Progress in regional data assimilation at the Met Office

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Contents

This presentation covers the following areas

- precipitation assimilation
- cloud assimilation
- multiple outer loop in 4D-VAR

Precipitation Assimilation

Using the Radar Data in 4D-VAR

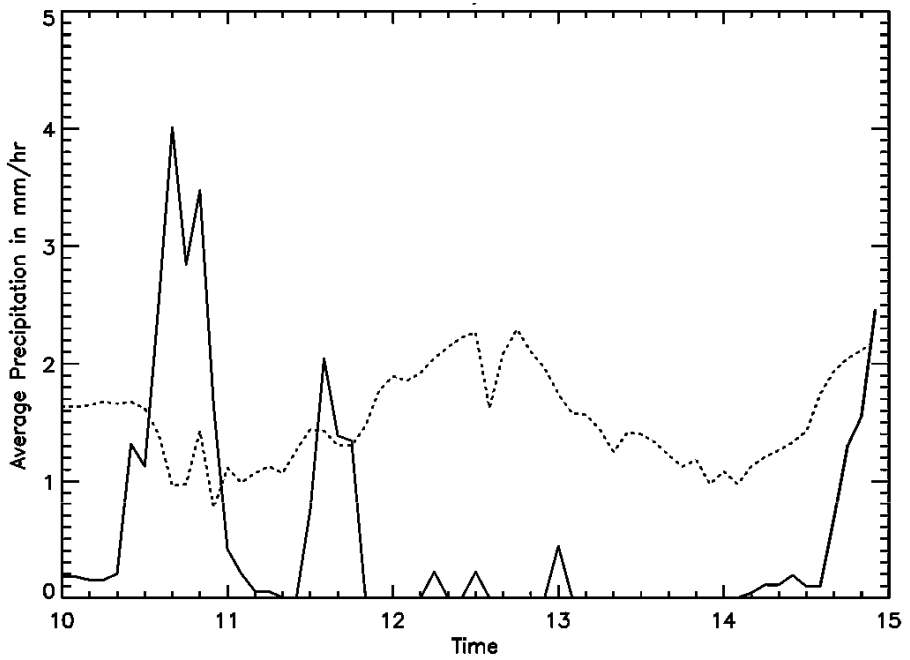
- Currently assimilate hourly radar-derived precipitation rates via latent heat nudging
- Testing assimilation of ppn rate in 4D-VAR
  - PF model has linearised microphysics (large-scale precipitation) and linearised convection scheme
  - Removes complication of running two assimilation schemes, 4D-Var & LHN
  - Potential to adjust dynamics to fit rainfall

On-off signal in model convective rainfall

Rain rate at single pixel:

