

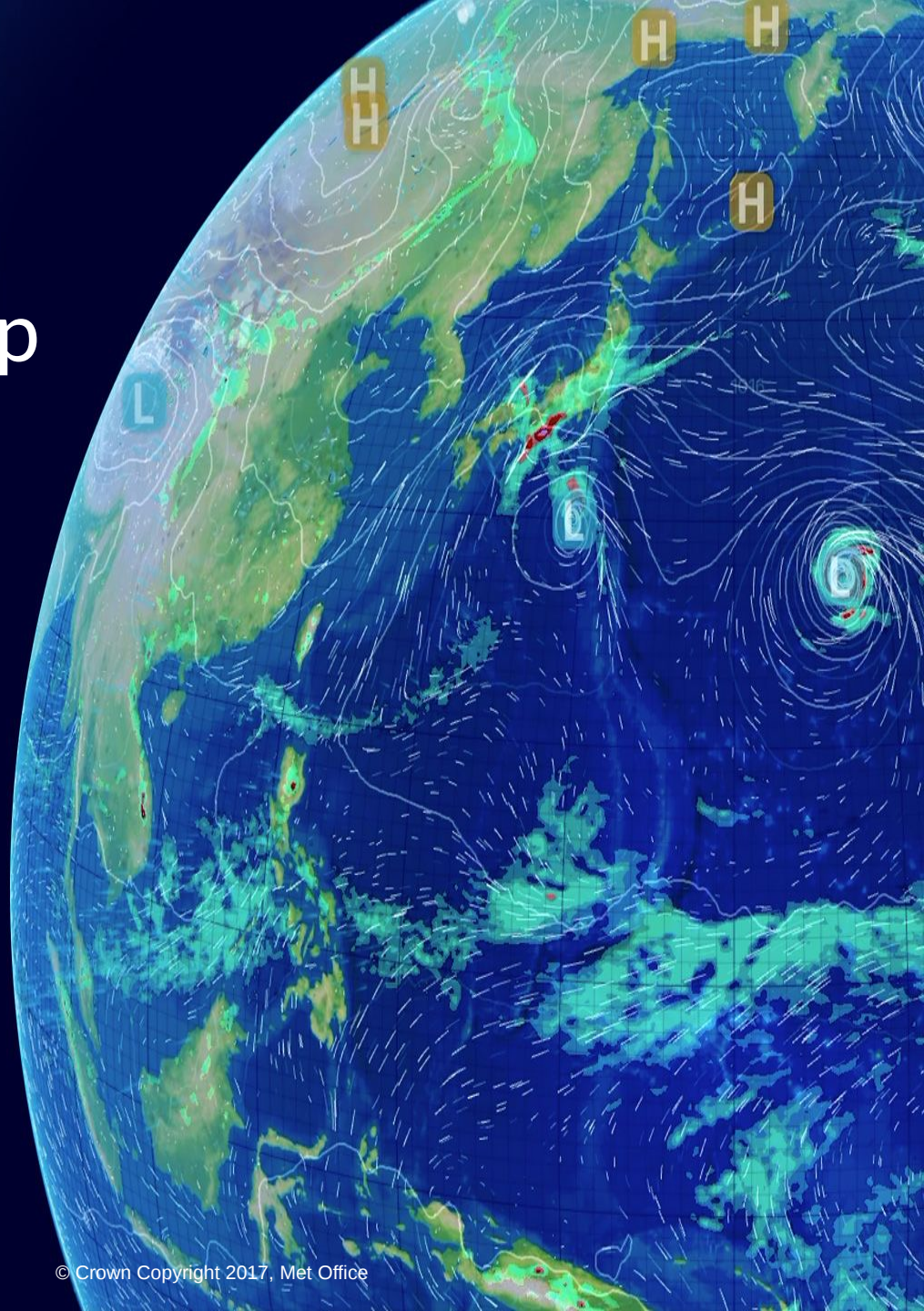
# UERRA User Workshop

## Met Office

## Reanalyses

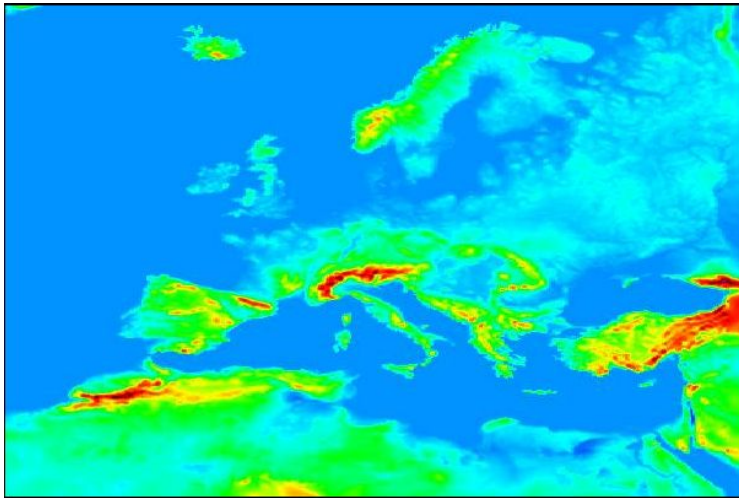
Peter Jermey & Richard Renshaw

November 2017



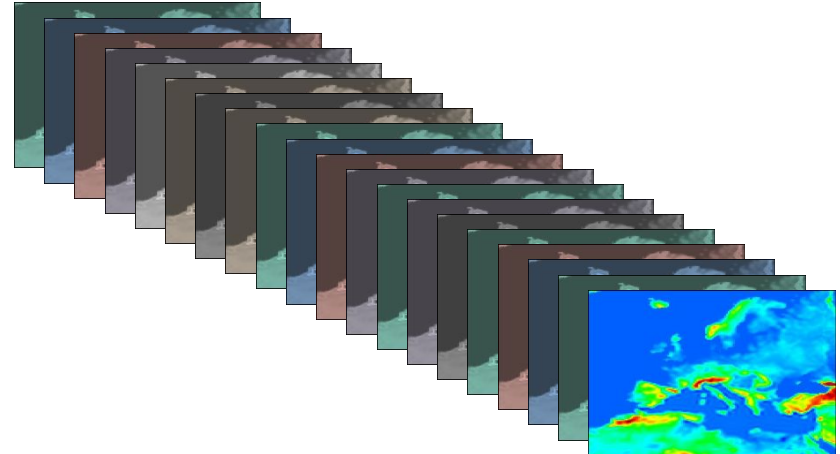
- Two reanalyses covering 1979 - 2016
- Uses unified model – outputs full atmospheric state surface to 40km
- Uses variational data assimilation at half resolution

