Overview of HIRLAM status and plans

Jeanette Onvlee

ASM/Workshop, Brussels

20080407

HARMONIE highlights

- Forecast model:
  - EDMF development
  - After Helsinki training week: Validation/sensitivity studies (AROME, ALARO, alternative parametrizations), nesting strategy
- Data assimilation:
  - Basic 3D-VAR setup and comparison to HIRLAM 3D-VAR
  - Start of activities 4D-VAR, surface DA
- System environment and tools:
  - Mini-SMS
  - Verification/monitoring and diagnostics

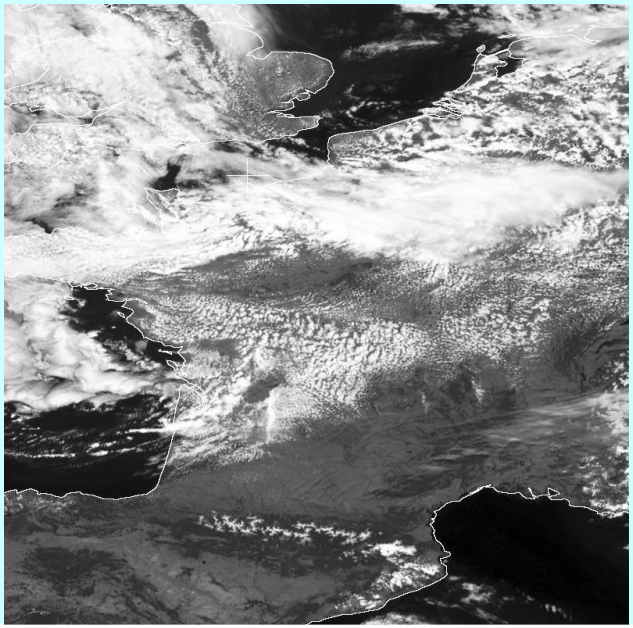
Forecast model activities

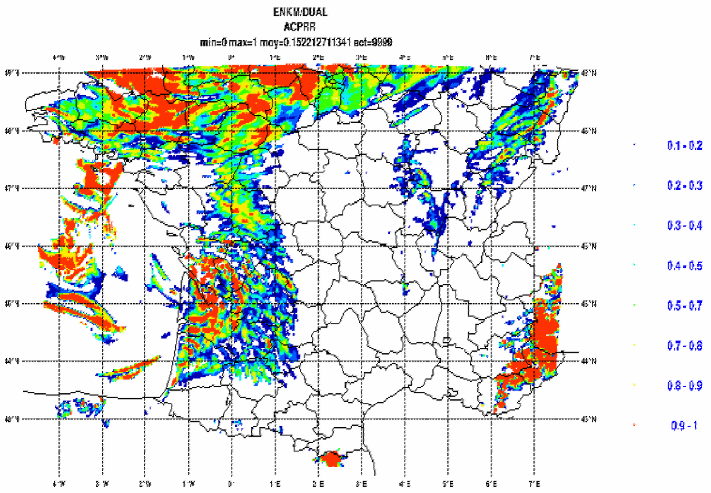
- Development / validation EDMF turbulence/convection scheme

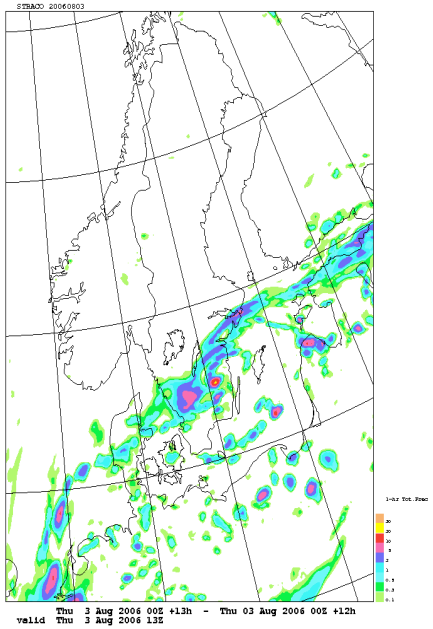
- Development of forecast script system / tools environment

