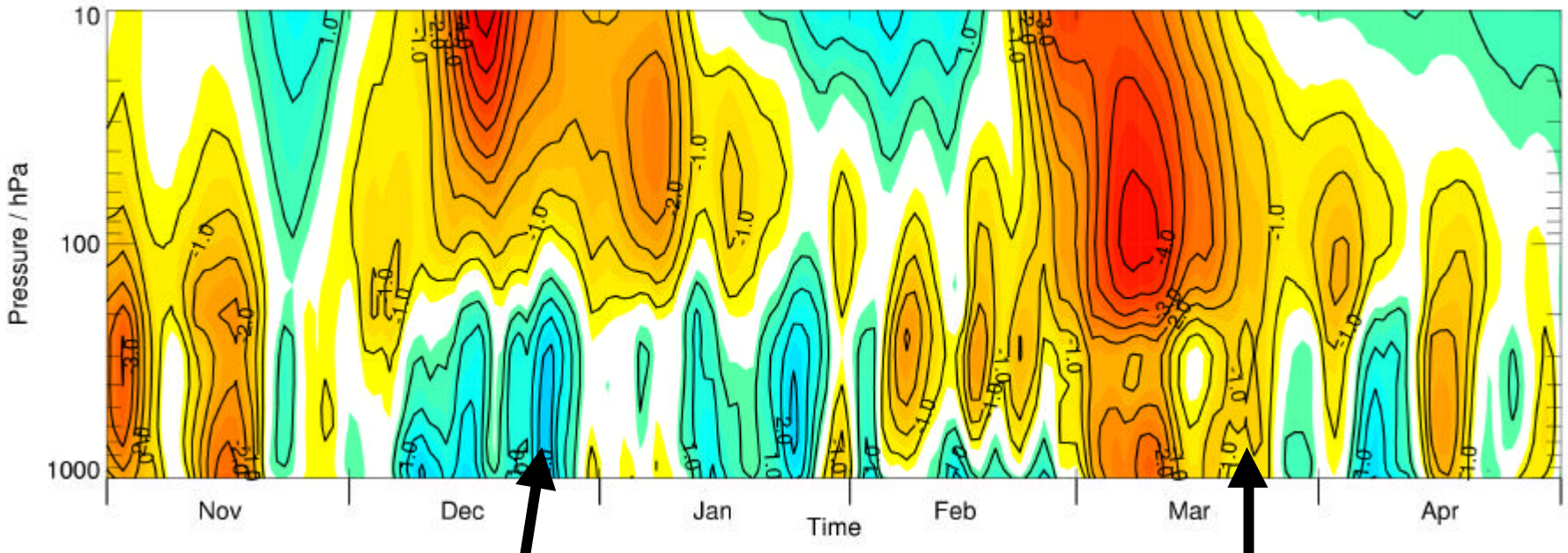
# The role of the Stratosphere in Medium-Range Weather Forecasts

**A J Charlton**
University of Reading, UK
**A O'Neill and W A Lahoz**
DARC, University of Reading, UK
**A Massacand and T N Palmer**
ECMWF, Reading, UK

The University of Reading

# Motivation

## AO Amplitude NH Winter 1998/1999




No Impact on Troposphere ?

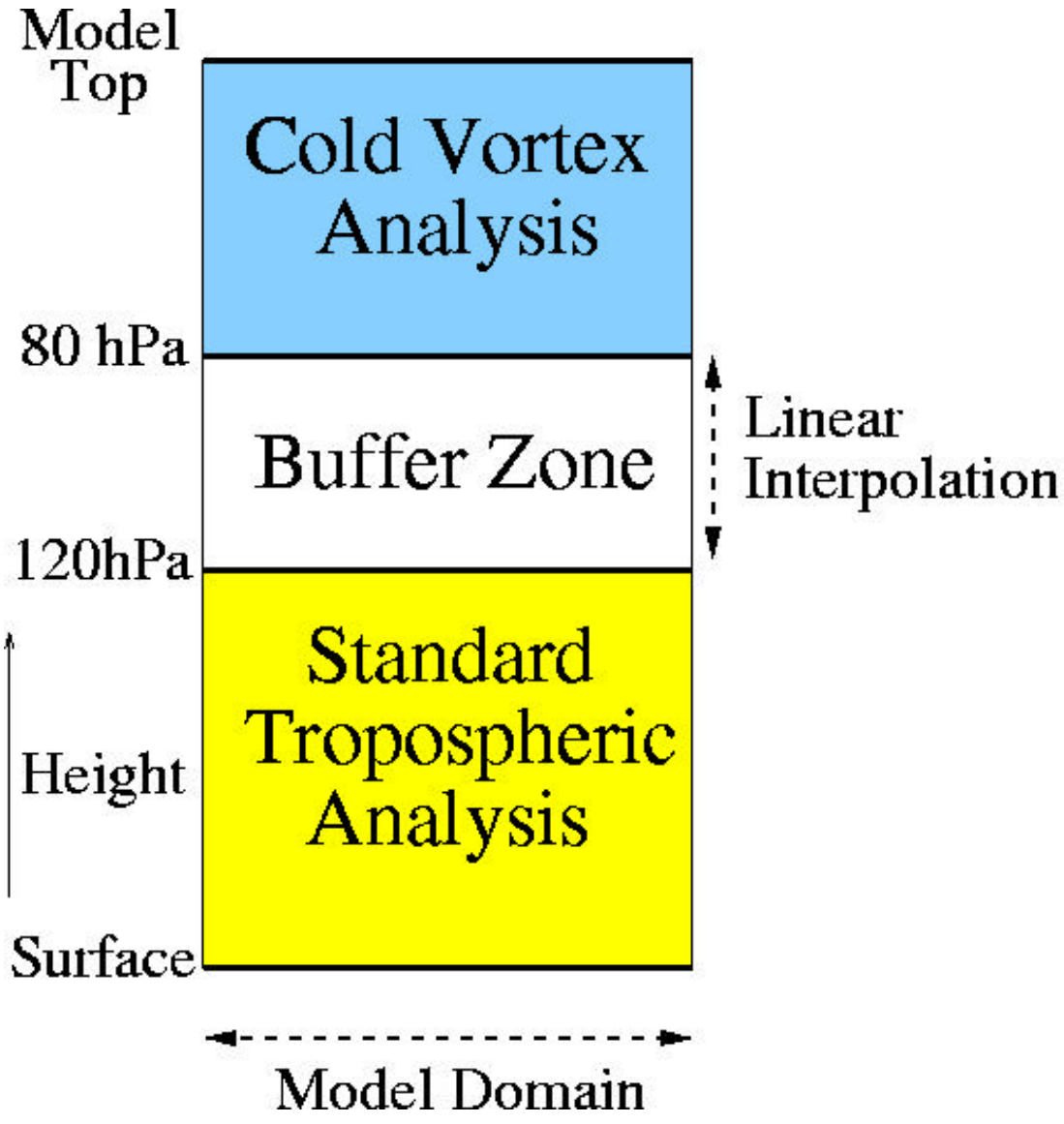
Predictability of Tropospheric Flow ?