## Deterministic

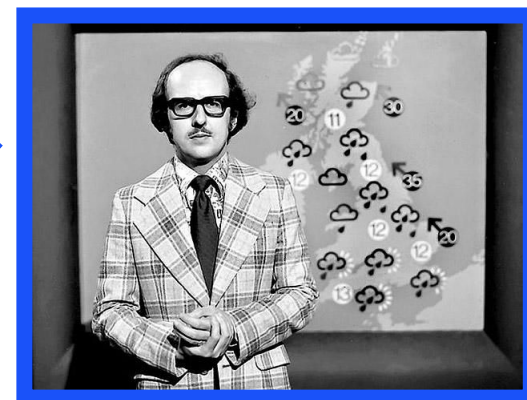


- 12km
- hybrid 4DVAR at 24km

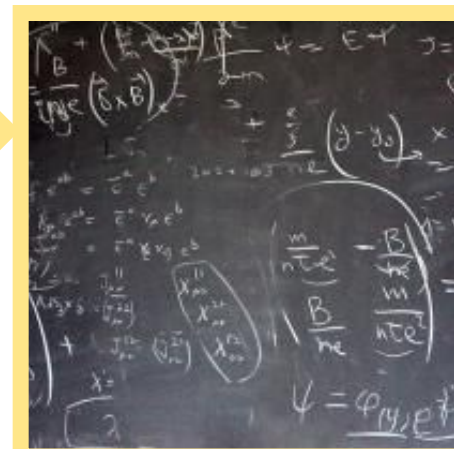
## Ensemble



- 36km
- 3DVAR at 72km



Reanalysis



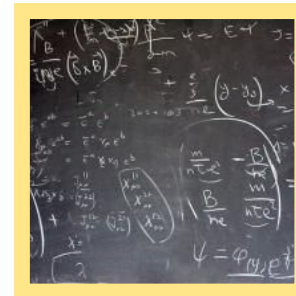
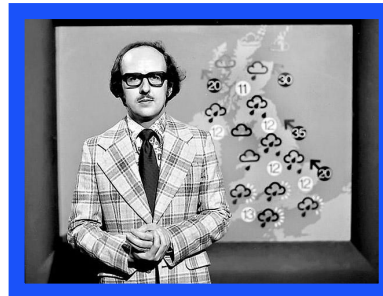
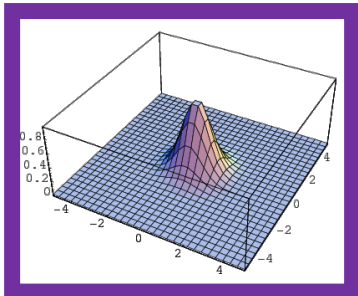