After Helsinki physics training week (sep 2007) studies started on:

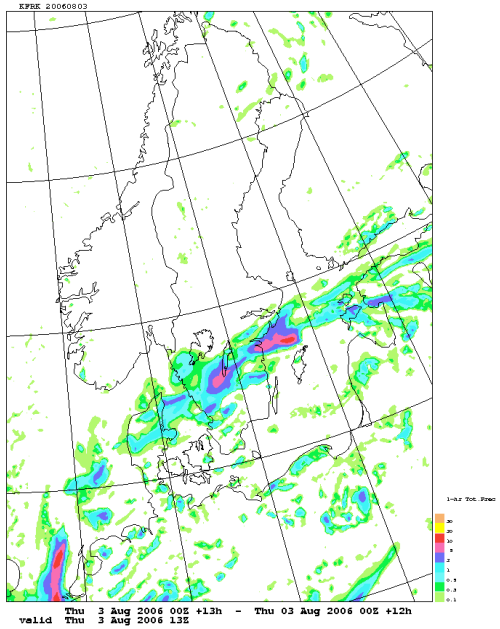
- Cloud/convection behaviour
- Nesting experiments
- Alternative physics parametrization / settings alternatives
- Surface characterization
  - ECOCLIMAP
- Later: Scale-dependencies of description of convection for range of resolutions relevant to HIRLAM (2,5,10km)