Large-Scale

Convective



Radar rainfall rates used hourly from T-2 to T+3

Equivalent background values are averaged over 30 minutes

Using the Radar Data in 4D-Var

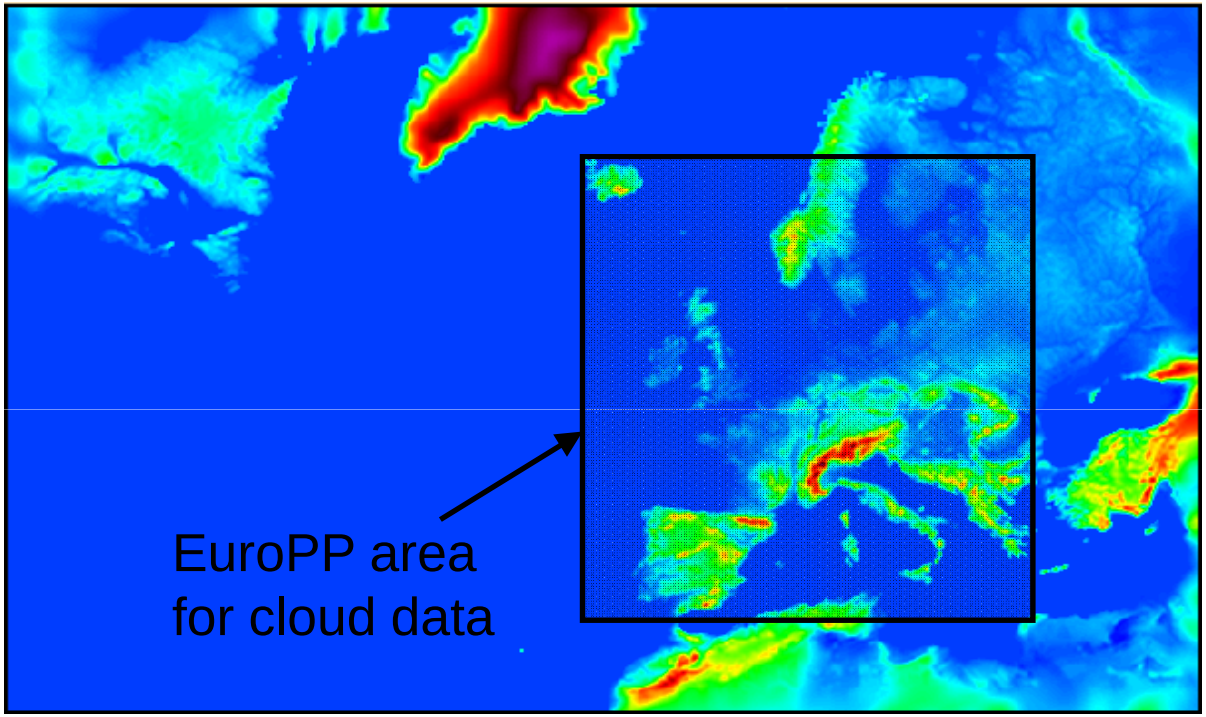
- 1-month NAE trial at 24km, results close to LHN
- Case studies: works best for large-scale rainfall
- Spin-up - Increased ppn in first few timesteps after assimilation. Can be reduced by
  - IAU – nudge increments into model
  - Tuning Jc penalty
- Test assimilating accumulations not rates
- Plans for further trialling with an additional Var outer loop

Cloud Assimilation

Cloud in VAR

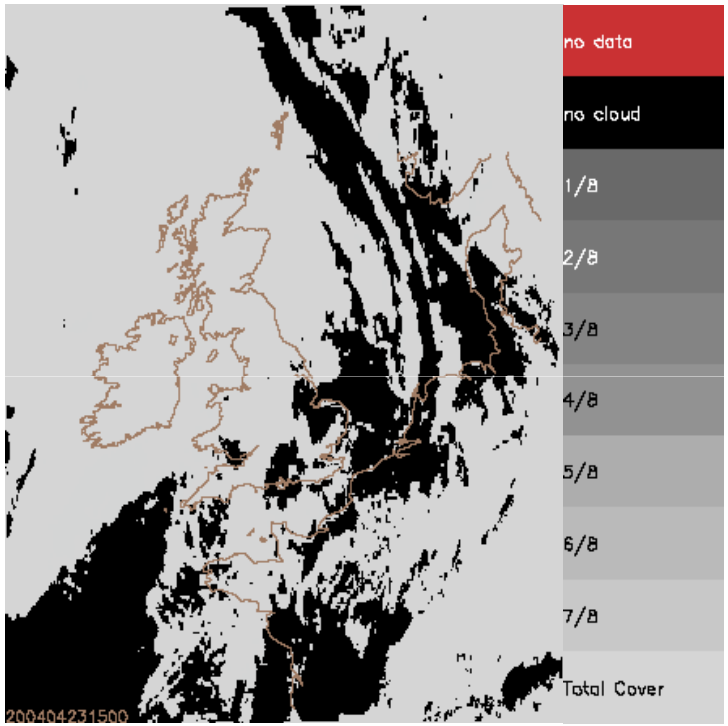
- Operational in NAE & UK4 from November 2008
- Uses gridded cloud fractions from nowcasting scheme
- Replaced nudging scheme (‘AC’) run in parallel to VAR
- Cloud fraction is assimilated as proxy Relative Humidity
- Performance comparable to AC scheme, but opens the way for further developments…