Met Office

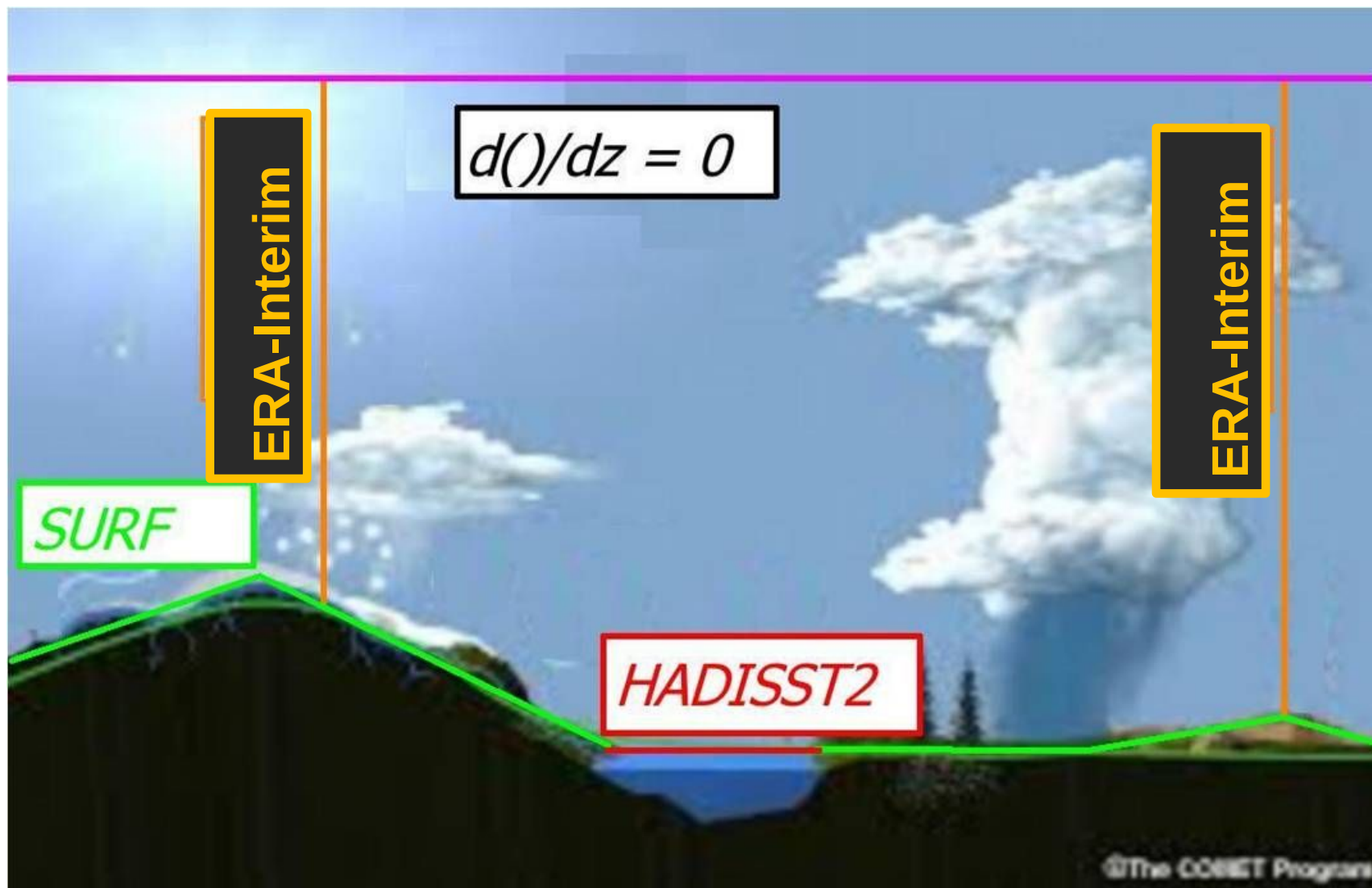
# VAR – Variational Data Assimilation

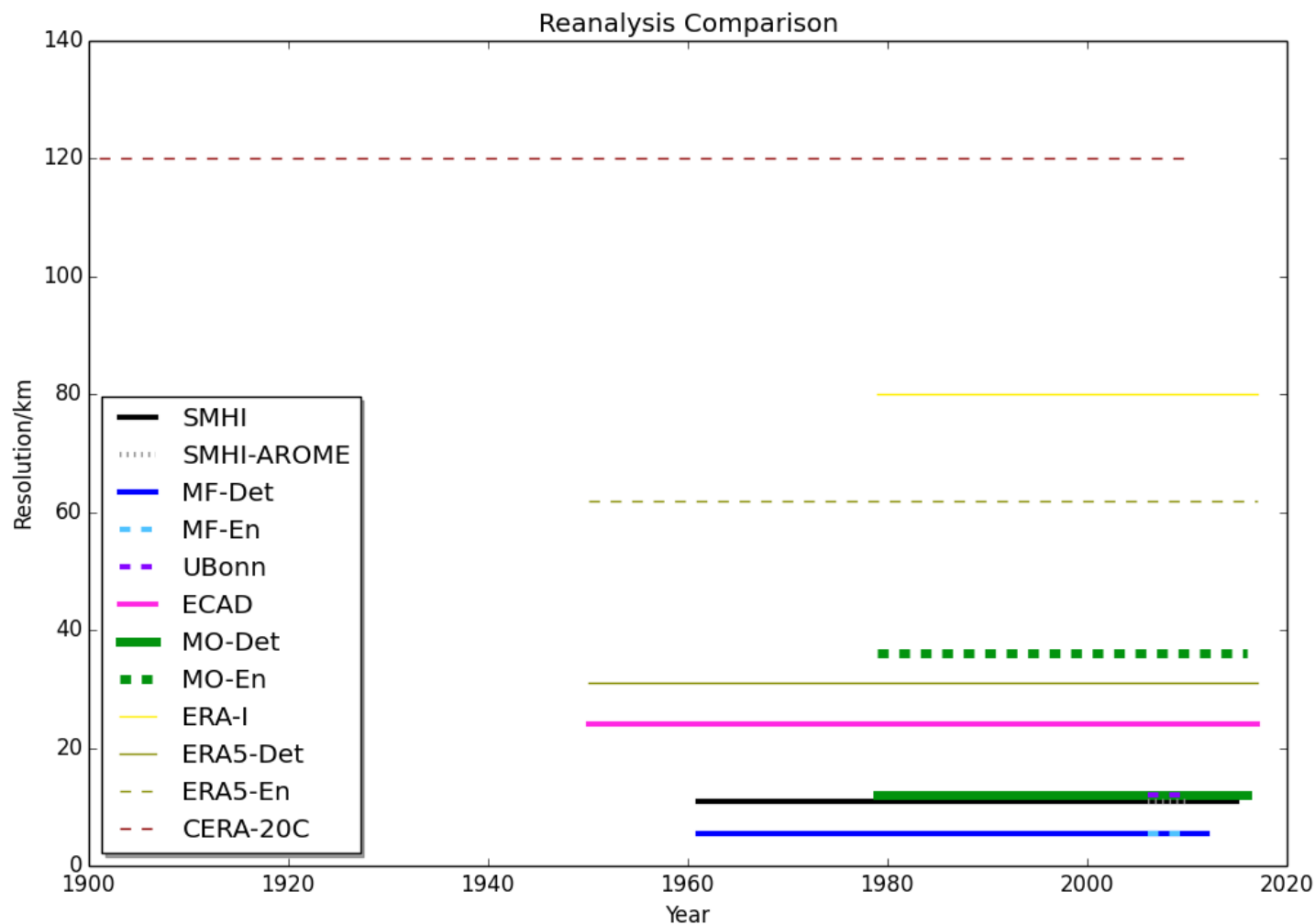


- VAR produces increments to the **background** by minimising a cost function
- Principal components of cost function are least squares differences:
  - **State minus observations**
  - **State minus background**
- Weights are given by **error covariances**
- 3DVAR **observation term** takes into **account 3D position**
- 4DVAR **observation term** takes into **account 3D position and time**
- Hybrid 4DVAR uses ensemble to estimate **background error covariance**
- **Products output by model (UM)**

