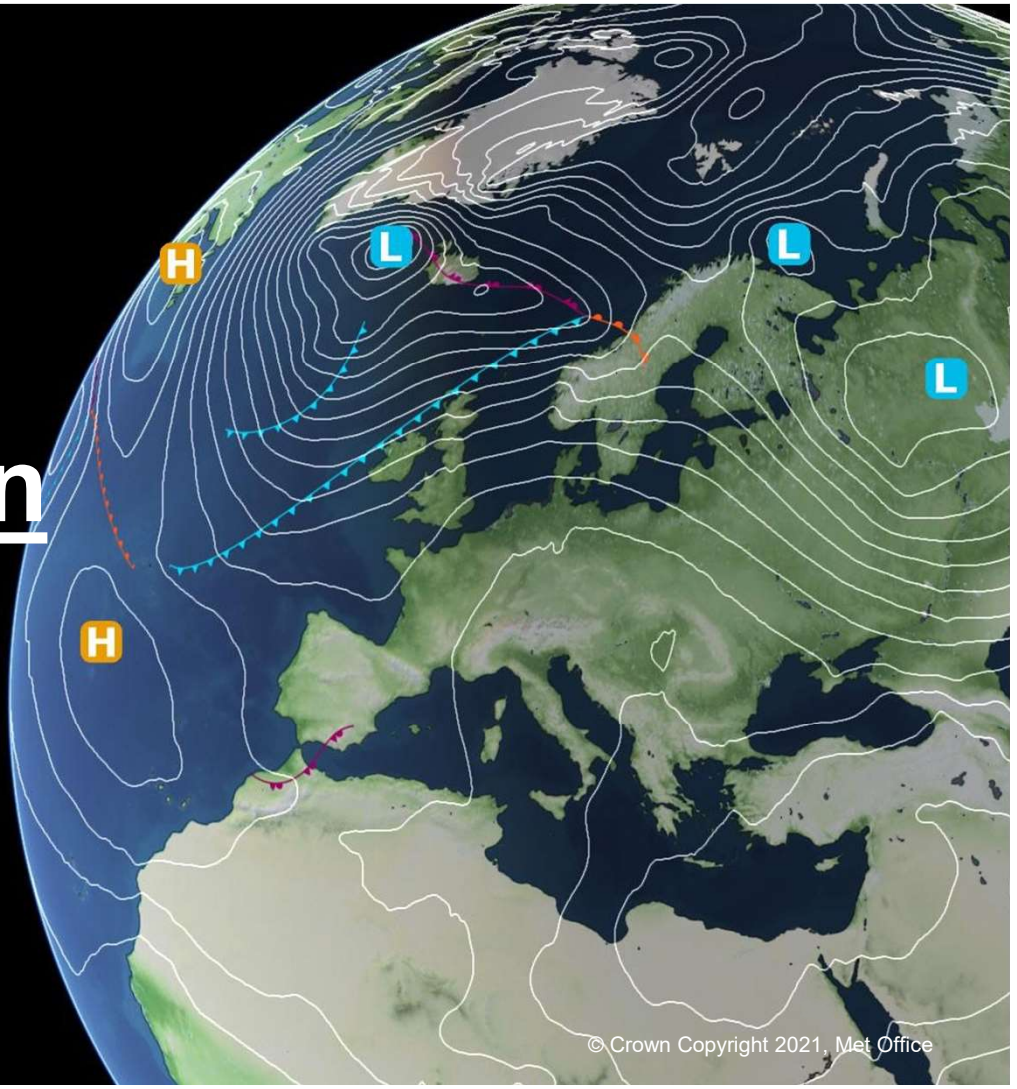
Met Office

Met Office LAM Data Assimilation What's next?