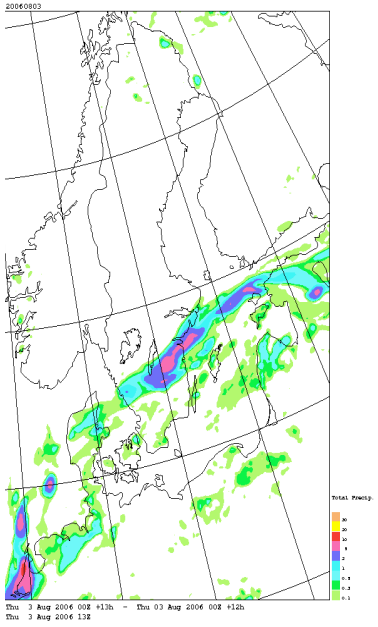




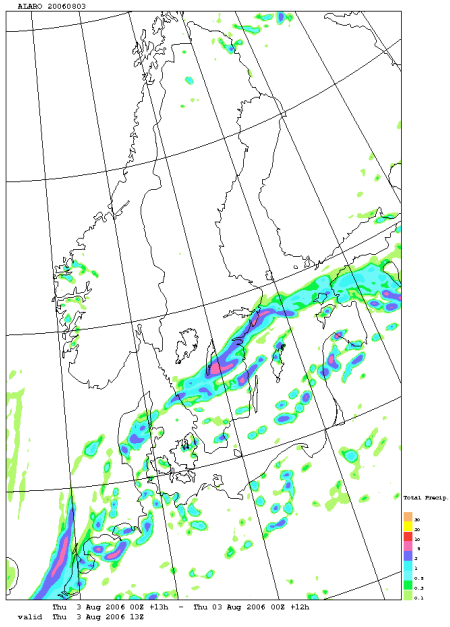
STRACO



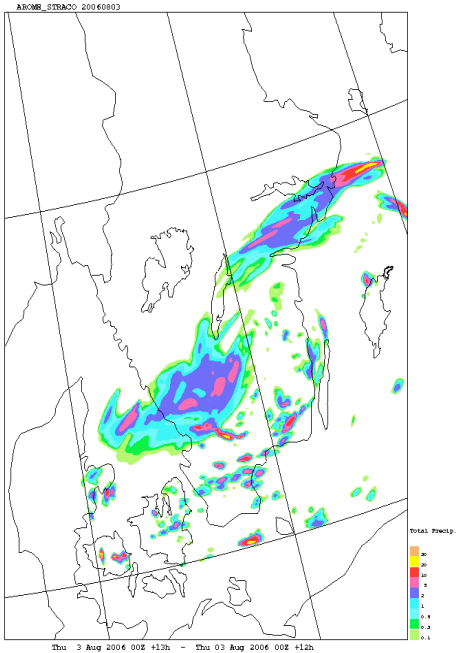
KFRK

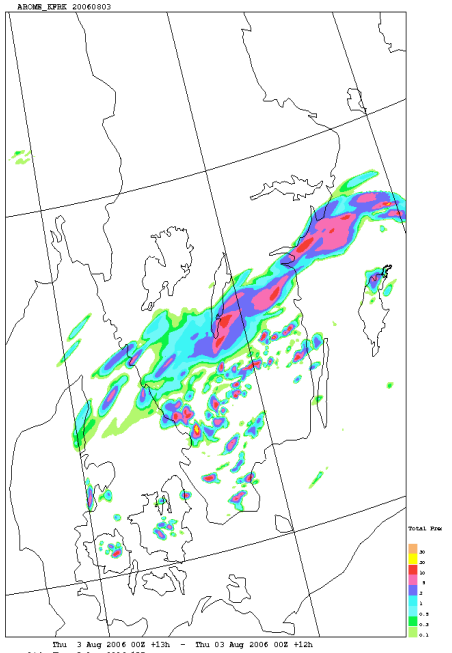


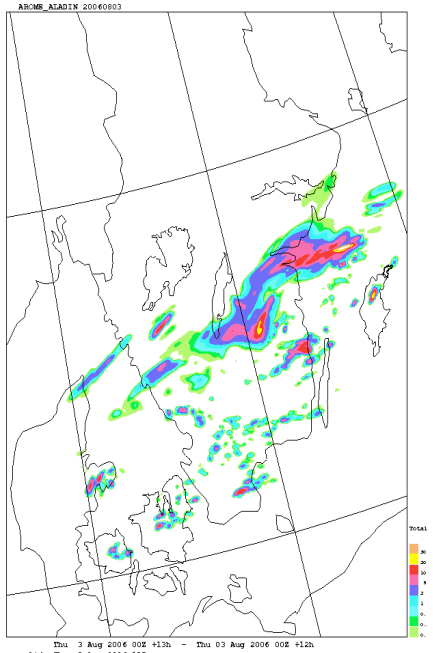
ALADIN

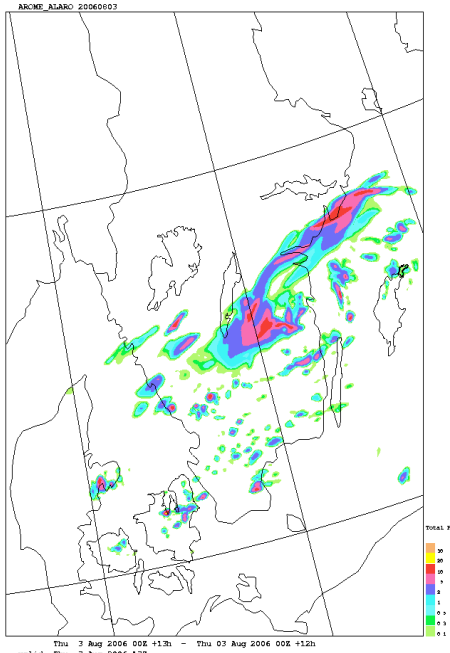


ALARO









Lateral boundary conditions

- Termonia, Oslo ASM/Workshop April 2007: proposal for method allowing translation of transparent lateral boundary approach to spectral model
- Late 2007: McDonald, Termonia, Voitus: definition of steps/activities to achieve this. However: long-term development at best
- Short term: study impact of higher frequency of updating LBC