# Aims

- Does the Stratosphere influence the Troposphere ?
- On what timescales ?
- Does the correct representation of the Stratosphere improve Tropospheric forecasts ?

# Methodology

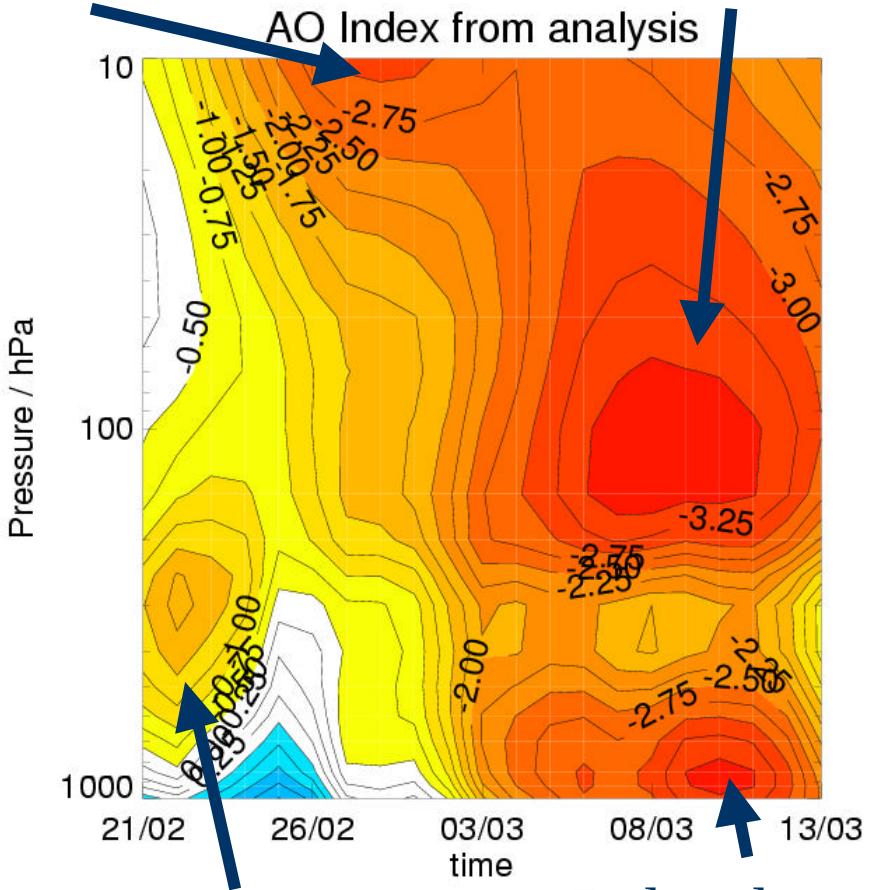
- ECMWF IFS model (T255L60).
- Warm Ensemble (20 Days, 30 Members).
- Cold Ensemble change initial stratospheric conditions.



# Model Validation

Sudden Warming

Downward Propagation ?

