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Model evaluation using seamless assessment

Keith Williams

SPARC meeting, 21/06/10

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What is ‘seamless model assessment’ ?

Depends who you ask!

- Traditional boundaries between Weather and Climate prediction are artificial.
- Many key systematic climate errors are common to short range integrations of the same model run from well balanced initial states.
- Seamless Model Assessment (our definition) is using a model across space and timescales to assess and improve the simulation of processes within the model.
- Having a Unified Modelling system increases the types of analysis which can be undertaken, but much can be learnt about climate models without an NWP/DA counterpart by still running them in ‘NWP mode’.

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Met Office zonal T & u biases

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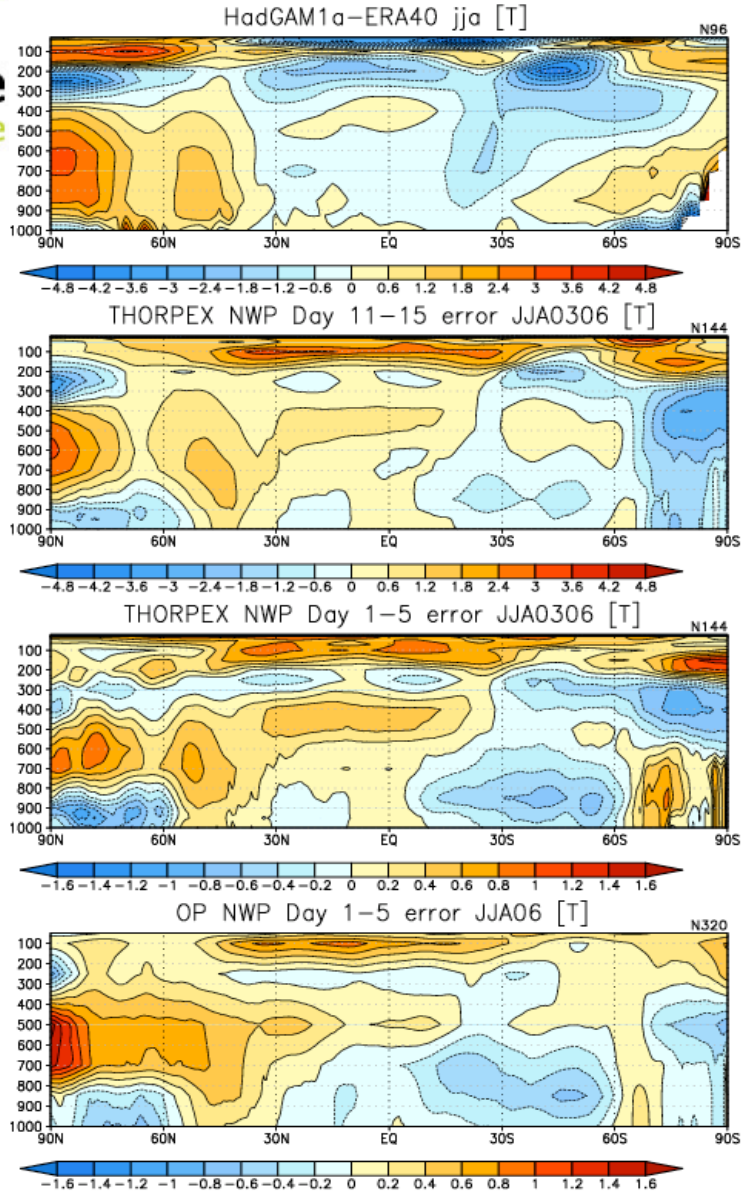
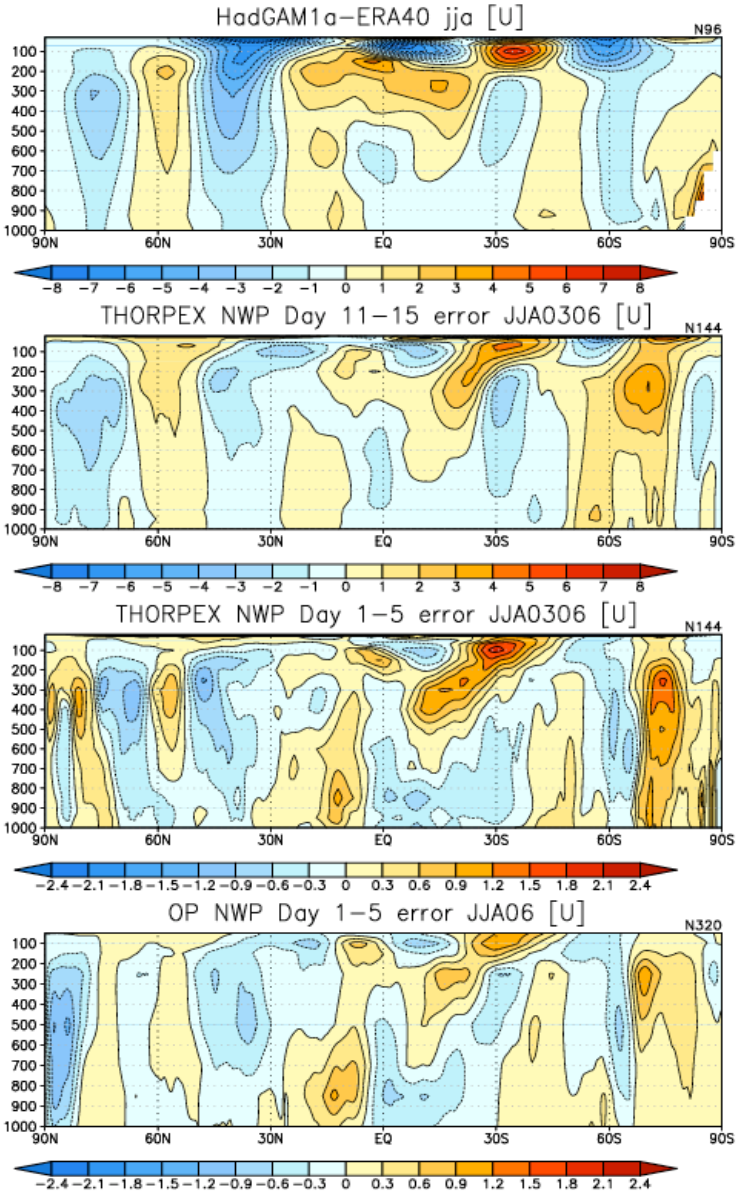
N96 AMIP

