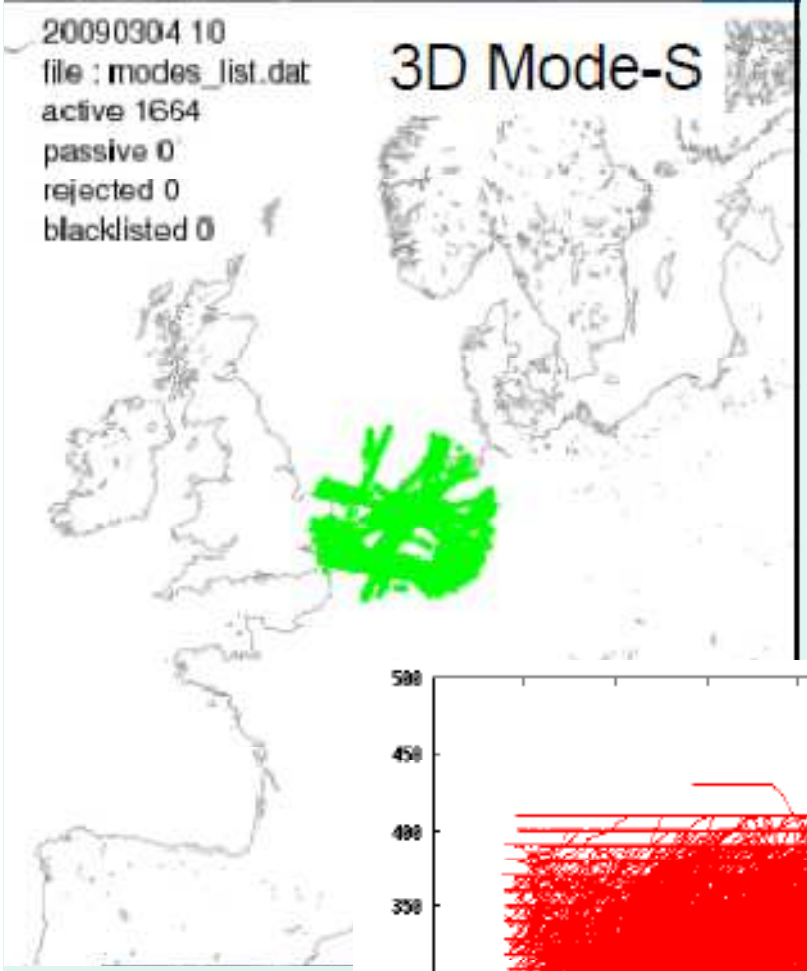
- HARMONIE 3D-VAR: local ensDA-based structure functions, large extension zone, start with RUC experiments
- Continued development of HARMONIE 4D-VAR.
- HIRLAM 4D-VAR: Jk for blending large scale structure
- Development of ETKF, started study of hybrid ensemble DA techniques

Challenge:

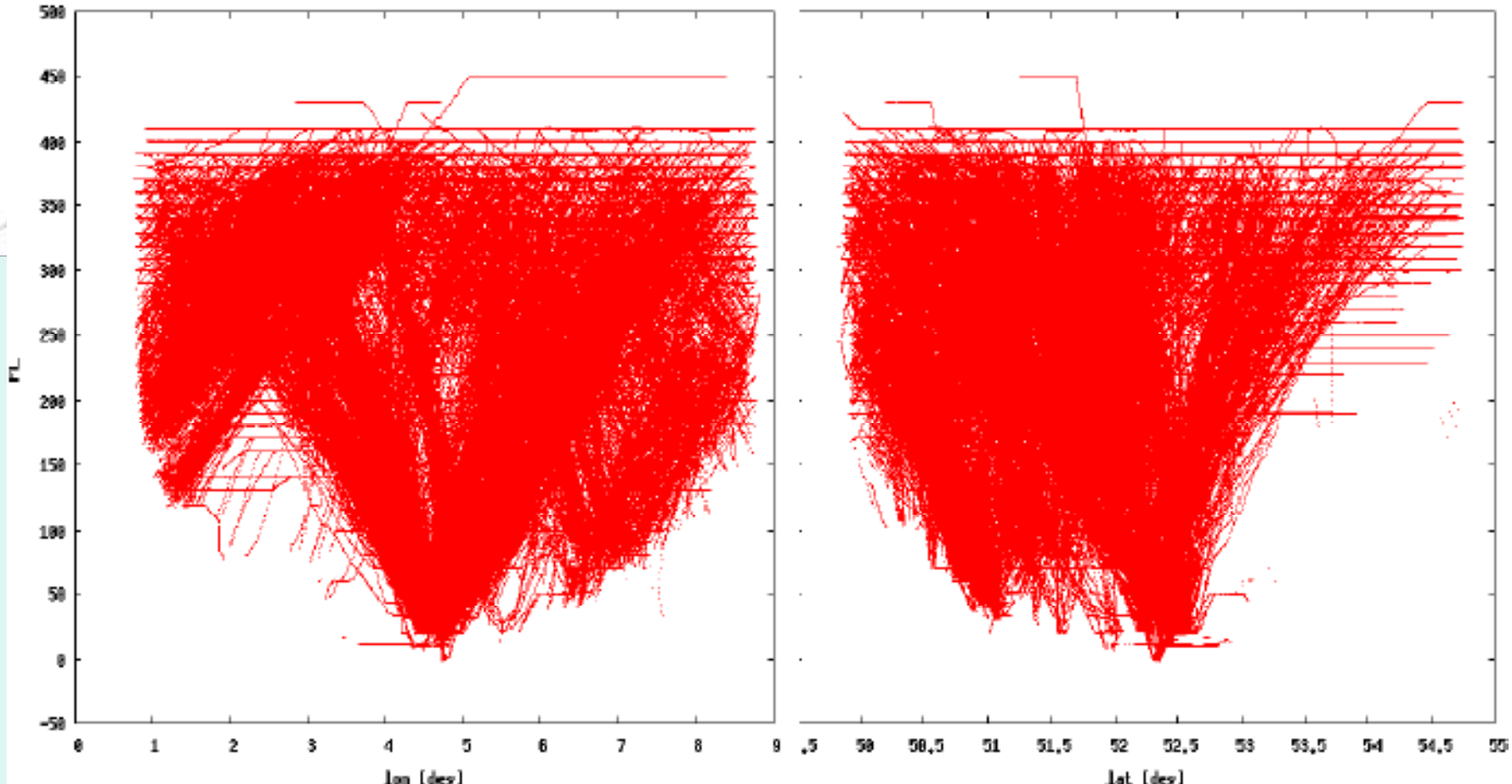
- determine best DA setup for mesoscale

Impact assessment of remote sensing obs:

- Participation HIRLAM/Harmonie-4km in EUCOS OSE experiments
- Radar reflectivity/wind assimilation: focus on ingest of different radars
- ModeS: new data source of potential interest. Impac assessment ongoing.



- **High data volume, quality fairly good**
- **Impact assessment being done**
- **Requires arrangements with aviation authorities**



Highlights and challenges (1): (Upper air) data assimilation

Algorithms:

- HARMONIE 3D-VAR: local ensDA-based structure functions, large extension zone, start with RUC experiments
- Continued development of HARMONIE 4D-VAR.
- HIRLAM 4D-VAR: Jk for blending large scale structure
- Development of ETKF, started study of hybrid ensemble DA techniques

Challenge:

- determine best DA setup for mesoscale

Impact assessment of remote sensing obs:

- Participation HIRLAM/Harmonie-4km in EUCOS OSE experiments
- Radar reflectivity/wind assimilation: focus on ingest of different radars
- ModeS: new data source of potential interest
- Challenge: how to get the best out of radar observations? Cloud assimilation?

Highlights and challenges (2): Upper air physics and dynamics

HARMONIE:

- Dynamics: NH VFE scheme, less diffusive SL scheme
- Experiments to determine optimal nesting strategy
- Physics:
  - “3D” turbulence and microphysics sensitivity studies
  - EDMF-M adaptations to improve treatment of fog/stratocumulus over sea
  - Large domains desirable to capture convective development well
- RCM community: ECMWF physics introduced as option

Highlights and challenges (2): Upper air physics and dynamics

HARMONIE:

- Dynamics: NH VFE scheme, less diffusive SL scheme
- Experiments to determine optimal nesting strategy
- Physics:
  - “3D” turbulence and microphysics sensitivity studies
  - EDMF-M adaptations to improve treatment of fog/stratocumulus over sea
  - Large domains desirable to capture convective development well
- RCM community: ECMWF physics introduced as option

Challenge:

complicated science => learn from each other as much as possible!

