HIRLAM activities in 2019:
A period of construction

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Getting things together

Preparing for:

- New algorithmic setups for data assimilation, at high resolution and in the nowcasting range

- Increasing relevance of observations from non-NMS networks

- Getting solutions together for convection/low cloud/fog problems

- A complete overhaul of the surface treatment

- How to make large domain sub-km resolution nowcasting EPS affordable?

- A revision of old code and scripts

- Convergence with ALADIN

- Operational cooperation in United Weather Centers

Data assimilation algorithmic developments

- Testing 4D-Var for operations

- Ensemble assimilation: development/ tuning of hybrid EnVar, LETKF, preparing intercomparison framework

- Assimilation setups for nowcasting:
  - Assess 4D-Var in nowcasting range with high temporal resolution data
  - Incorporate cloud initialization,
    field alignment

- Begin to adapt assimilation system to sub-km resolutions

- Making improved re-analysis setups (CARRA, PRECISE/CERRA)

Increasing use of (spatially dense) observations from non-meteorological networks

In addition to the meteorological networks of conventional, satellite and ground-based remote sensing data, we explore:

- Private weather stations
- Smart phones
- Road network data
- Observations from wind energy farms
- Hoping to get some new ideas here...

Requires attention to:

- Acquisition aspects (technical/legal)
- Quality control and preprocessing (use of automated learning systems)
- Impact assessment: how to validate?

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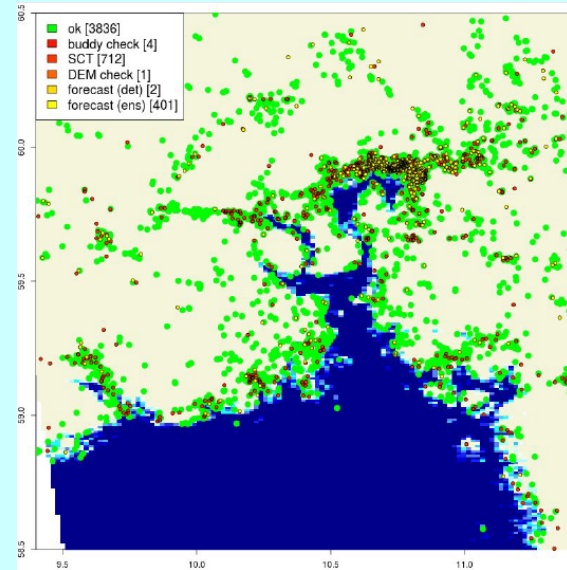
Temperature

Thousand of observations used over relatively small but densely populated area

SCT, spatial consistency test

DEM, digital elevation model

forecast test. The observations are compared against the NWP model fields. It is possible to consider deterministic and ensemble NWP outcomes.

Norwegian Meteorological Institute

Getting solutions together for observed convection/low cloud and fog problems

- Problems related to low clouds/fog and convection

    - Multiple causes and corrective actions in Cy43h2
        - surface evaporation/ assimilation
        - adaptations in turbulence, shallow convection schemes
        - cloud microphysics.

- Aerosol:

    Sea salt, sulphate, hydrophylic organic material and black carbon implemented in radiation parametrization;

    Impact small but positive when significant aerosol are present

# Modified Harmonie turbulence, convection and cloud scheme Improved low clouds

Wim de Rooy

Main deficiency in Harmonie cy40 is the underestimation of low clouds and overestimation of cloud base,(important for aviation). Primarily based on physical arguments, substantial changes are made to the turbulence (together with Peter Baas and Geert Lenderink), the convection and the cloud scheme.