EWGLAM 2022
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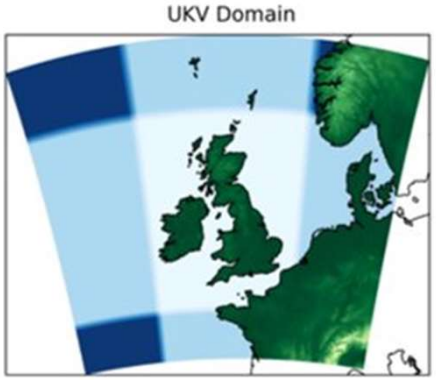
Actual Met Office LAM DA



- Hourly 4D-Var assimilation method.
- Linear Perturbation Forecast (PF) model and DA, 4.5 km resolution (constant on the whole domain).
- UM model resolution in UK region 1.5km. Resolution 1.5x4 km along the edges and 4x4 km at the corners.
- LBC from 00, 06, 12, 18 UTC from global model (10km resol.)
- Ages of LBC runs lies in range T-3 : T-8.
- Observation cut-off 45 mins, 80 mins only for 11UTC and 23 UTC (to catch radiosonde data).
- Use of Large Scale Blending (LSB) to better represent the large-scale motions.
- VarBC applied to satellite radiances.
- Operational forecast in range T+12:T+120.

New model update

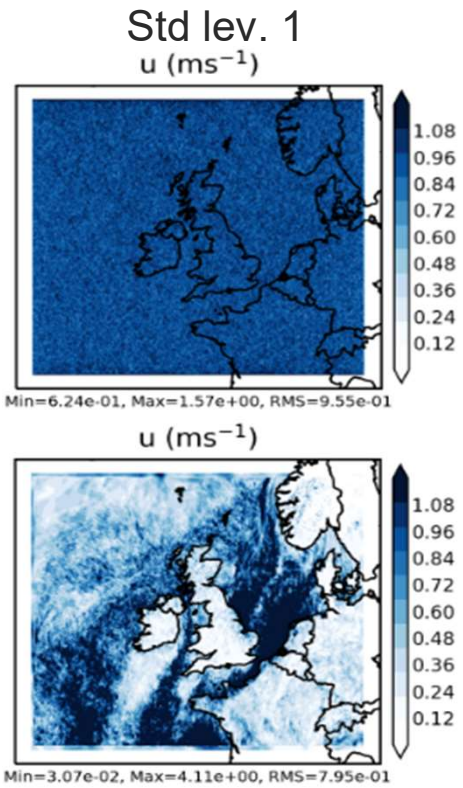
- New:
  - Cloud fraction scheme
  - Microphysics scheme (CASIM)
  - Activation depending on the aerosol
- Relative to operational:
  - CASIM has less intense precipitation and more light precipitation
  - CASIM convective cell sizes are smaller
  - CASIM biases and RMSE better or similar for synoptic weather metrics
- Implication in the moisture assimilation. Future application of moisture incrementing operator (operational in the global).
- Testing different model levels: 90 and 120.

NGDA (long term > 5 years)

- JEDI application for Data Assimilation (JADA).
- Redesign (in modern C++) DA for LFRIC (new model) in the new supercomputer.
- Big effort, need also new adjoint model.
- Focus on Ensemble and Global model.
- LAM-DA postponed to the future.
- The new system is very flexible, easy to adapt to different DA methods (if exist).
- Easier to use with different Weather Services. UM partners could collaborate and develop DA systems based on JEDI.

Possible variational DA upgrade

- Static climatological covariances are horizontally homogeneous and isotropic.
- No orography and error of the day.
- Balanced and hydrostatic (not supporting vertical motions).
- For Hybrid 4D-Var in UKV we required a high pass filter, zero increments at the boundary.
- First tests of Hybrid 4D-Var where encouraging, the development has been stopped as resources are moved to NGDA.
- Hybrid 4DEn-Var is a possible solution, avoiding complication related to PF model. The Met Office is moving to ensemble-based system.
- Introduction of LSB. Thus LAM DA can concentrate on the small scales only (high pass filter).
- Issue: 4DVar remains a quasi-Gaussian method, relying on errors being small.



Other possible DA schemes

Allow some non-Gaussianity and nonlinearity.
Ensemble based schemes advance the analysis of model state during the time. The evolution of sample mean and covariance is useful for handling non linearities. Ensemble based covariances are straightforward in a fully couple model.

- EnKF with its different flavours
  - Ensemble forecast covariances.
  - Hybrid ensemble and static forecast covariances.
  - Local Ensemble Transform KF (LETKF) -> new JEDI software.
- Particle filter: how does it behave at very high dimensions?

My open questions:

- Perturbation of LBCs
- Model error representation
- Initial ensemble
- …


Questions, discussion, suggestions