North Atlantic / European model

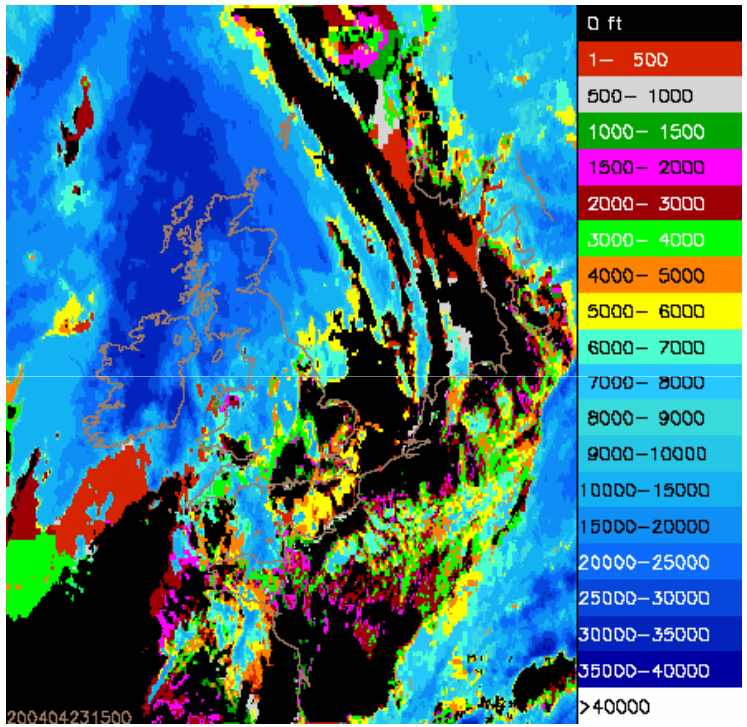


SEVIRI cloud products currently supplied to EuroPP

Cloud Mask



CTH



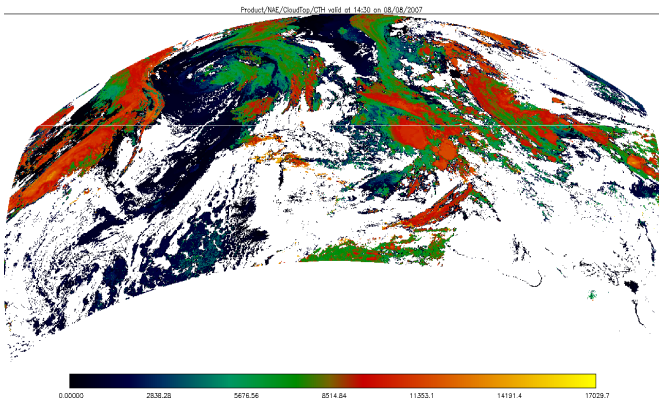
Using several of the SEVIRI channels, together with background data from a previous NWP forecast, cloud mask and cloud-top height products are calculated by the Autosat processor and disseminated to EuroPP.

Assimilation of SEVIRI cloud products directly into NAE model

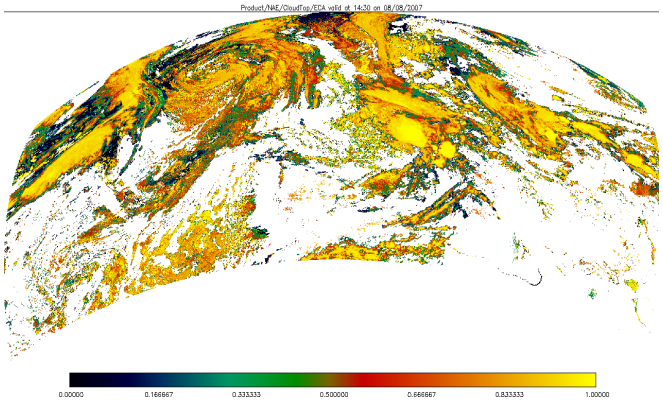
Can potentially use data for entire domain