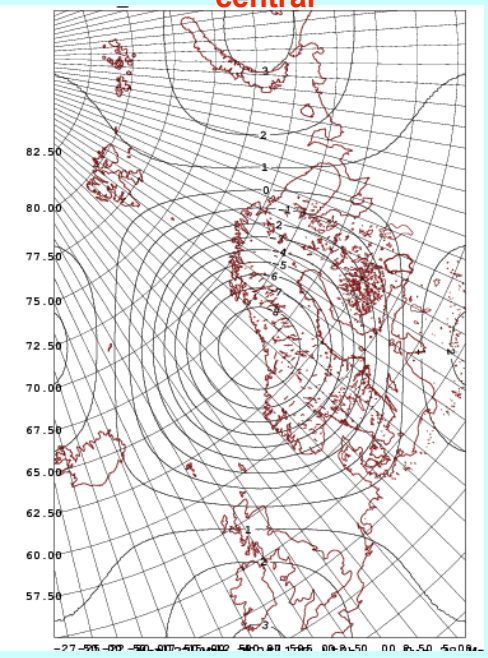
Data assimilation in HARMONIE

- Setup of basic 3D-VAR system/ODB at met.no, ECMWF
- Mini-SMS script system for full cycling with upper air/surface data assimilation
- Comparison ALADIN-HIRLAM 3D-VAR
  - Extension zone treatment, varQC
- Start with preparations 4D-VAR
- Use of observations:
  - IASI, radar
  - Preprocessing: high-resolution BUFR radio sondes

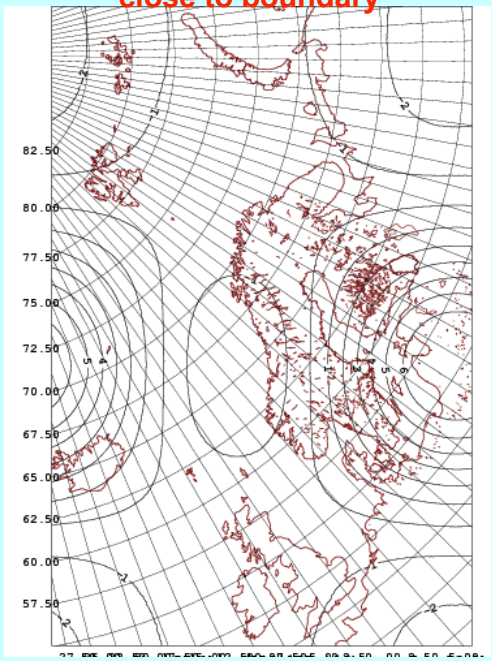
Extension zone problem

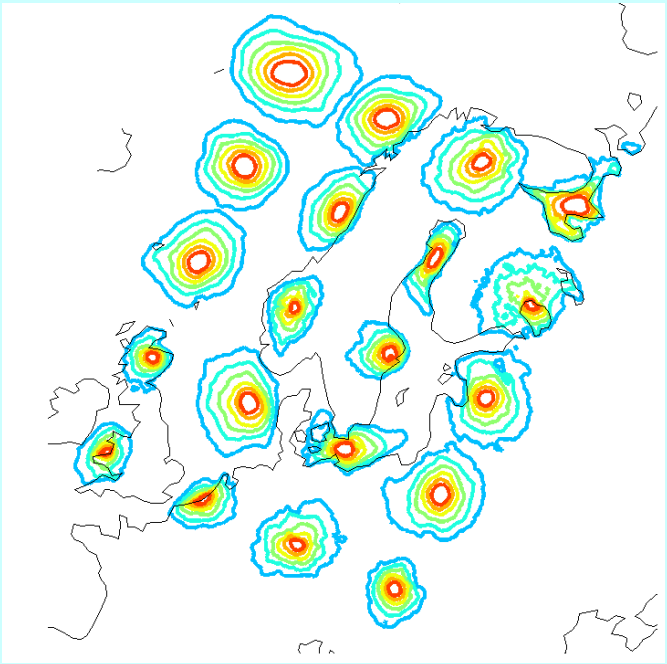
- Extension zone in ALADIN too small when used over large domains
- Proposed solution: use larger extension zone in background constraint only
- Future possible solution: use of wavelet transform (also for introducing flow-dependency)

central



close to boundary





Surface data assimilation/modelling

- Surface DA system: initially OI based on CANARI, in order to have something simple available soon
- Comparison CANARI with HIRLAM SPAN ongoing => improve CANARI where necessary
- Assimilation of T2m, RH2m, SST. Later also LAI, scatterometer soil moisture, lake data, …
- From late 2008 onwards: development of more advanced soil assimilation (simplified EKF)