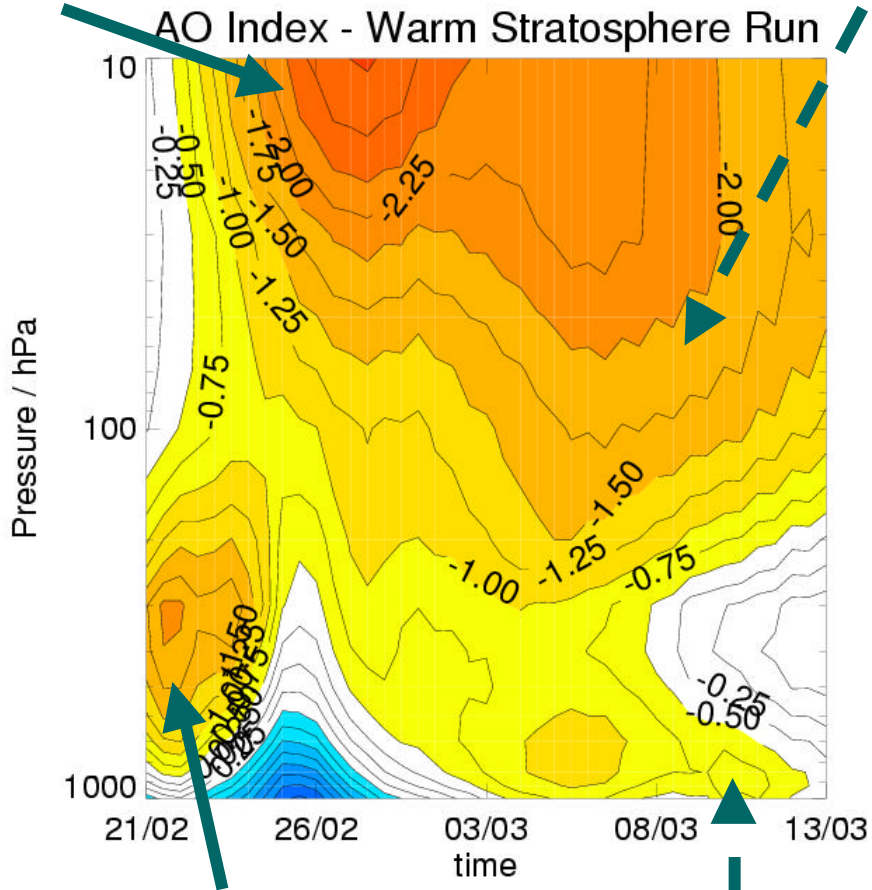



Troposphere Disturbed

Related to Stratosphere ?

Sudden Warming

Downward Propagation ?

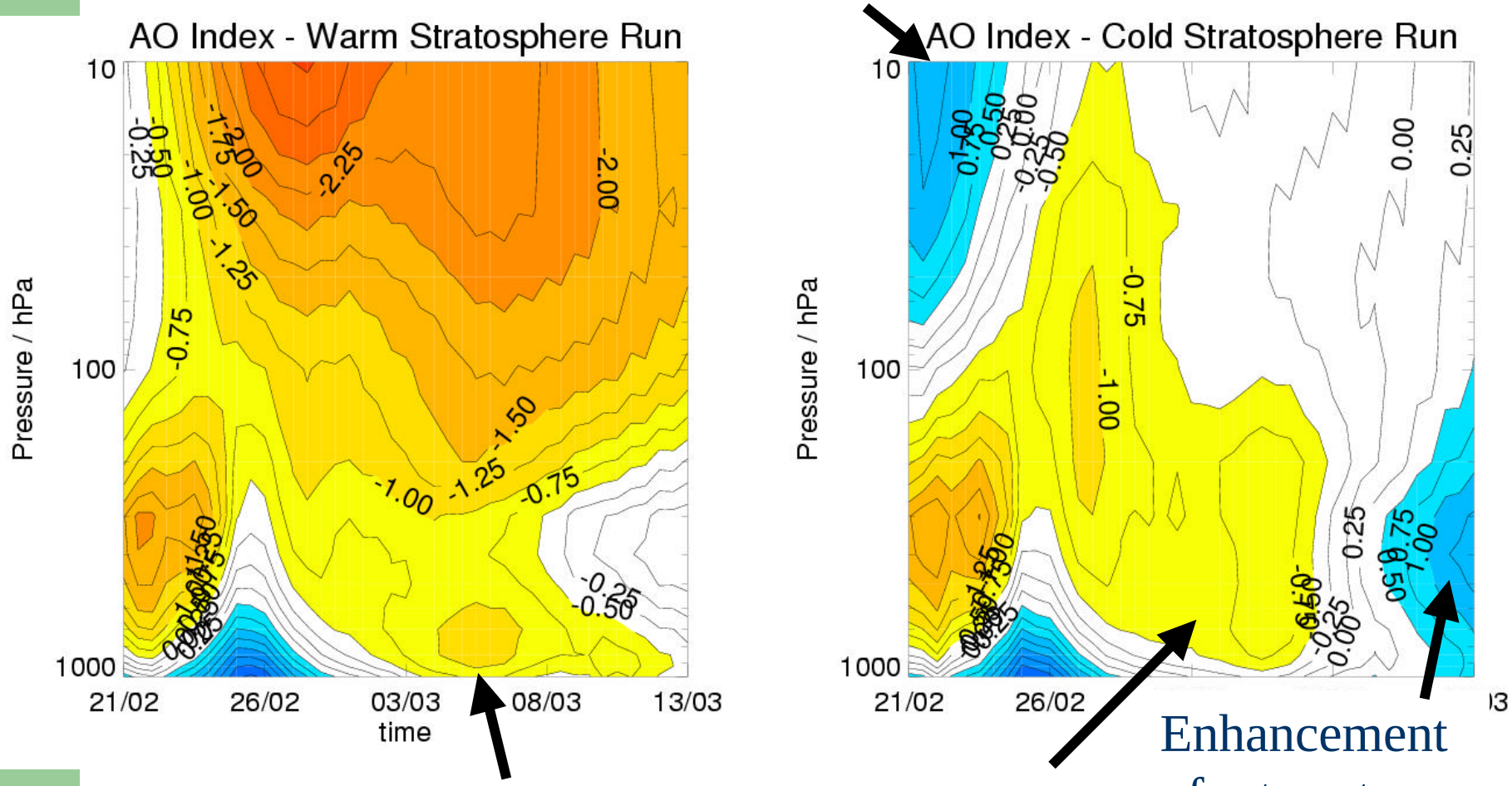



Troposphere Disturbed

Related to Stratosphere ?

