

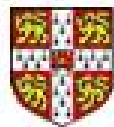
# Development of a Nudged CCM

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# Introduction

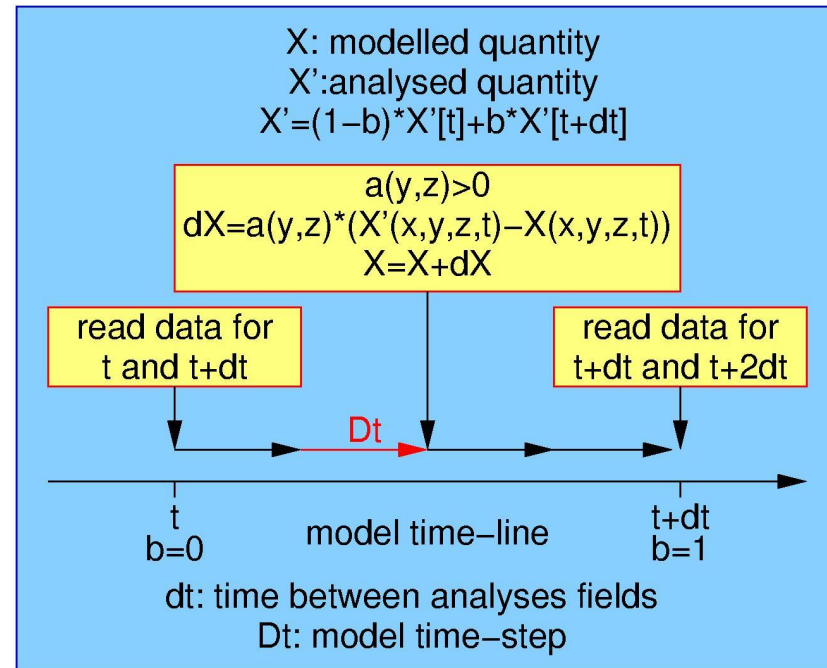
- UKCA is a CCM based on the UM (HadGAM1)
- Talks on Tuesday described its features
- Expand this model to allow nudging
- Nudging assimilates analyses (eg ERA-40) to allow model to reproduce 'weather'
- Introduce subject and model
- Demonstrate that the addition of nudging allows the model to follow the ERA-40 analyses

# Motivation

- GCM produces reasonable agreement over long timescales
- Doesn't reproduce day to day weather
- Still a few biases
- Complicates the study of chemistry
- Assimilate ERA-40 to reproduce observations
- Allow chemistry to be studied in isolation
- Increases data sets available for validation

# Nudging

- Follow ECHAM **CCM validation** approach
- Nudging is **weak** form of data assimilation
- Small relaxation parameter ( $a=0.056$ )
- Nudge  $u$ ,  $v$ ,  $T$  ( $\theta$ ) from ERA-40
- **Limit height** range