HARMONIE system aspects

- Summer 2007: Script system for forecast model under miniSMS
- Early 2008: extension with data assimilation and surface to full cycling system (nearly completed)
- Generation of SURFEX climate fields: still problematic
- Integrated automated monitoring/verification system for HARMONIE and HIRLAM
- Inclusion of own/ALADIN diagnostic tools
- Mitraillette testing environment implemented at ECMWF for easier pre-phasing testing

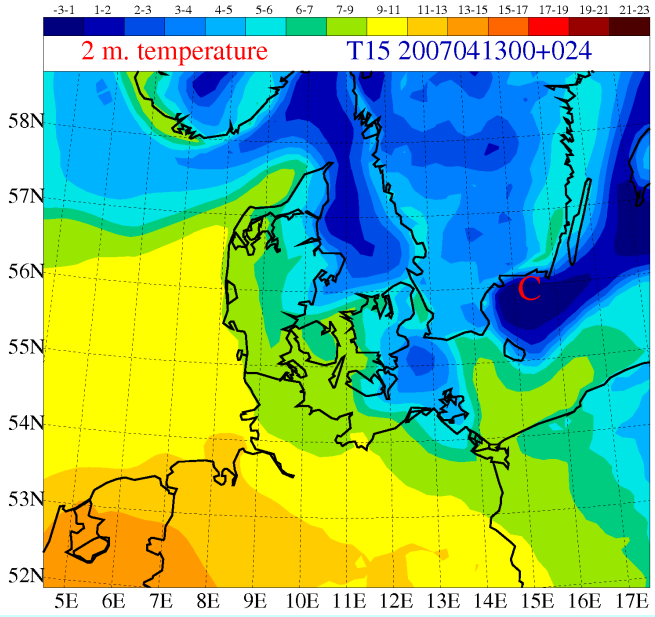
Synoptic HIRLAM data assimilation developments

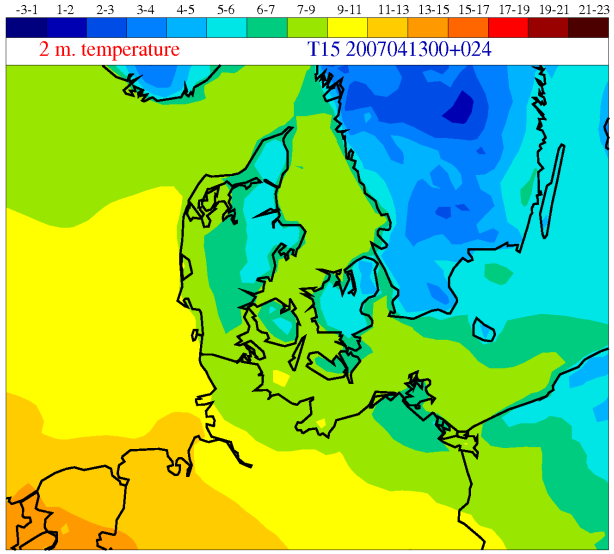
- 4D-VAR default assimilation scheme in Reference System 7.2
- Comprehensive impact studies (CIS) with 3/4D-VAR
  - ground- and space-based remote sensing observations
  - first for Atlantic/Arctic, then for convection, then extend to HARMONIE.
- Assimilation of cloud- and surface-contaminated data
- Scientific/technical documentation of 4D-VAR system