Highlights and challenges (2): Upper air physics and dynamics

HARMONIE:

- Dynamics: NH VFE scheme, less diffusive SL scheme
- Experiments to determine optimal nesting strategy
- Physics:
  - “3D” turbulence and microphysics sensitivity studies
  - EDMF-M adaptations to improve treatment of fog/stratocumulus over sea
  - Large domains desirable to capture convective development well
- RCM community: ECMWF physics introduced as option

Challenge:

complicated science => learn from each other as much as possible!

HIRLAM:

- Developments to be wrapped up in versions 7.3 and 7.4 (alpha-release Dec 2010), apart from:
- ENVIRO-HIRLAM: studies of impact chemistry/aerosols on atmosphere, “3D” radiation.

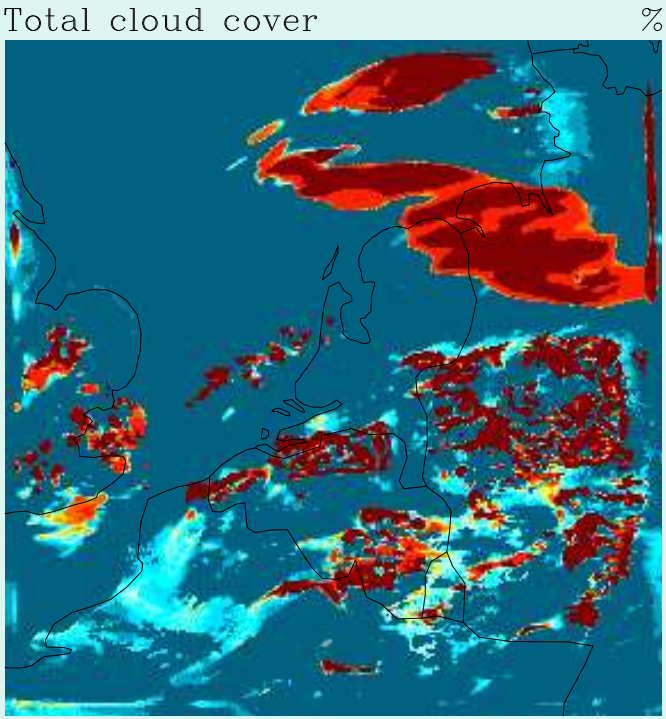
Enhanced description of fog/low clouds:

Improved low cloud over sea:

MODIS

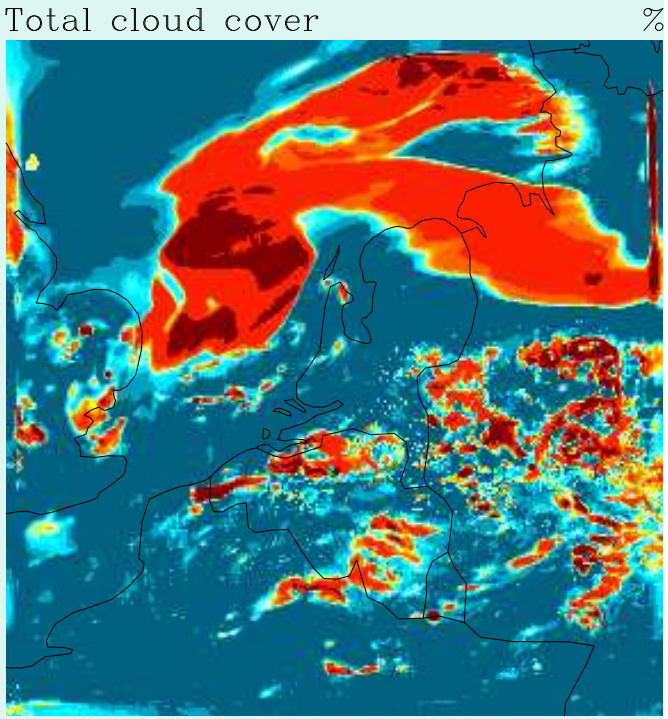
EDKF

EDKF VT=2008051312 (+36h)



Adapted EDMF

EDMFm+ VT=2008051312 (+36h)



Highlights and challenges (3): Surface

HARMONIE:

- Surface DA (OI) and surface scaling introduced, validation ongoing. Preparations for introduction of EKF for soil moisture, later for other sat data.
  - (Scalability and efficiency of different parts of code)
- Snow analysis under development
- Flake: 2d lake workshop Sep2010. Development / validation of snow over ice parametrizations. Extended lake database made available.