Resolution

Timescale

N320 5 Days





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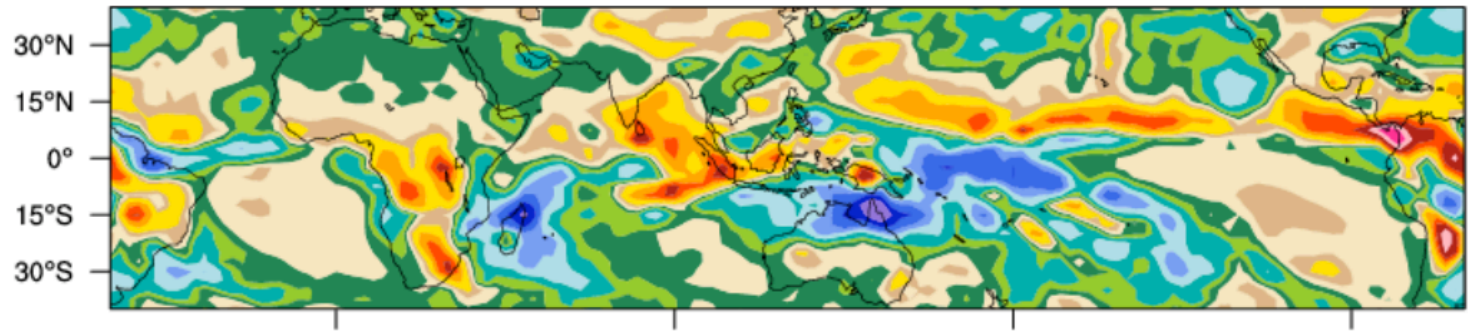
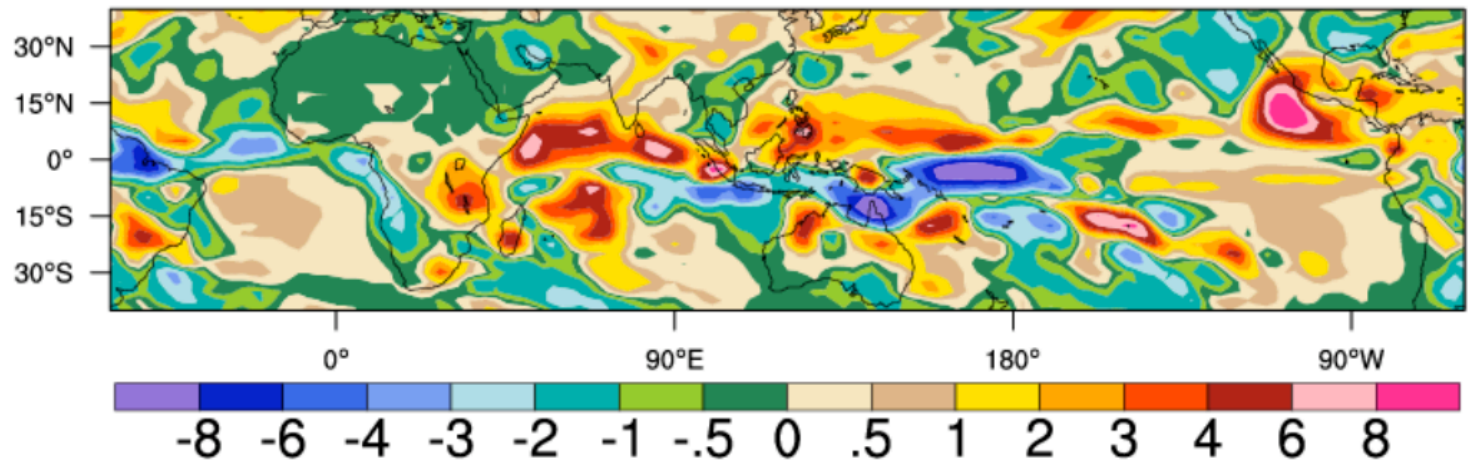
GFDL precipitation biases