No intermediate step via EuroPP nowcasting system

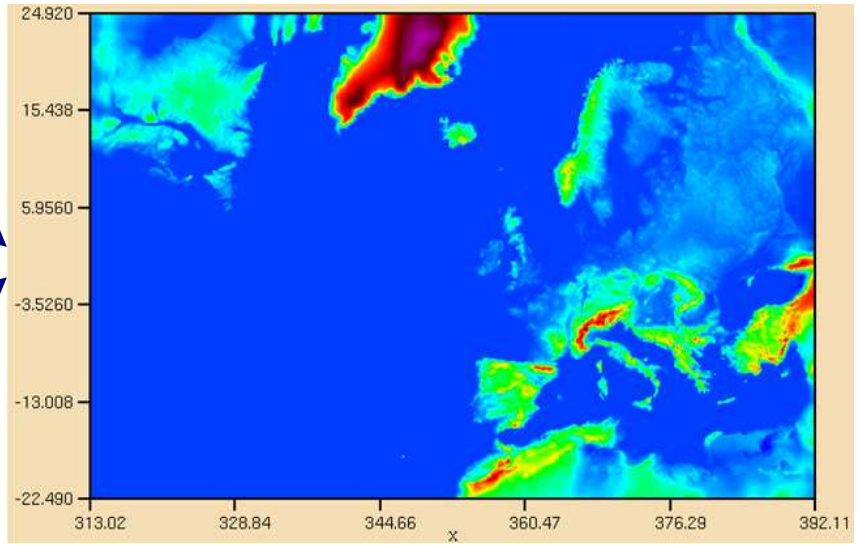
BUT no surface cloud data



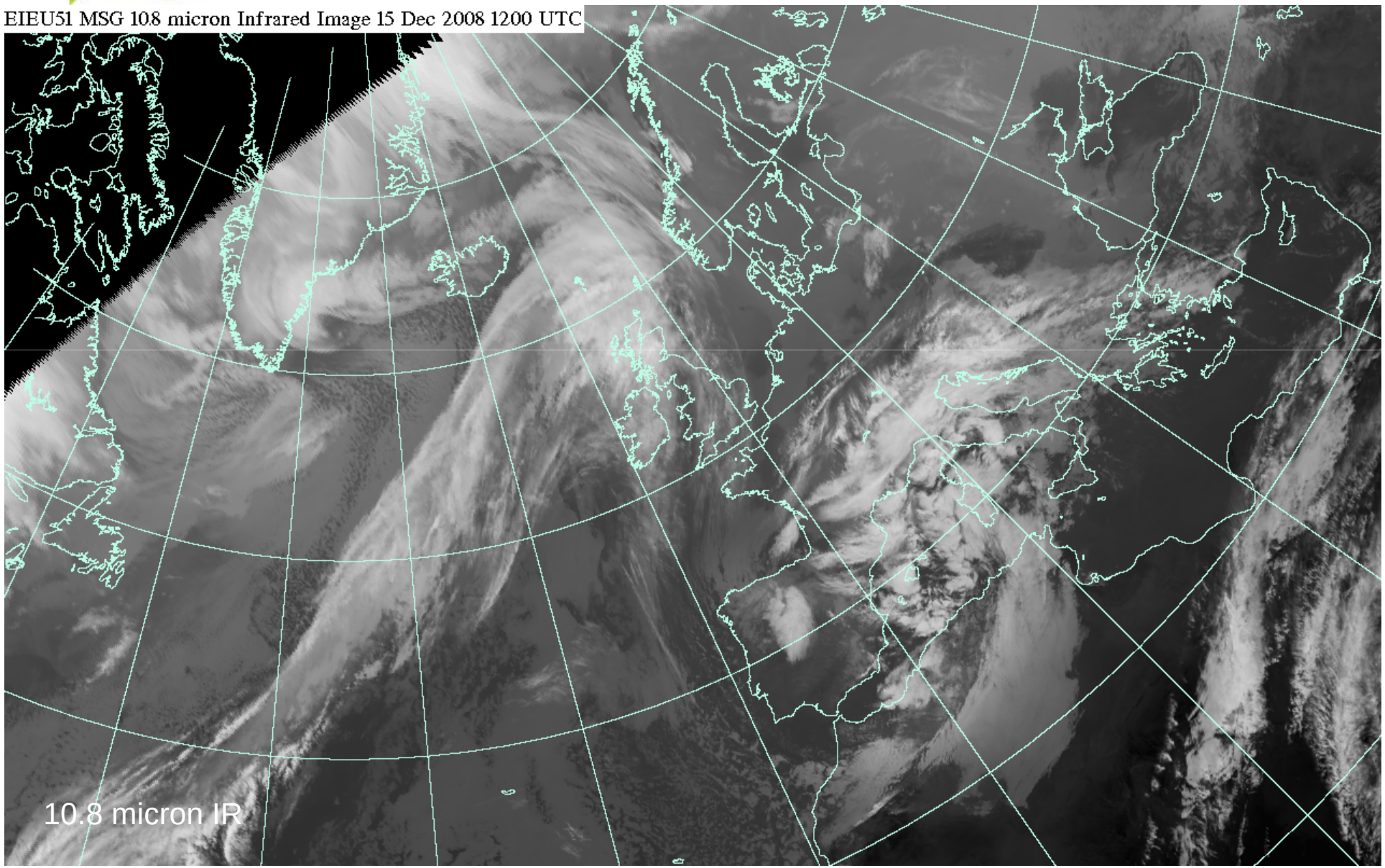
CTH