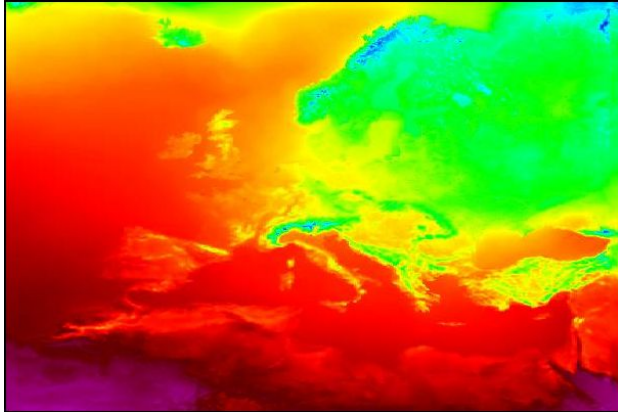


# Boundary Conditions

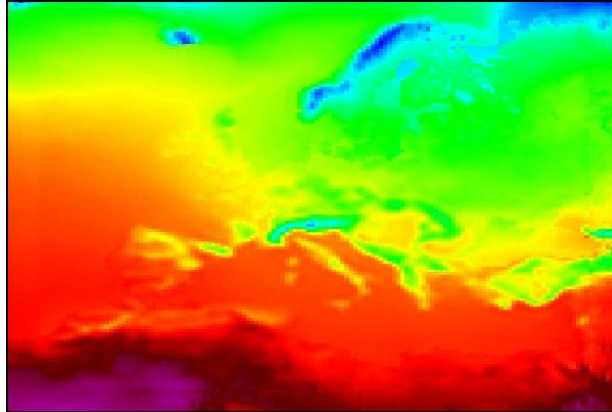




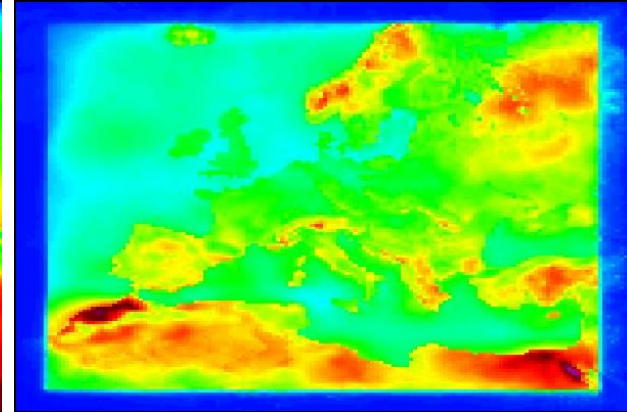
# 2m Temperature



Deterministic

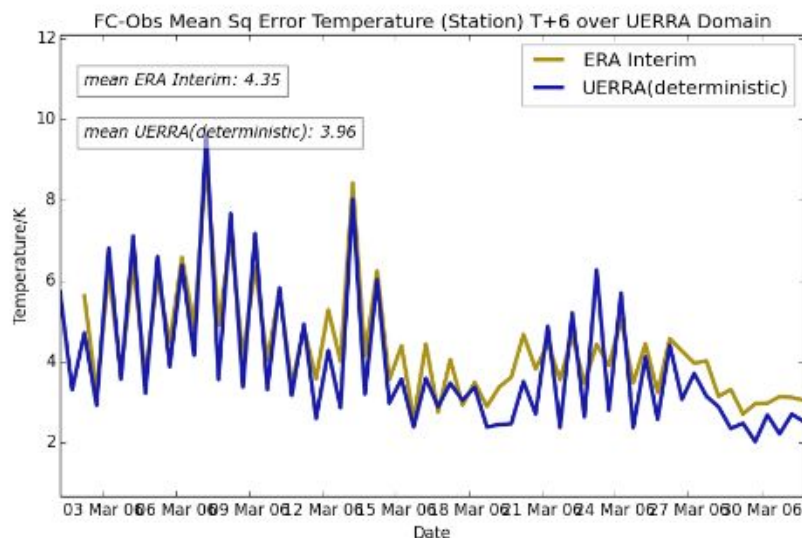


Ensemble Mean



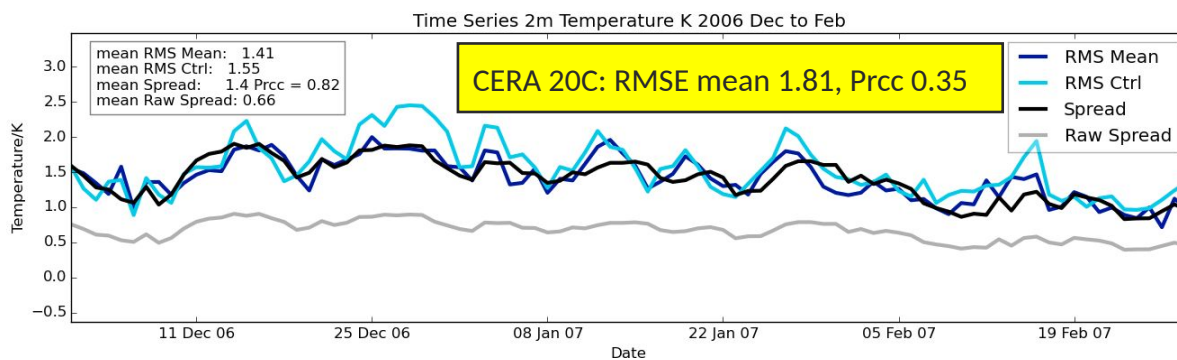
Ensemble Spread

# 2m Temperature



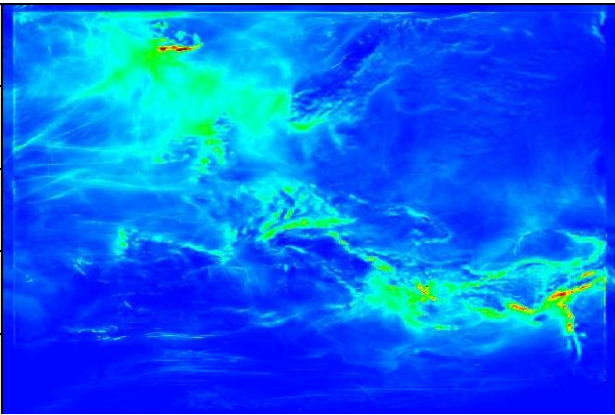