# Comparison of Runs

Cold Vortex

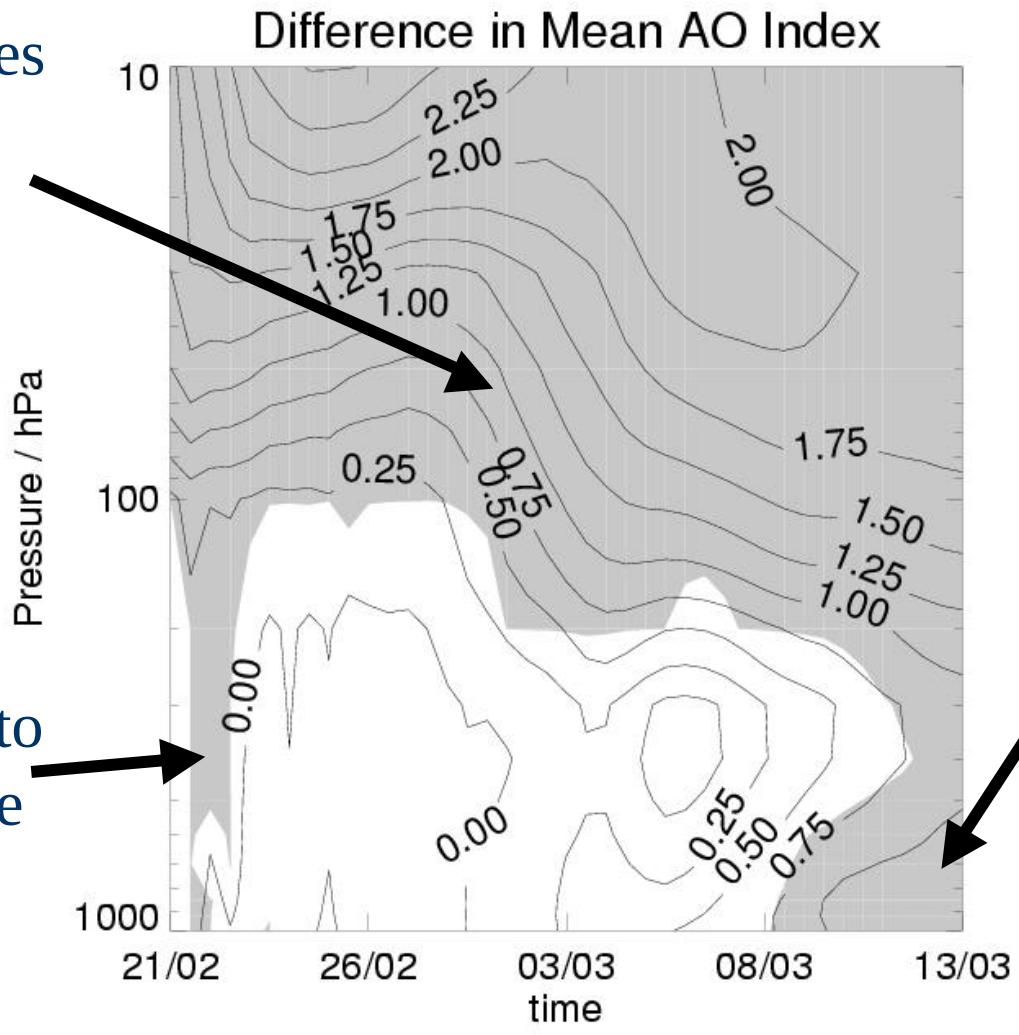



Troposphere less disturbed

Enhancement of return to undisturbed

# AO Differences

Phase lines tilt down



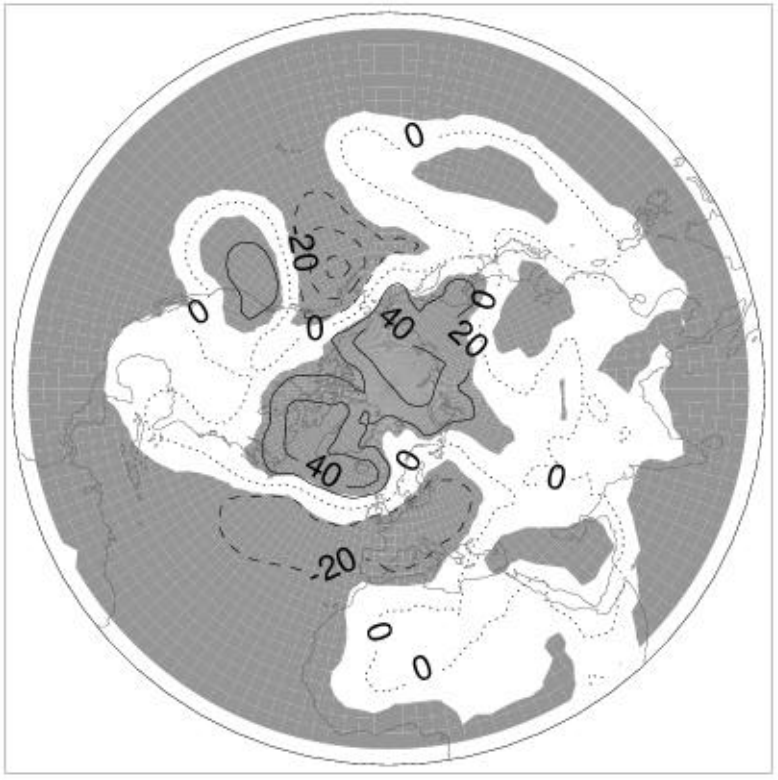

Adjustment to initial change

Significant, small change to Tropospheric AO