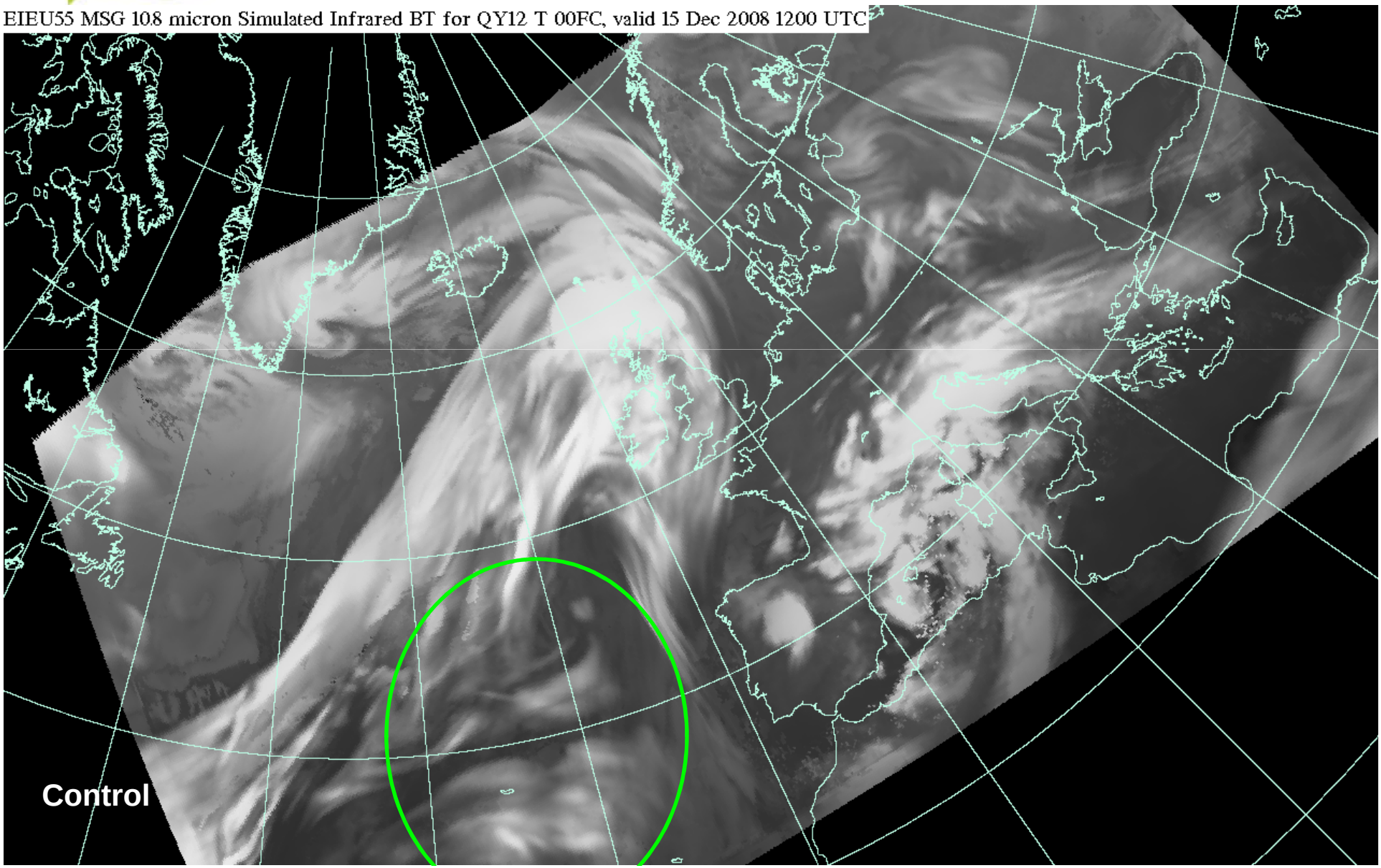
ECA



MSG imagery – 12Z, 15/12/2008



Simulated imagery – 12Z, 15/12/2008, T+0



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