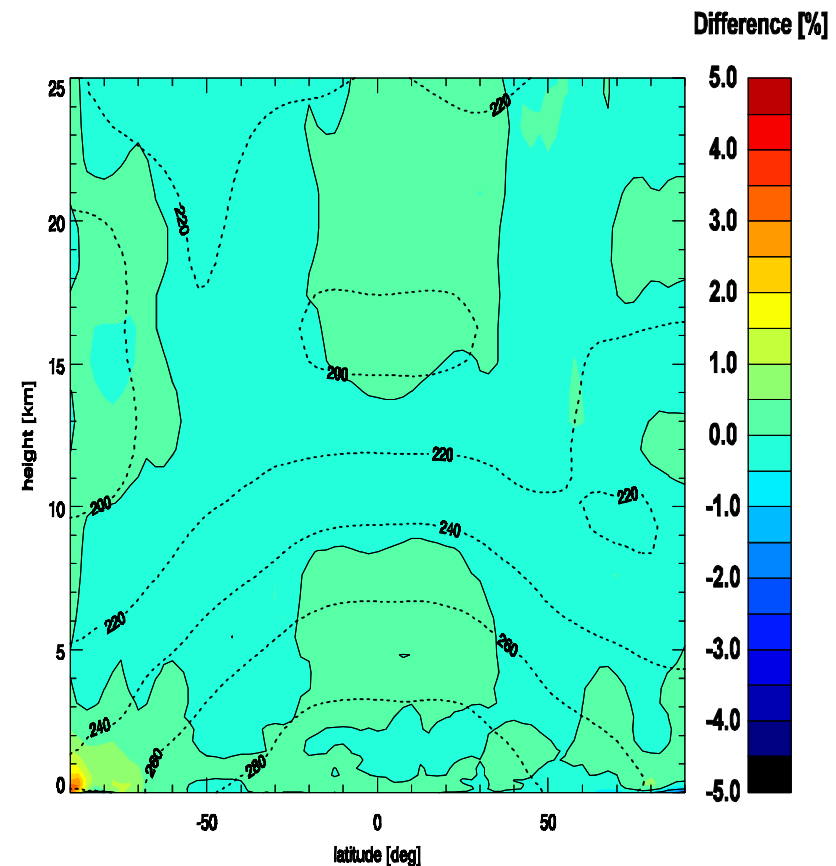
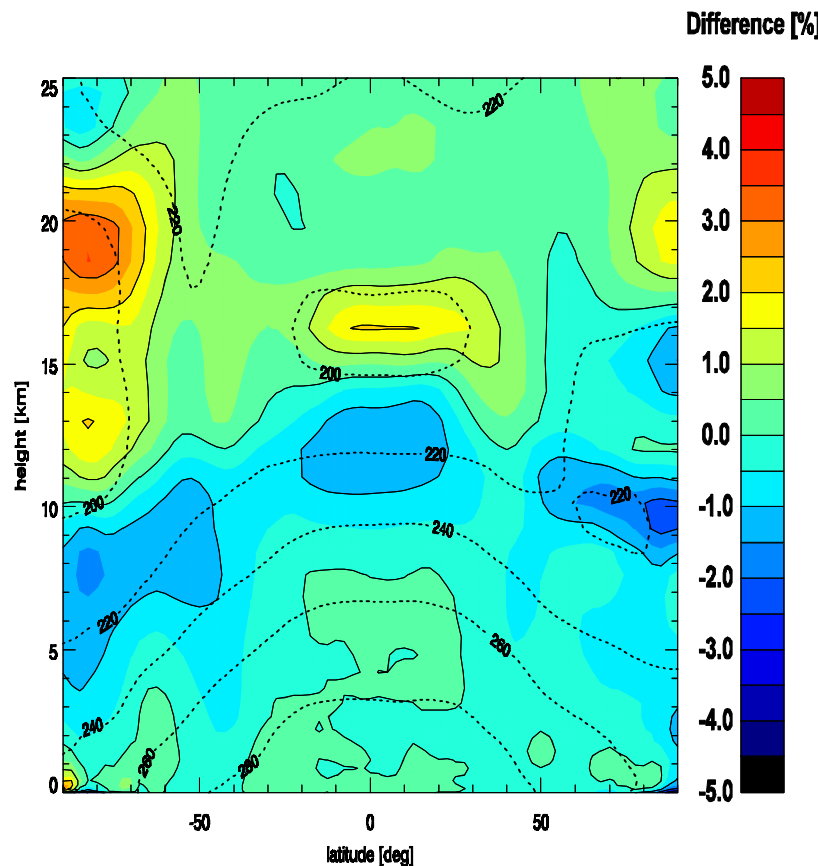


# Model Validation

- Ran for a year – **stable**
- Focus on Oct, Jan and Jul in **detail**
- Run **with** and **without** nudging
- Calculate **bias**, **RMSE** and **correlations**
- Look at variables nudged directly (**u**,  **$\theta$** ) and those implicitly ( **$P_s$** , **q**,  **$\omega$**  etc)
- Change **strength** of nudging
- Change **data** (pressure versus model levels)