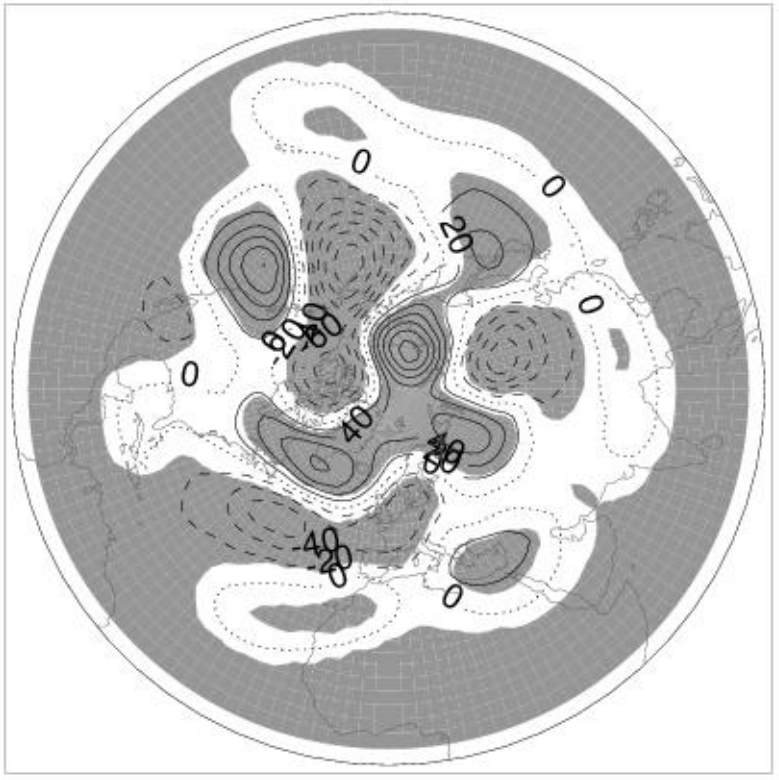
Shading = Significant 99%

# Height Differences

Mean Height Difference 1000 hPa

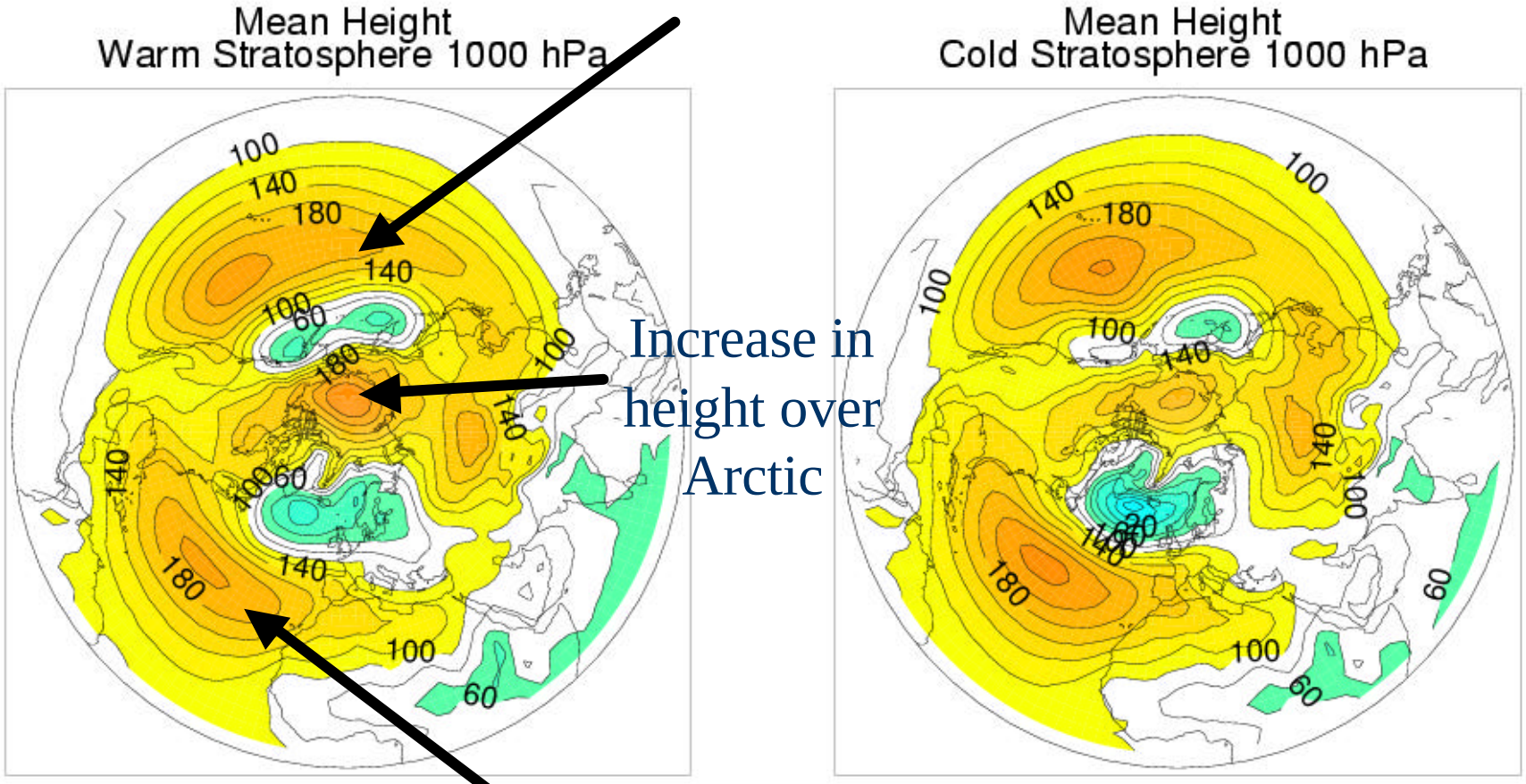



Mean Height Difference 300 hPa



# Difference at Surface

Change in intensity of Pacific High

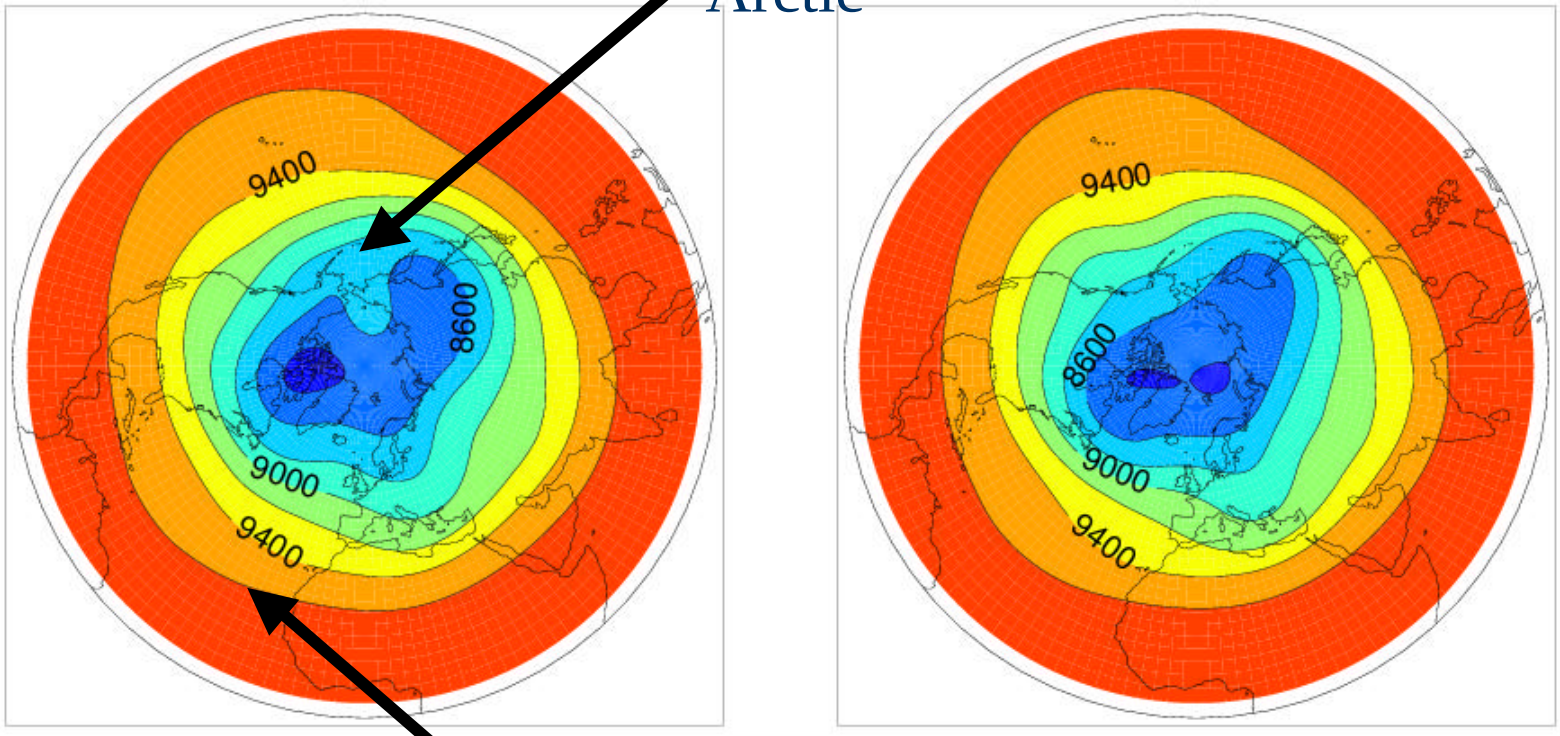