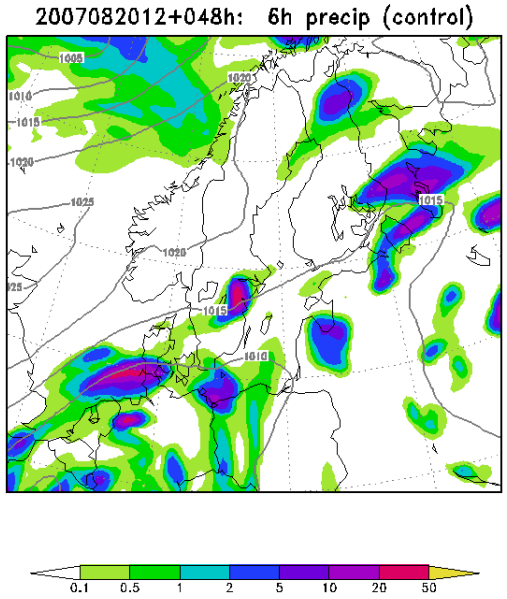
2008: Further optimize 4D-VAR and extend with e.g. multiple outer loops; finish CIS for synoptic scales

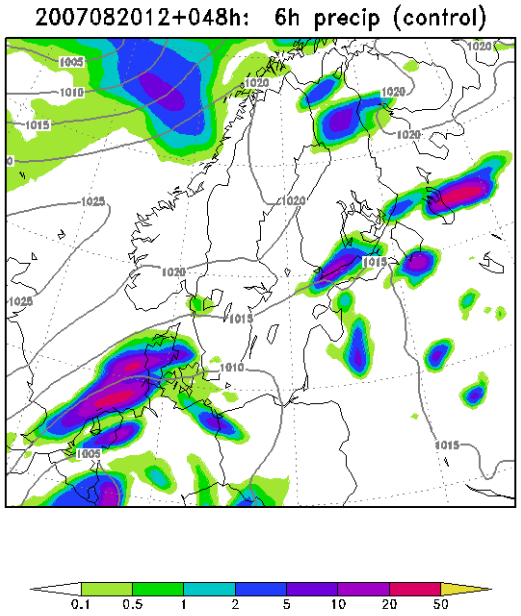
Synoptic HIRLAM forecast model developments

- STRACO – Kain-Fritsch/Rasch-Kristjansson comparison
- Cleaning / recoding convection/condensation schemes
- Turbulence scheme: CBR improvements for stable boundary layer; validation of QNSE (Sukorianky et al)
- Surface (snow/forest) scheme
- Coupling with other earth system components: start made with coupling to atmospheric chemistry transport models


-3-1 1-2 2-3 3-4 4-5 5-6 6-7 7-9 9-11 11-13 13-15 15-17 17-19 19-21 21-23
2 m. temperature
T15 2007041300+024
58N
57N
56N
55N
54N
53N
52N
5E 6E 7E 8E 9E 10E 11E 12E 13E 14E 15E 16E 17E
C