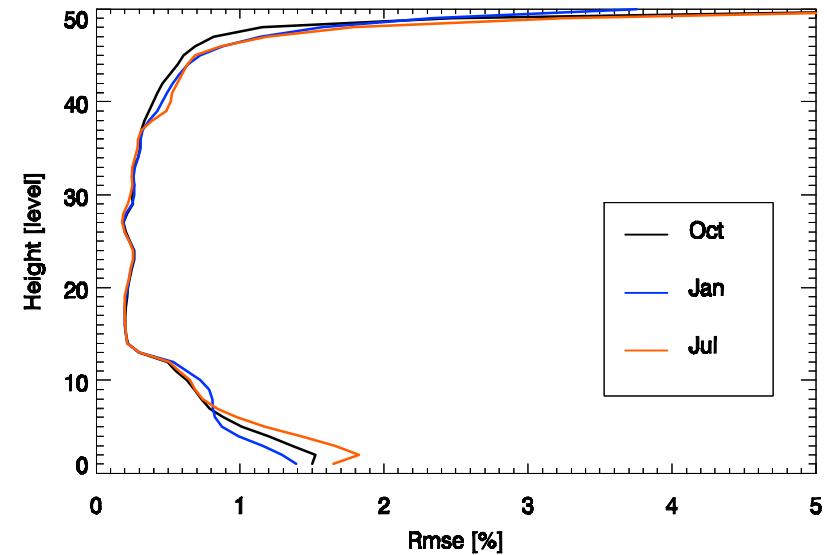
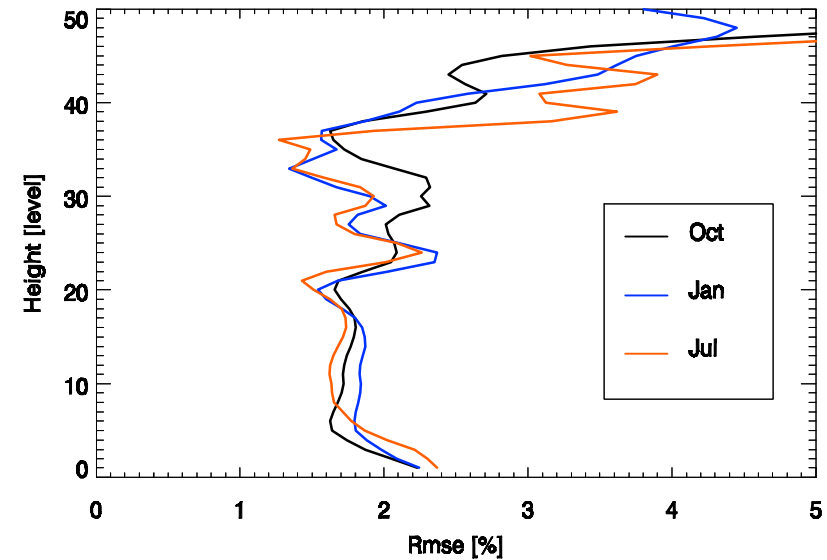
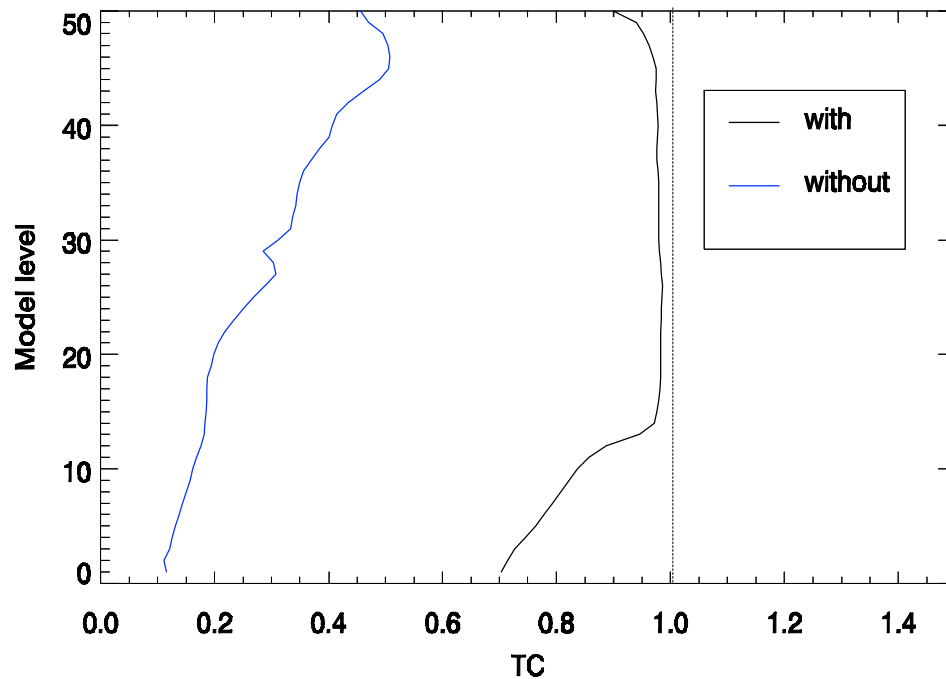
# Potential Temperature ( $\theta$ ) Biases