## Deterministic

March	1979	1988	1997	2006	2016
Diff %	1%	1%	9%	9%	20%

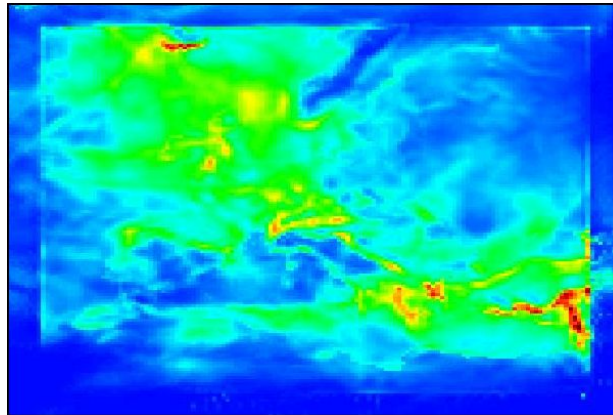


## Ensemble

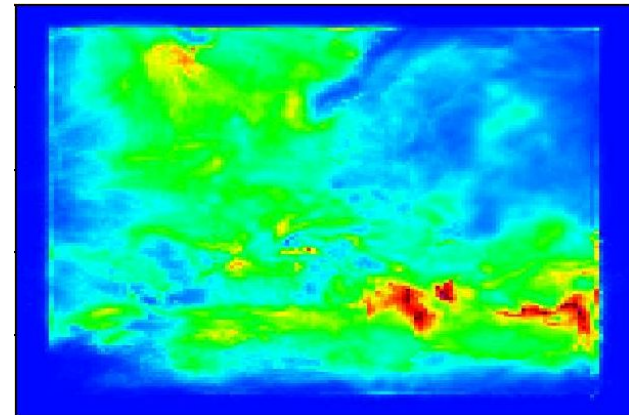
# Precipitation



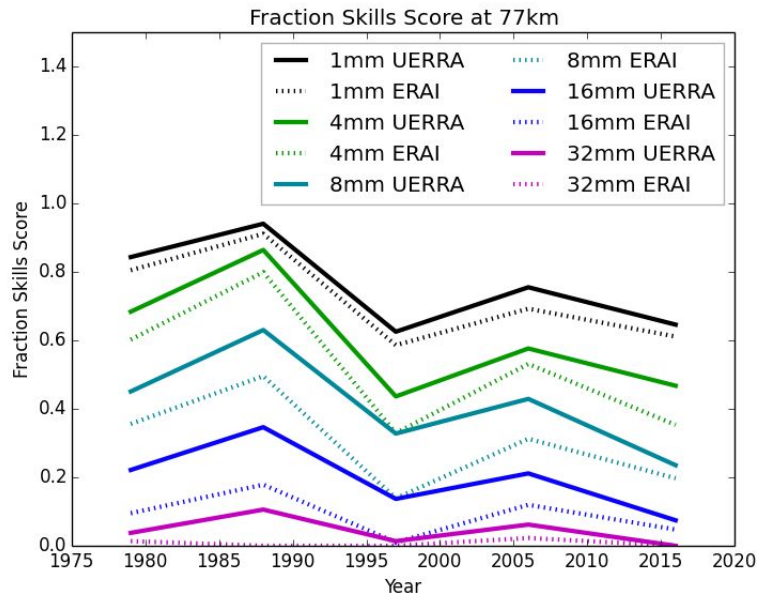
Deterministic



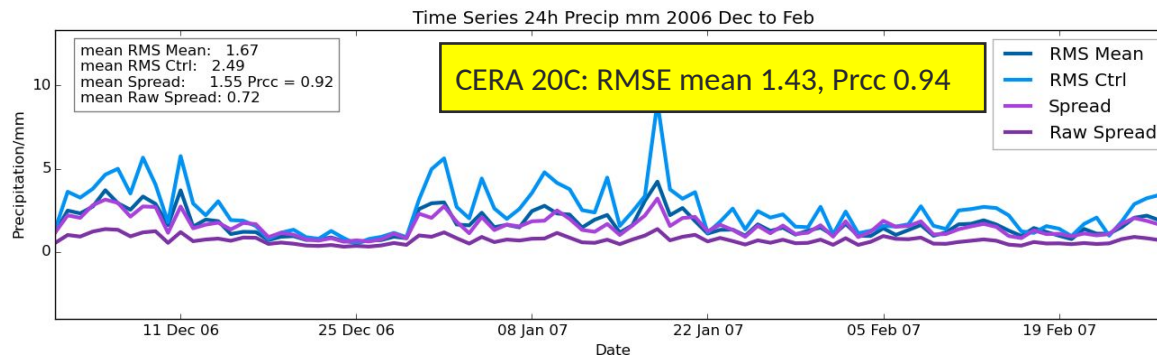
Ensemble Mean



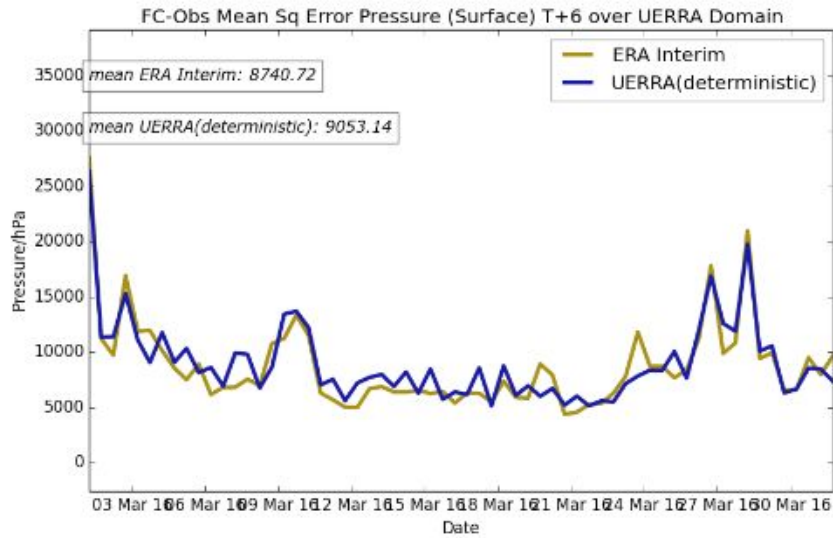
Ensemble Spread