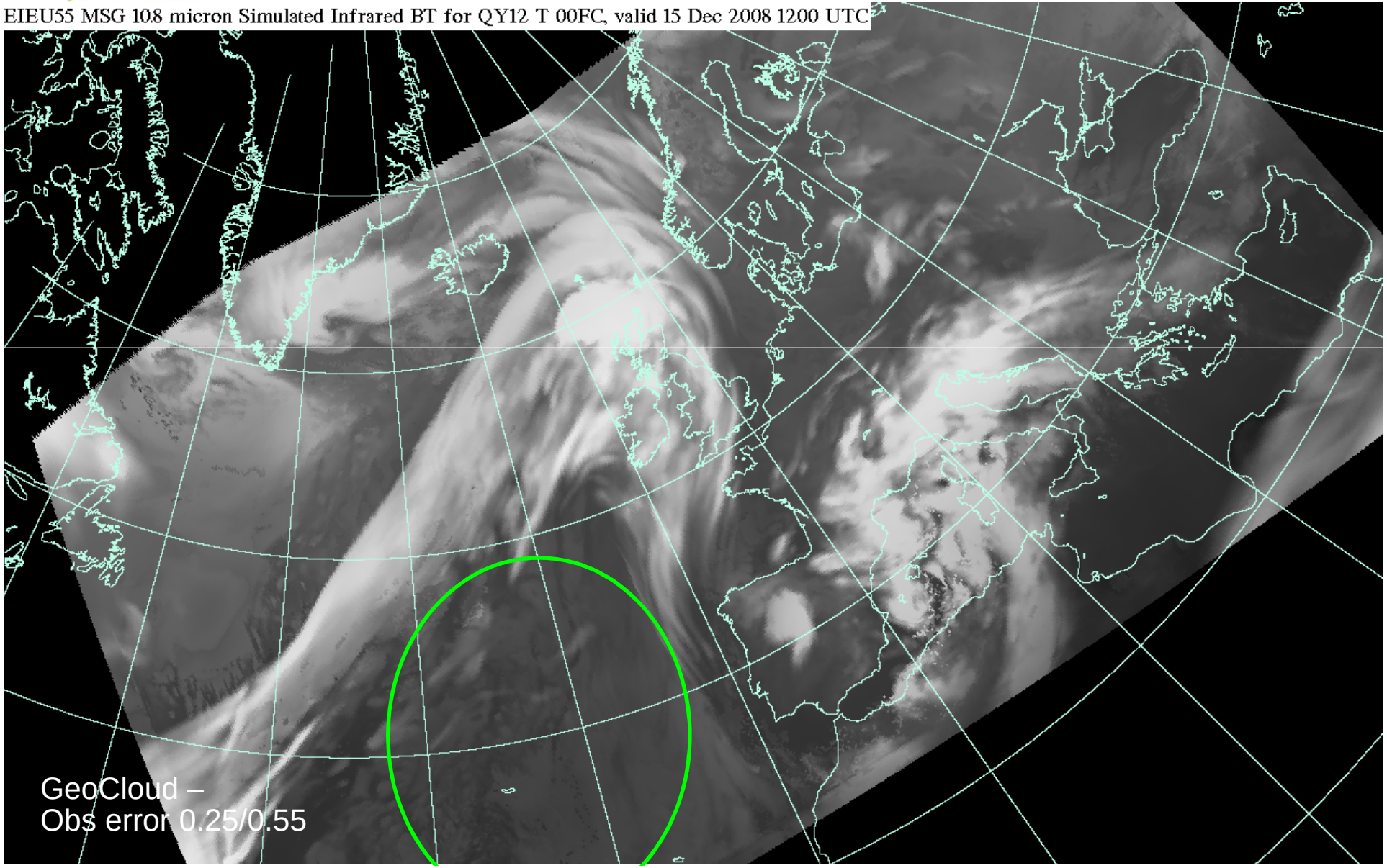
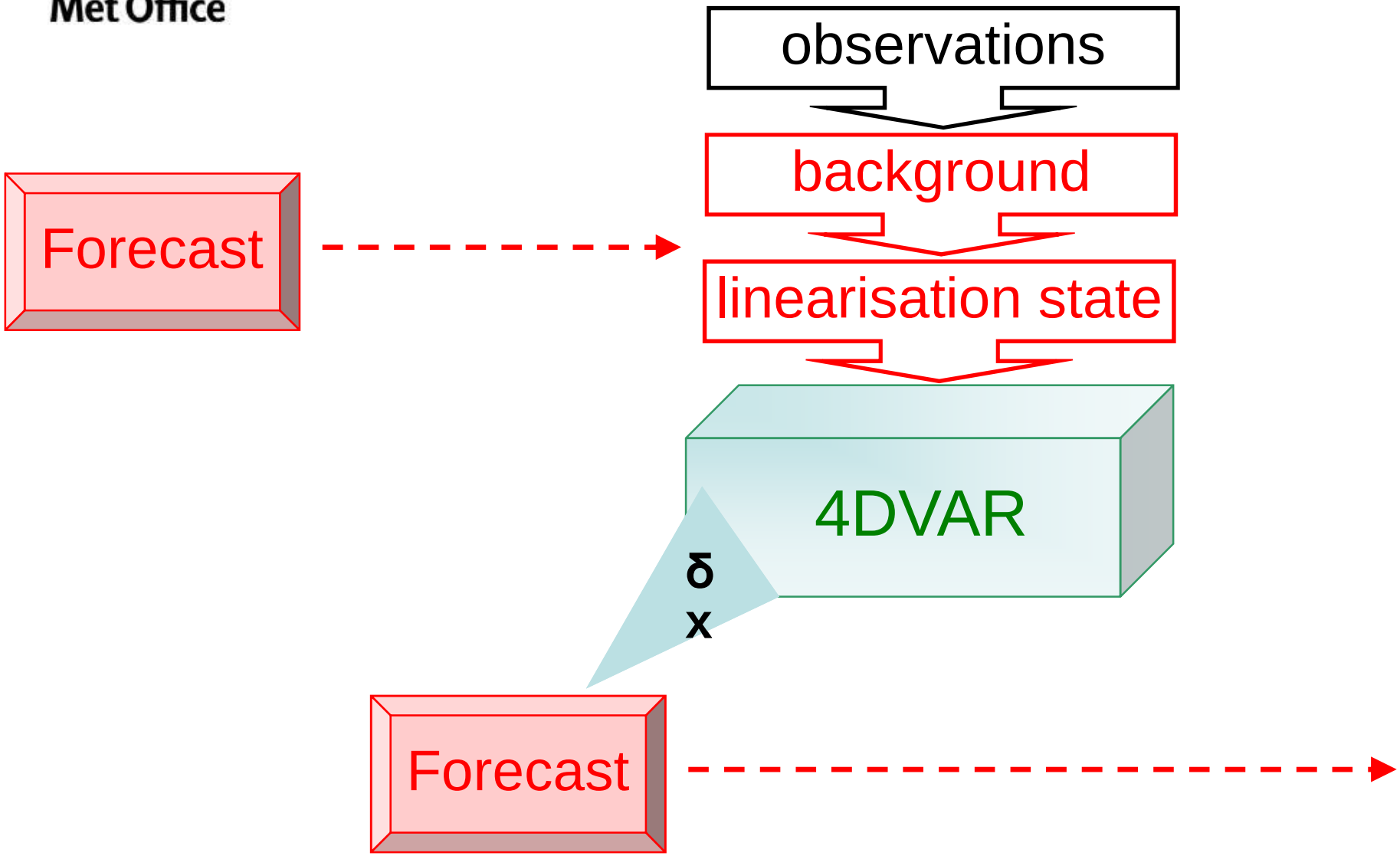
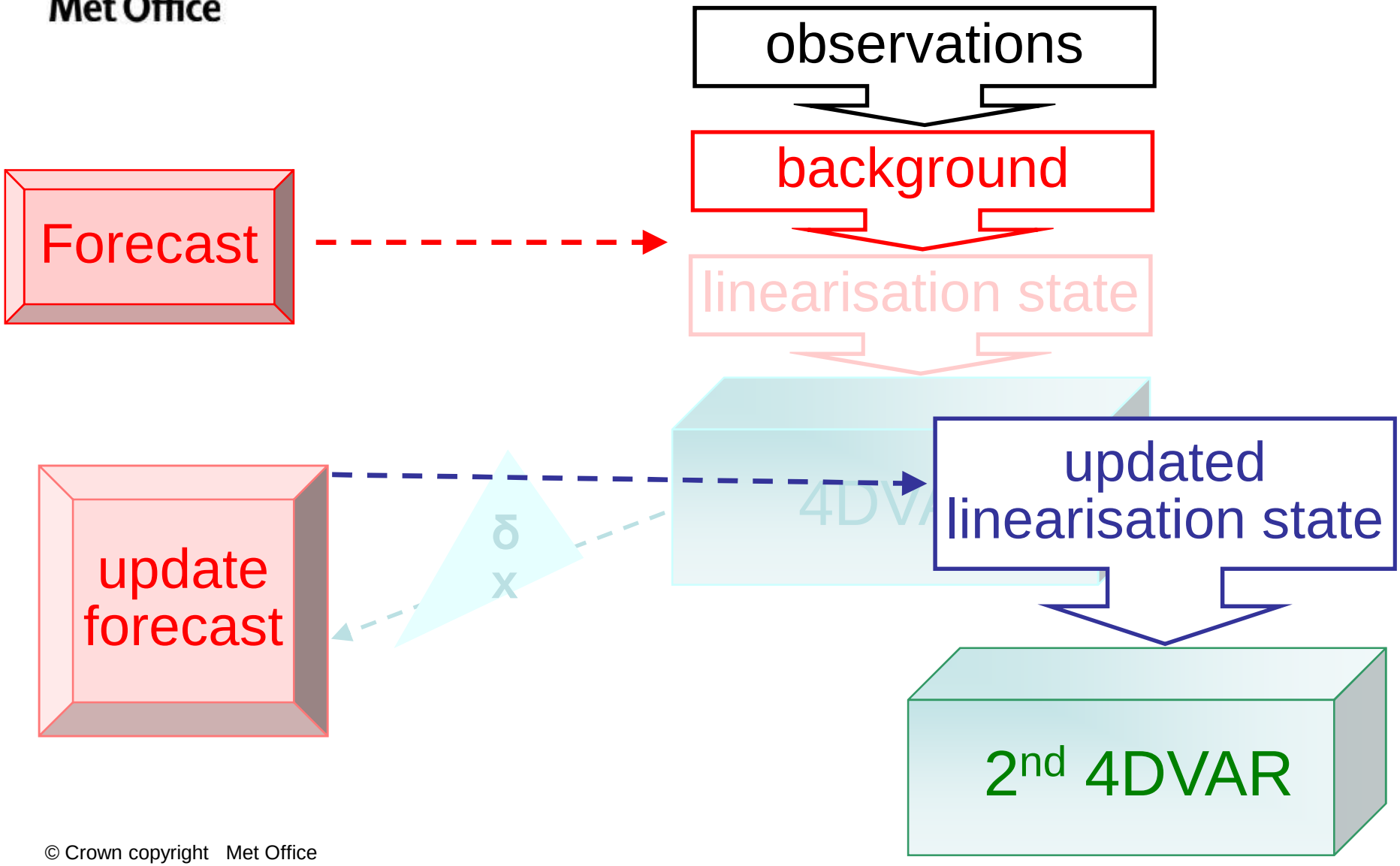


Multiple Outer Loop in VAR

Standard assimilation cycle



+ second outer loop



Second Outer Loop

- Reduces error of linearity assumption for non-linear processes

  - likely to be important for cloud and precipitation

- Increases cost of NWP by approx 50%
- Positive impacts in L38 NAE for Winter 2008/9
- Inconclusive for Summer 2009 and for both seasons at L70

Questions?