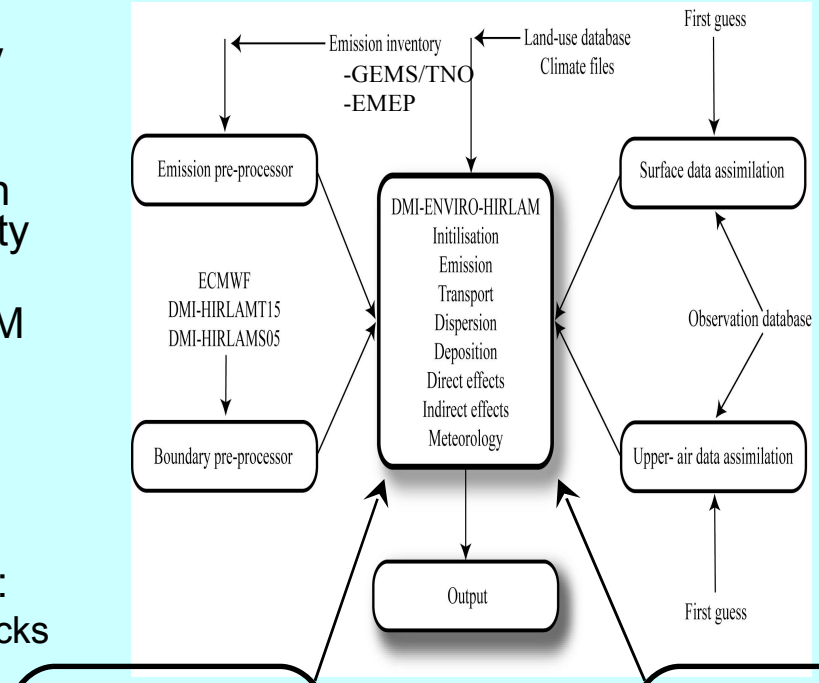

-3-1 1-2 2-3 3-4 4-5 5-6 6-7 7-9 9-11 11-13 13-15 15-17 17-19 19-21 21-23
2 m. temperature
T15 2007041300+024


2007082012+048h: 6h precip (control)
0.1 0.5 1 2 5 10 20 50


2007082012+048h: 6h precip (control)
0.1 0.5 1 2 5 10 20 50

Coupling with other earth system components

- Chemistry:
  - Several HIRLAM institutes already involved in chemistry transport modelling involving HIRLAM
  - HIRLAM-coordinated contacts with atm. chemistry transport community initiated
  - Short-term actions (mostly HIRLAM only):
    - HIRLAM output adaptations
    - Better mass conservation of advection scheme
  - Longer term (expand HIRLAM community with ACT researchers):
    - Two-way coupling to study feedbacks
    - Allow variety of ACT models with strict interfacing
    - Enviro-chem framework approach
- Ocean: 2009 and later



GLAMEPS status

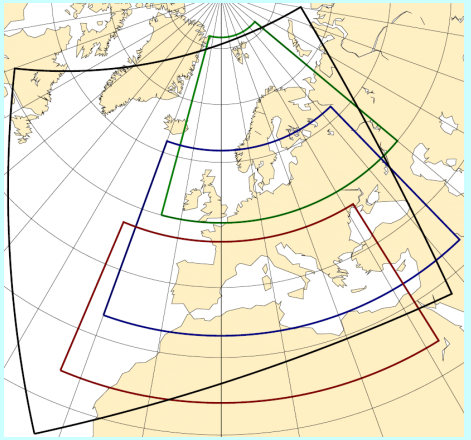
Ingredients of GLAMEPS v0:

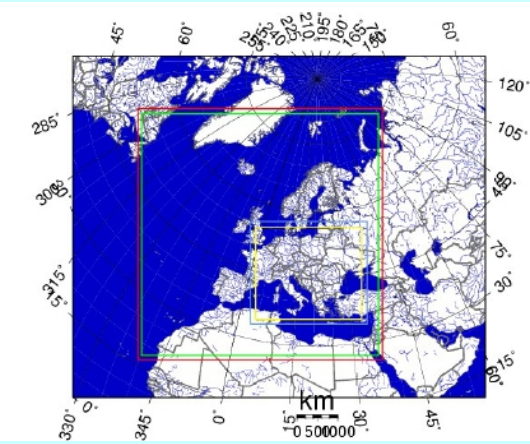
- ECMWF TEPS for Europe
- HIRLAM EPS: downscaling with two convection schemes, SLAF, stochastic physics
- ALADIN: downscaling with PEARP, TEPS; experiences in LAEF, Beijing 2008
- Monitoring/verification system, calibration tools

Further developments:

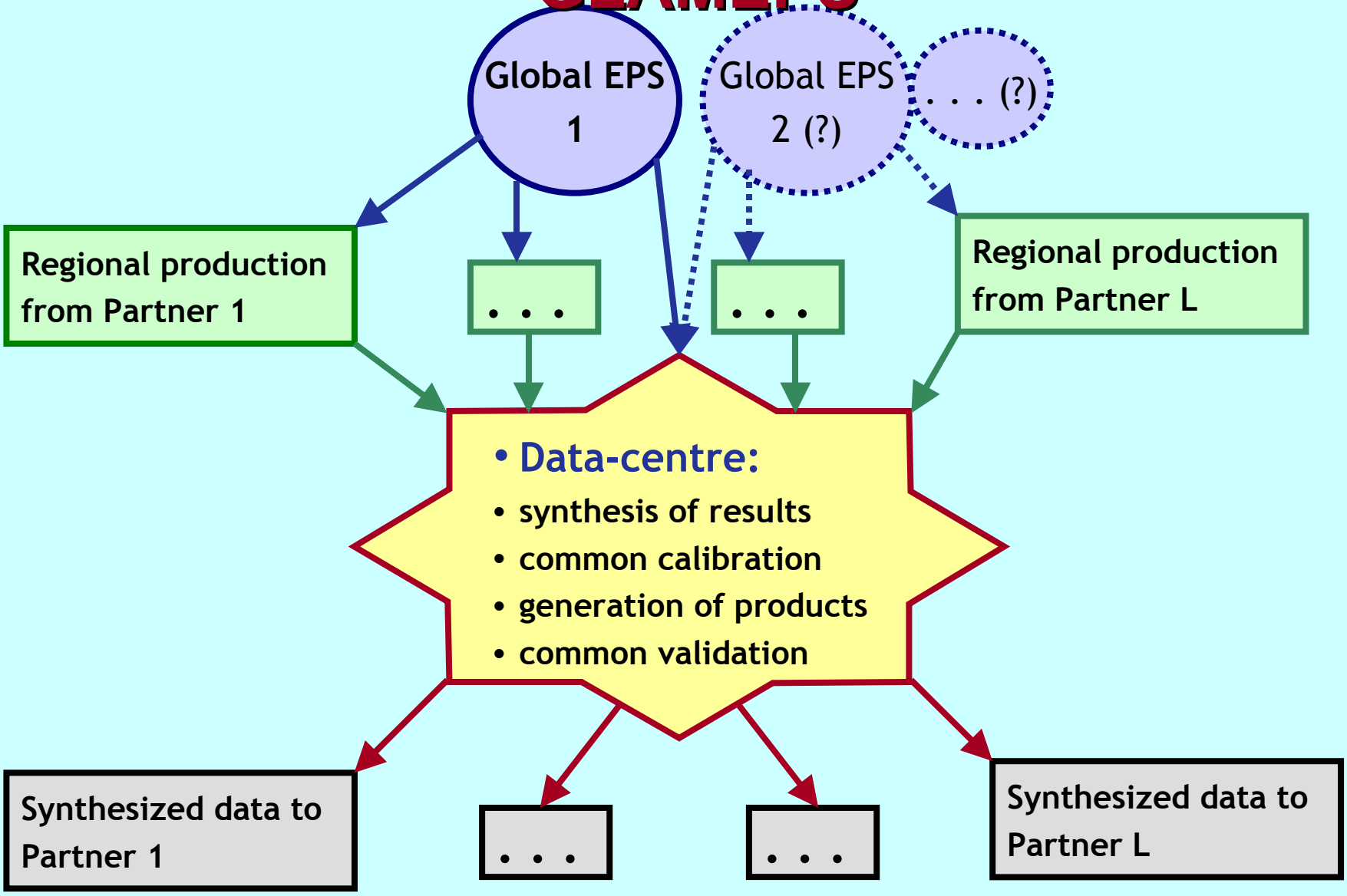
- HIRLAM, ALADIN singular vectors, breeding, ETKF, …

2008: calibration of v0 on longer NRT runs, test cases for high-impact weather; preparations for distributed production; validate new perturbation methods





Basic Operational Concept of GLAMEPS



Use of model in academic community

- HARMONIE forecast model, HIRLAM data assimilation
- Use for both research and education purposes
- Aspects to consider:
  - Easy availability, downloading, compilation and building facilities on variety of architectures
  - Adequate, user-friendly documentation/instruction and test data for relevant (synthetic) cases
  - Easy coupling to accessible meteorological data
  - Educational value/simplicity
  - Feedback possibilities