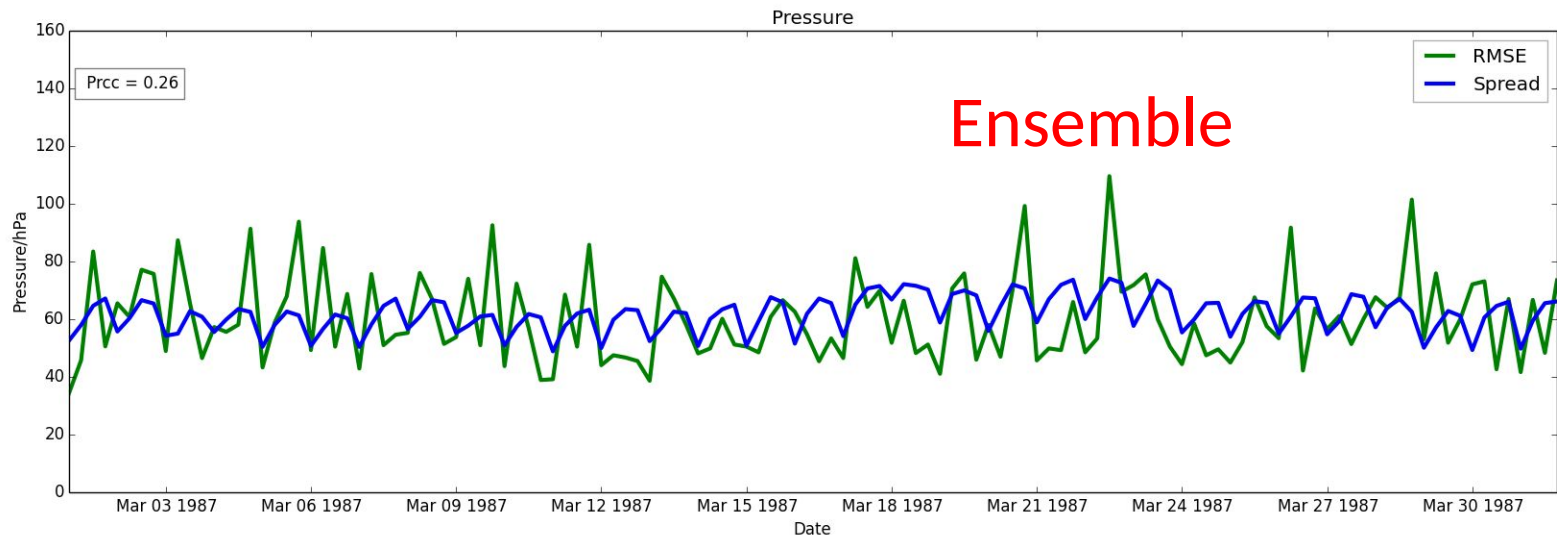
Deterministic



Ensemble

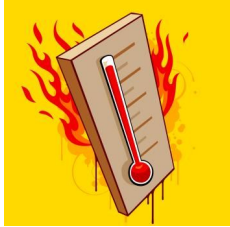


Deterministic



Ensemble

# Met Office Wide range of consistent atmospheric fields



Available on a range of level types

- Surface
- Height above orography
- Pressure levels
- Model levels

- **Two reanalyses – deterministic (12km) & ensemble (36km)**
- **Reanalysis of full atmospheric state 1979-2016**
- **Wide range of consistent atmospheric variables available**
- **Ensemble useful for uncertainty estimates**
- **Ensemble suffers from precipitation spin-up issues**
- **Deterministic improves on ERA-Interim for most variables inc. precipitation**
- **Global models are better at representing large scale variables such as pressure**