Frequency bias of cloud base height for December 2018 (similar results for January 2019).
1 means same climatology as observed

Reference cy40

Adapted scheme cy43

verification by Sander Tijm

Less than 10% of observed is forecasted!
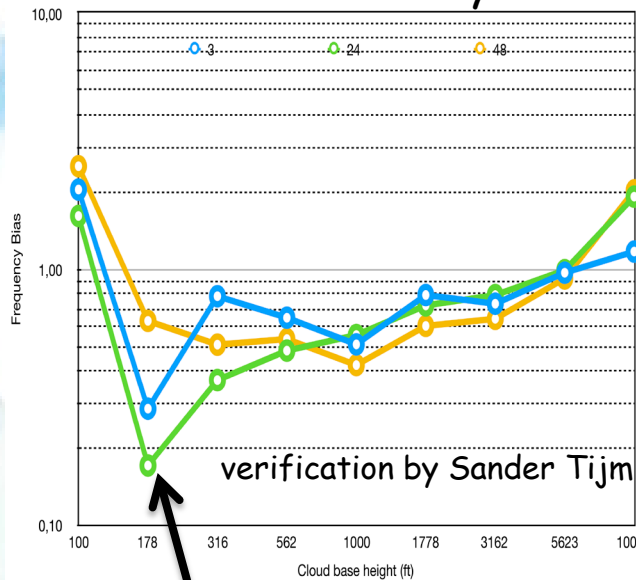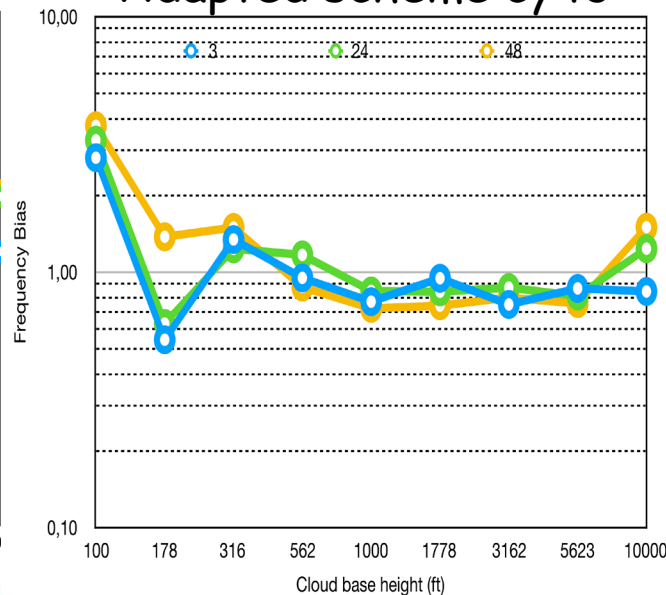
Strongly improved forecasts of low clouds and cloud base height.

Related to better preservation ofinversions, improved forecasts of strong convective precip events.

Good performance on other parameters is preserved.

Cy43h2: A complete overhaul of the surface

- …A combination of new surface modules for soil, snow, snow-over-vegetation and orographic parametrization for turbulence, and enhanced sea ice and lake modules…

- …In combination with more sophisticated surface assimilation schemes for soil and snow…