HIRLAM:

- Past winter: Snow and lake initialization issues.

Highlights and challenges (3): Surface

HARMONIE:

- Surface DA (OI) and surface scaling introduced, validation ongoing. Preparations for introduction of EKF for soil moisture, later for other sat data.
  - (Scalability and efficiency of different parts of code)
- Snow analysis under development
- Flake: 2d lake workshop Sep2010. Development / validation of snow over ice parametrizations. Extended lake database made available.

HIRLAM:

- Past winter: Snow and lake initialization issues.

Challenges:

- More realistic surface model requires higher quality and retuning of (many) other model aspects. Likely to get only worse at higher resolutions
- Snow and lake analysis: international obs exchange

Nesting experiments

- “Conventional wisdom”:
  - Avoid too big resolution gap, use multiple nesting instead
  - High LBC frequency essential for finescale models
- Experiments:
  - double nest with various options for intermediate model (HIRLAM/Harmonie) vs single nest, impact of domain size, LBC frequency, interpolation procedure, …
- Harmonie:
  - Experiments carried out for winter period over Spain. Under evaluation. To result in default recommended nesting approach.
- HIRLAM:
  - Experiments carried out for several periods over Denmark => recommendation to do direct nesting of S03 in ECMWF.

Nesting experiments

- “Conventional wisdom”:
  - Avoid too big resolution gap, use multiple nesting instead
  - High LBC frequency essential for finescale models
- Experiments:
  - double nest with various options for intermediate model (HIRLAM/Harmonie) vs single nest, impact of domain size, LBC frequency, interpolation procedure, …
- Harmonie:
  - Experiments carried out for winter period over Spain. Under evaluation. To result in default recommended nesting approach.
- HIRLAM:
  - Experiments carried out for several periods over Denmark => recommendation to do direct nesting of S03 in ECMWF.

- Challenges:
  - Intercompare nesting strategies, define “best practice”?
  - Common approach to ECMWF LBC project?

Highlights and challenges (4): GLAMEPS

- GLAMEPS-v1 (EUROTEPS + HIRLAM EPS + ALADEPS, 12.5km/40L, 52 members) running in NRT since Feb. Soon to be upgraded to new (ensDA-based) EUROTEPS.

- Short-term plans:
  - Verification against new ECMWF EPS
  - Various tests
  - Calibration
  - Product development and visualization
  - Comparison with LAEF, consider combination

- Towards a convection-permitting ensemble:
  - Experience being gained with 4km ensemble at met.no, 5km ensemble at DMI

Highlights and challenges (4): GLAMEPS

- GLAMEPS-v1 (EUROTEPS + HIRLAM EPS + ALADEPS, 12km/40L, 52 members) running in NRT since Feb. Soon to be upgraded to new EUROTEPS.

- Short-term plans:
  - Verification against new ECMWF EPS
  - Increase of resolution to ~10km, larger domain
  - Test of (EUROTEPS+LAMEPS at present resolution) vs (ECMWF EPS+LAMEPS at higher resolution)
  - Calibration
  - Product development and visualization
  - Comparison with LAEF, consider combination

- Towards a convection-permitting ensemble:
  - Experience being gained with 4km ensemble at met.no, 5km ensemble at DMI

Challenges:

- How to make optimal use of operational resources?
- Future role of SRNWP after refusal of EurEPS proposal?

Organizational aspects

- Year of preparations for new programme HIRLAM-B (2011-2015)
  - ⇒ External review
  - ⇒ preparation of MoU
  - ⇒ update of 10-year strategy (2011-2020) and formulation of scientific objectives for new programme
  - ⇒ Selection of programme management ongoing
  - ⇒ Lithuania to become new member in 2011
- Cooperation with ALADIN to be continued, intensified
  - Common work plan 2011