- Bias in **models** (free and nudged) and **data**
- **Warm bias** in model disappears



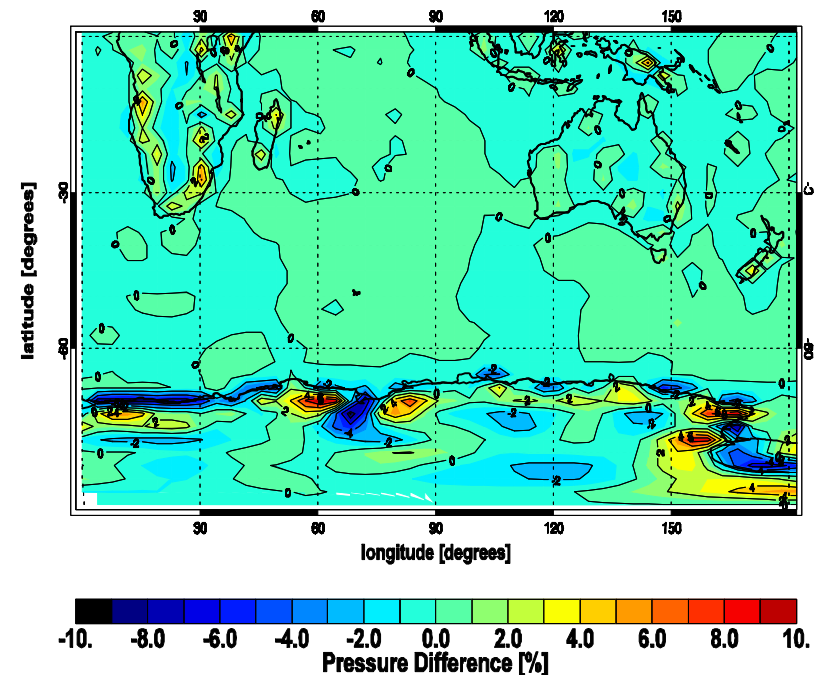
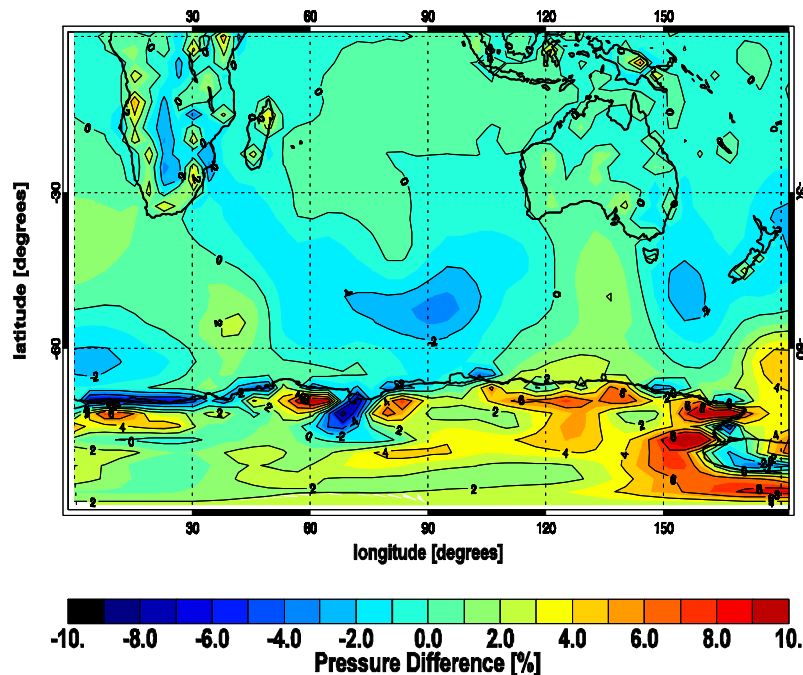
# Other Diagnostics