- …A revised, higher-resolution physiography: ECOCLIMAP-SG…

- …And an alternative horizontal spatialization method: TITAN/Gridpp vs CANARI

The challenge of making affordable large, large domain sub-km resolution nowcasting EPS
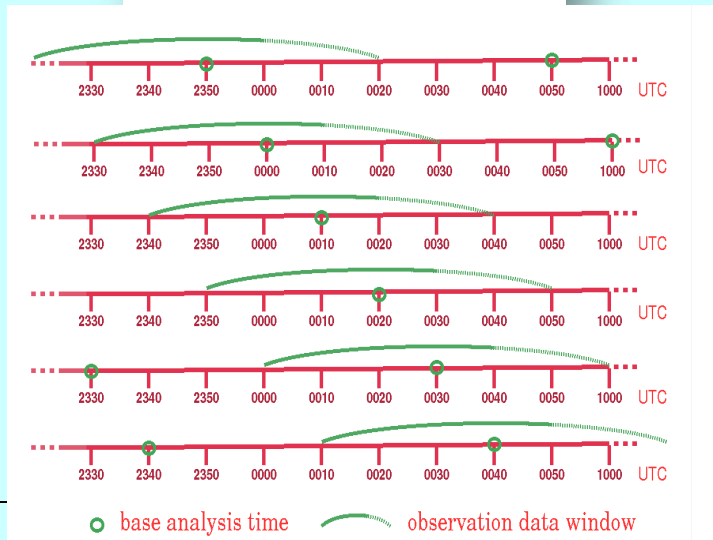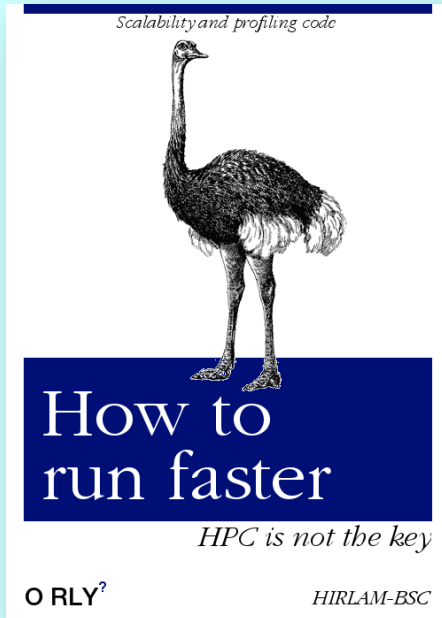
Approaches under investigation:

- Continuous (overlapping windows) assimilation approach

- Use of quadratic or cubic spectral grids

- Single versus double precision

- Assessment and optimization of parallellization (MPI/OpenMP)

- Cooperation with Barcelona Supercomputing Center on performance and scalability improvements

- Code and I/O optimization in mixed architectures

- More scalable non-spectral solvers (RMI)

- ......

Scalability and profiling code

How to run faster

HPC is not the key

O RLY?   HIRLAM-BSC

base analysis time   observation data window

Revision of old scripts, code and tools

- Move to GIT repository

- Working on overhaul of scripting system
  * Greater modularity, clearer separation of code/scripts
  * Recoding scripts to Python (or similar)
  * New tools for building executables and suite definition
  * Linking code, executables and scientific / technical documentation
  * ...

- Consider replacing/rewriting old code: e.g. TITAN/Gridpp

Data Assimilation in Harmonie-Arome
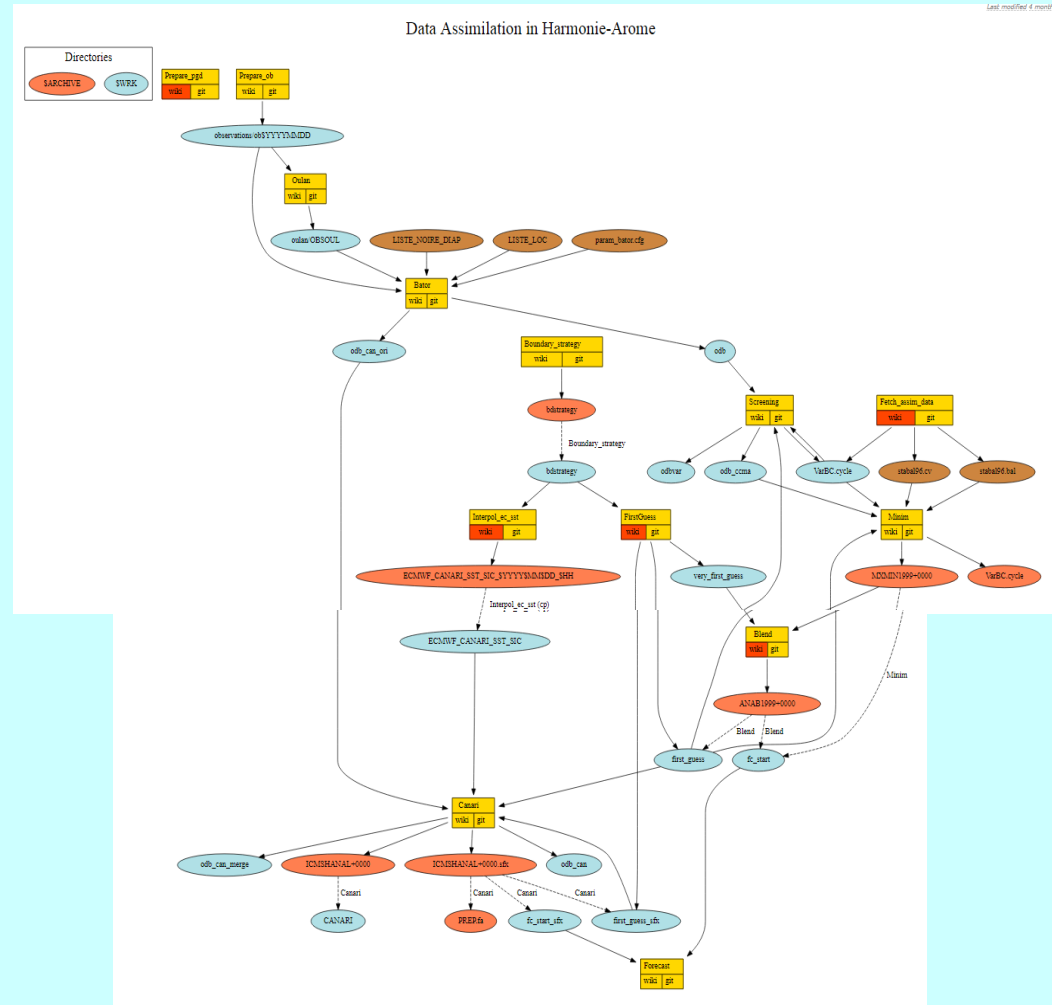
Towards a single consortium with ALADIN/LACE…