Increase in height over Arctic

Change in intensity of Azores High

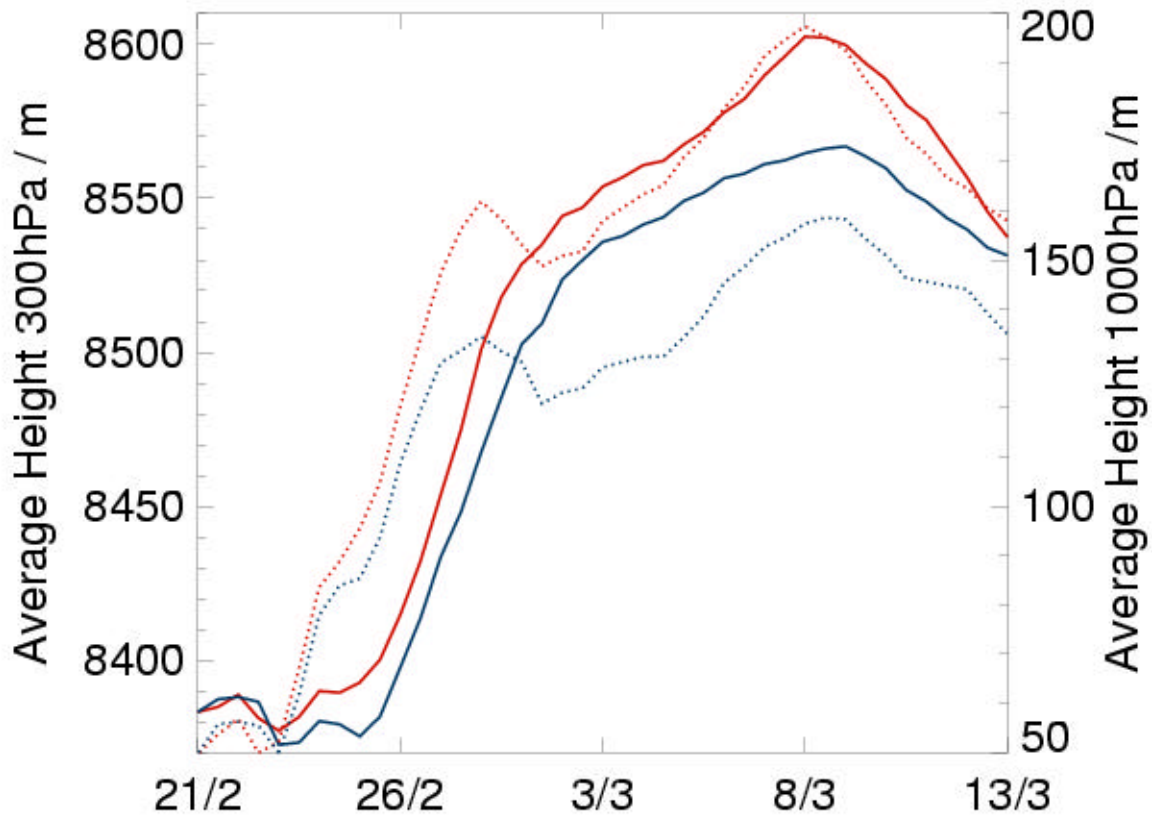
# Difference in Upper Troposphere

Enhanced Height over Arctic




Little difference in Atlantic Sector

# Average over Arctic Basin




Area weighted average over Arctic Box

15-20 Days

(90-60N,130E-130W)