- Examine **RMSE** and **correlations** in time and space



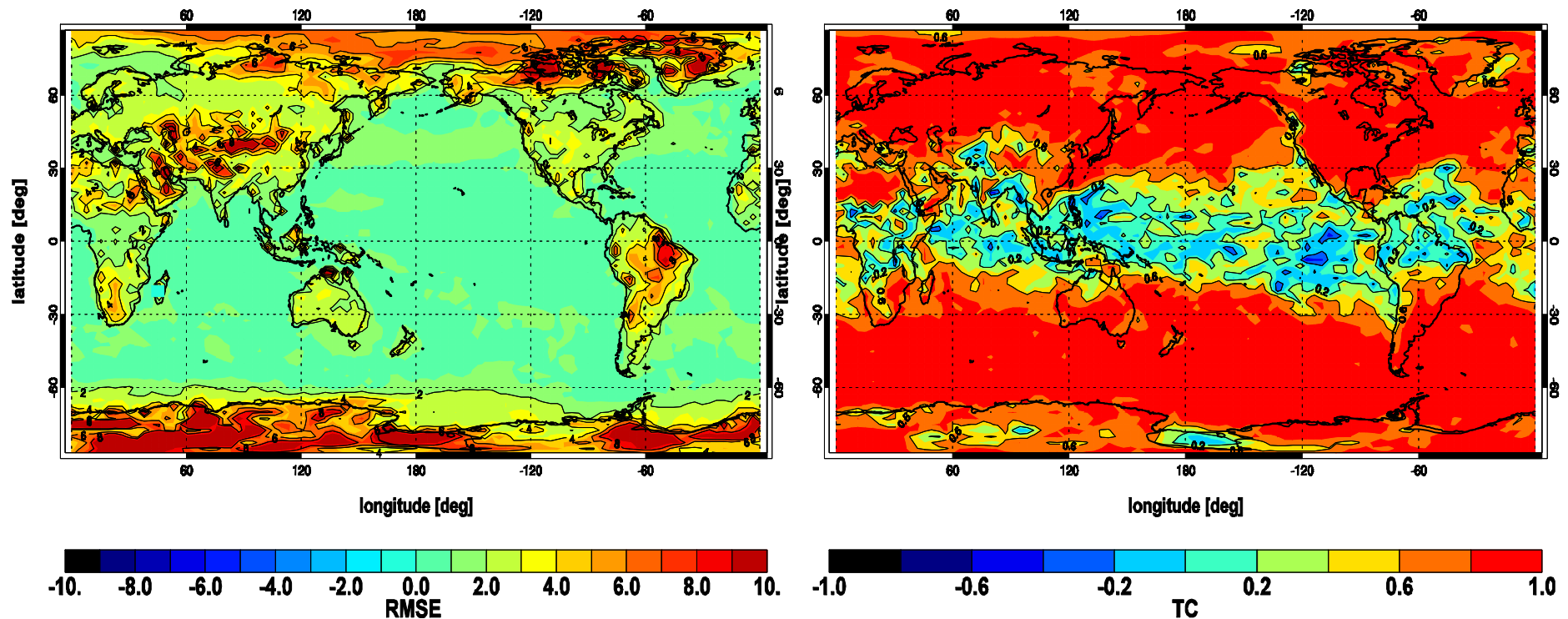
# Surface Pressure

- Look at a variable that we **don't adjust**
- Make **snapshot** comparisons between **models** (free and nudged) and **data**
- Synoptic systems reproduced in **S Ocean**



# Spatial Variation

- Look at the **surface** RMSE and TC for theta
- Prescribing **SSTs** constrains surface
- Correlations best in **extra-tropics**



# Summary

- Nudging has been added to **UKCA** model
- Improves agreement with **ERA-40** analyses
- Allows study of **chemistry** in isolation
- Allows use of episodic **datasets**
- Technical note released soon