Convergence actions:

- 2016: Agreement on data policy, CMC's. Definition of Harmonie-Arome CMC

- 2017, 2018: Joint setup of rolling work plan and monitoring of R&D efforts

- 2018: Agreement on mission and scope of joint consortium

- **2019: Consider working organization and funding principles of new consortium, start drafting MoU**

Preparing for common operational production
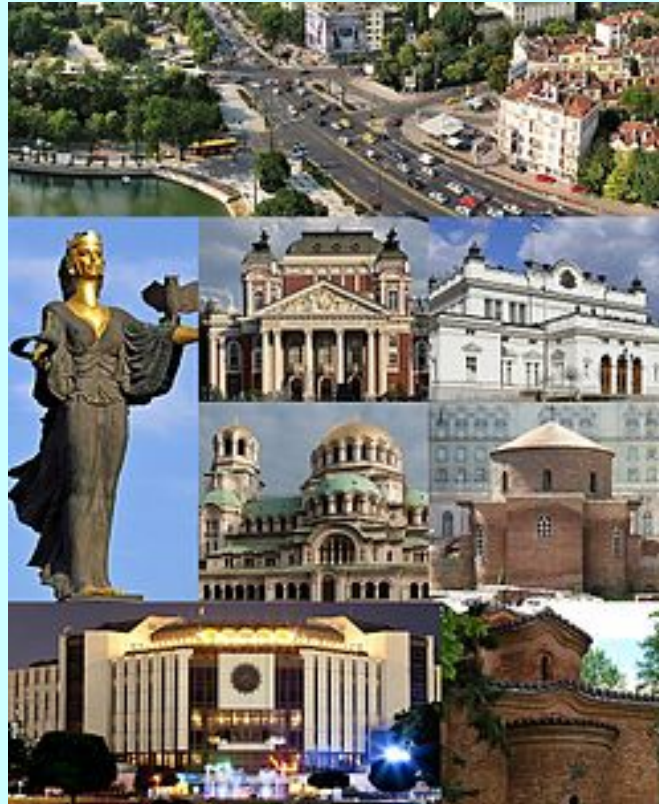## (United Weather Centers)

UWC and UWC-West work plans

UWC-East: prepare for incorporation of Baltic weather services in MetCoOp

UWC-West:
- Choice for location/method of financing of joint HPC
- Working groups preparing for HPC and infrastructure, preprocessing, NWP configuration and data architecture, post-processing aspects of joint operation.

Questions?

Have a fruitful meeting and enjoy your time in Sofia!