Red=Warm Stratosphere

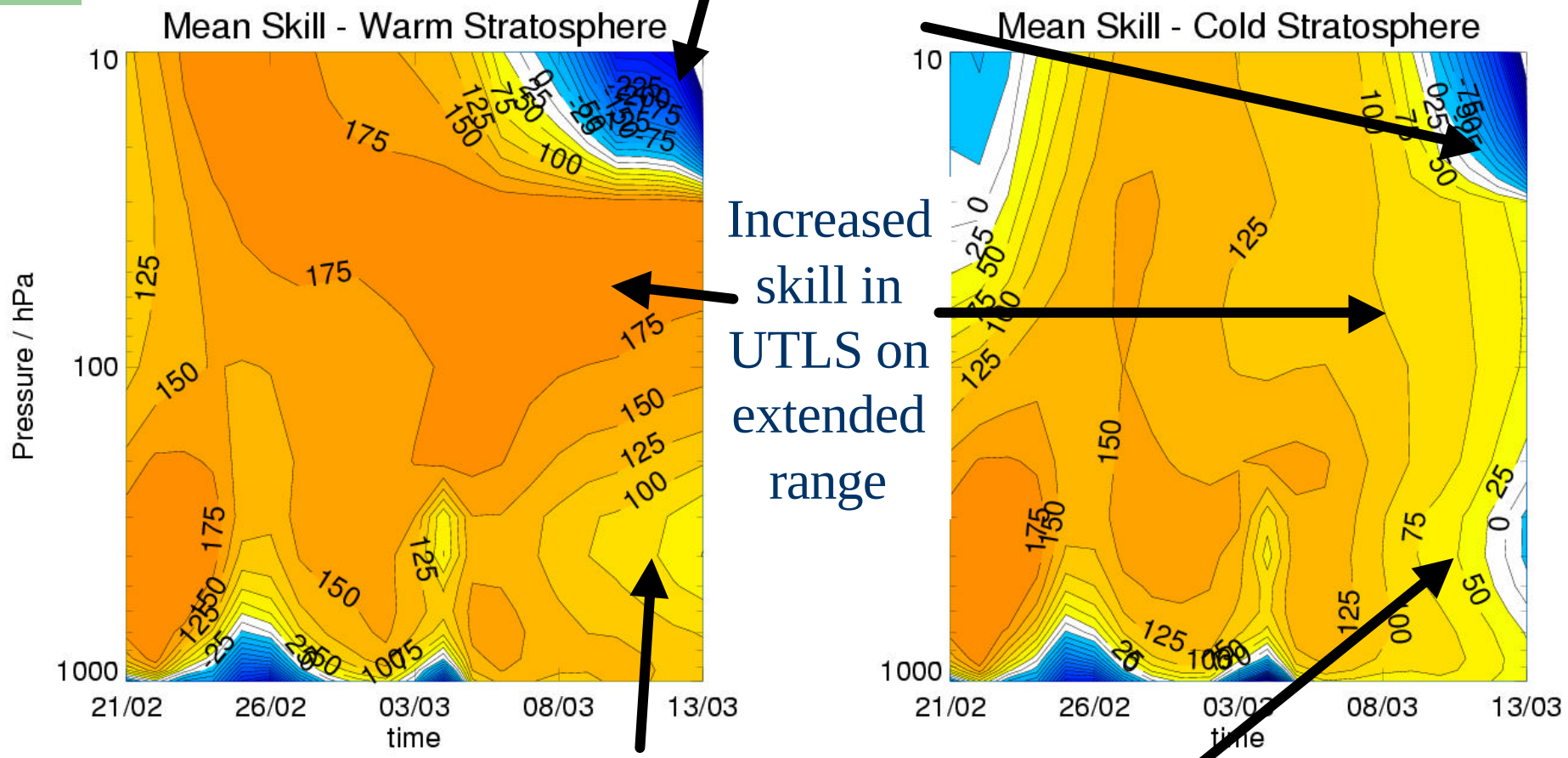
Blue=Cold Stratosphere

Solid Line=300hPa

Dotted Line=1000hPa

# Impact on Forecast Skill

Rapid loss of Skill in Stratosphere

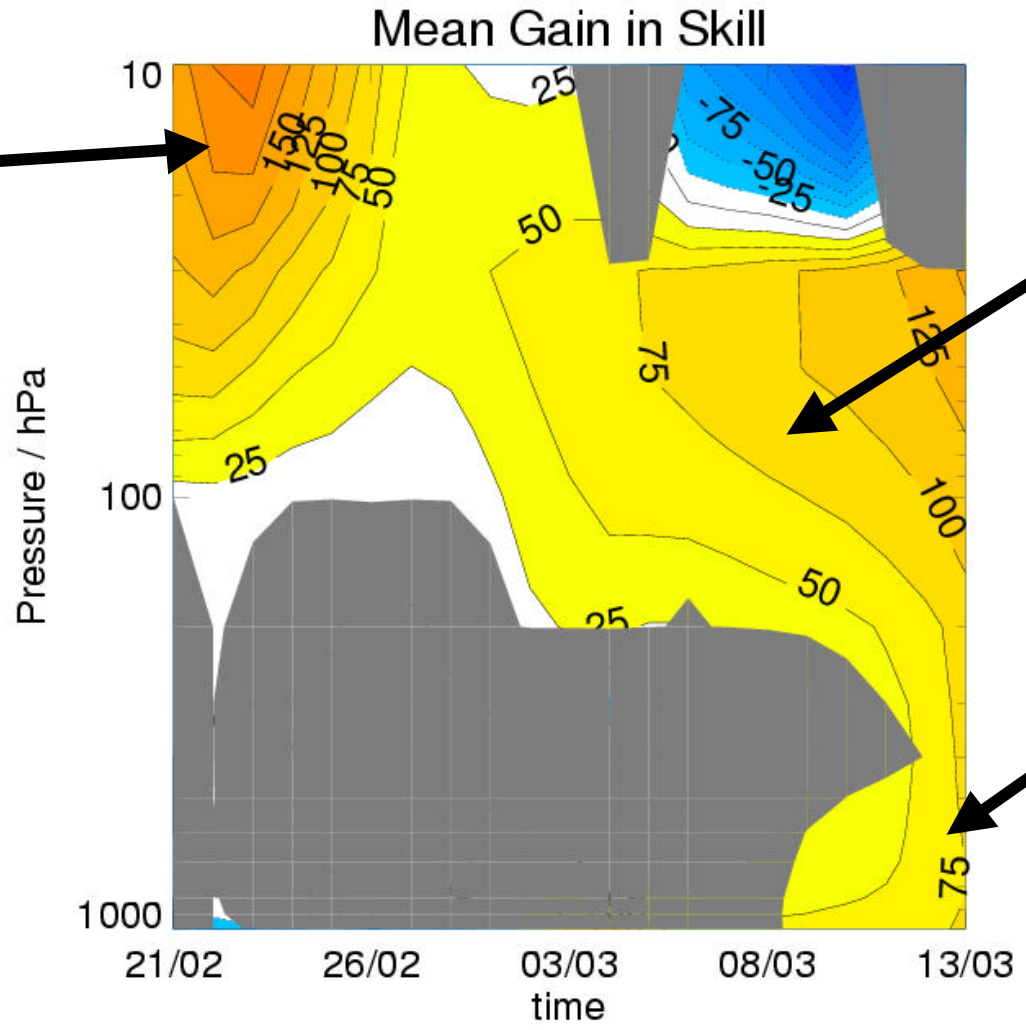



Increased skill in UTLS on extended range

Reduced loss of Skill in Troposphere

# Gain in Skill

Correct Initial Conditions




Significant increase in skill despite decrease above

Increase in skill significant after 15 days

# Summary

- Stratospheric initial conditions affect troposphere.
- Changes to Geopotential Height ~25-50m
- Timescale 15-25 days
- Increase in skill 100% after 15 days

a.j.charlton@reading.ac.uk

http://www.met.reading.ac.uk/~swr00ajc