Day 3 error



AMIP error



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Example analysis 1: Cloud regimes (MetUM)

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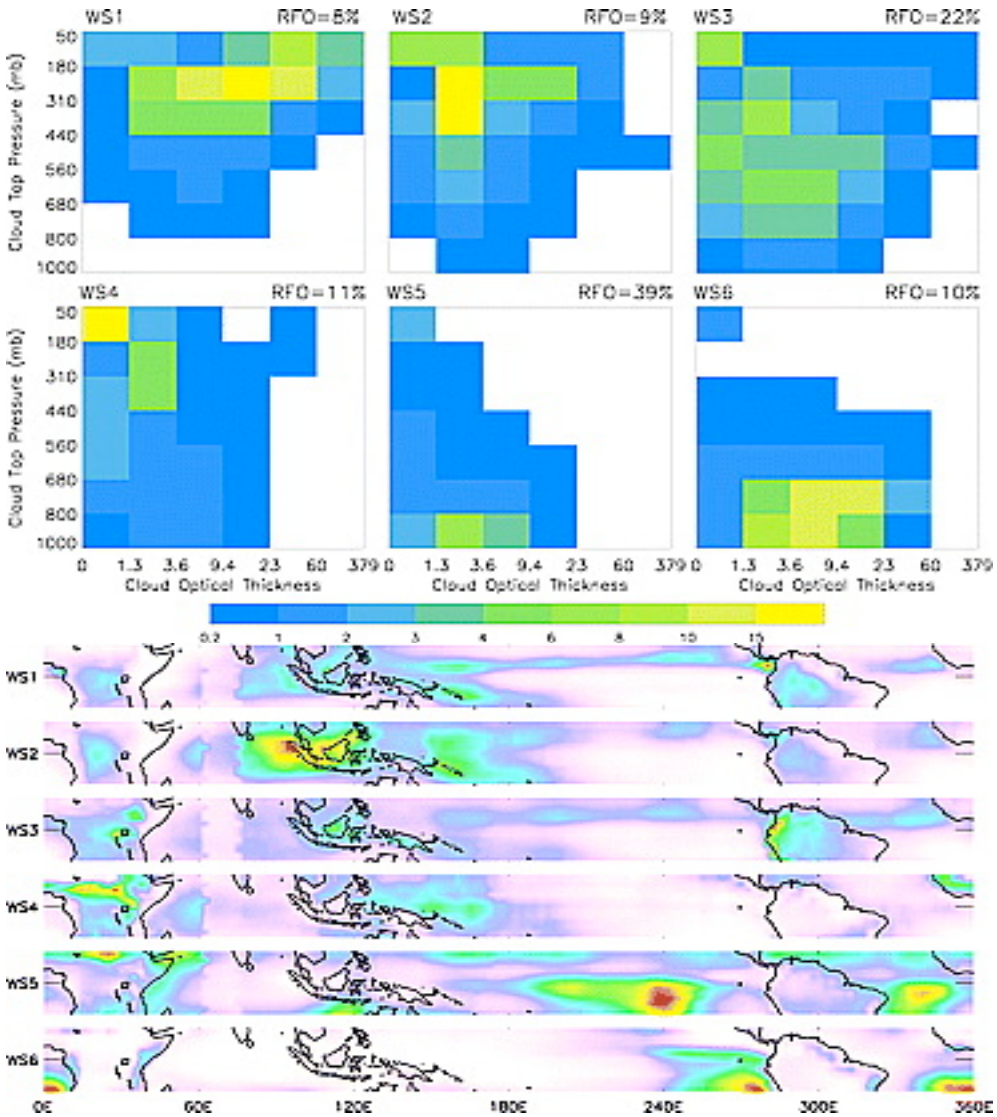
ISCCP cloud regimes



Rossow et al. (2005, GRL)

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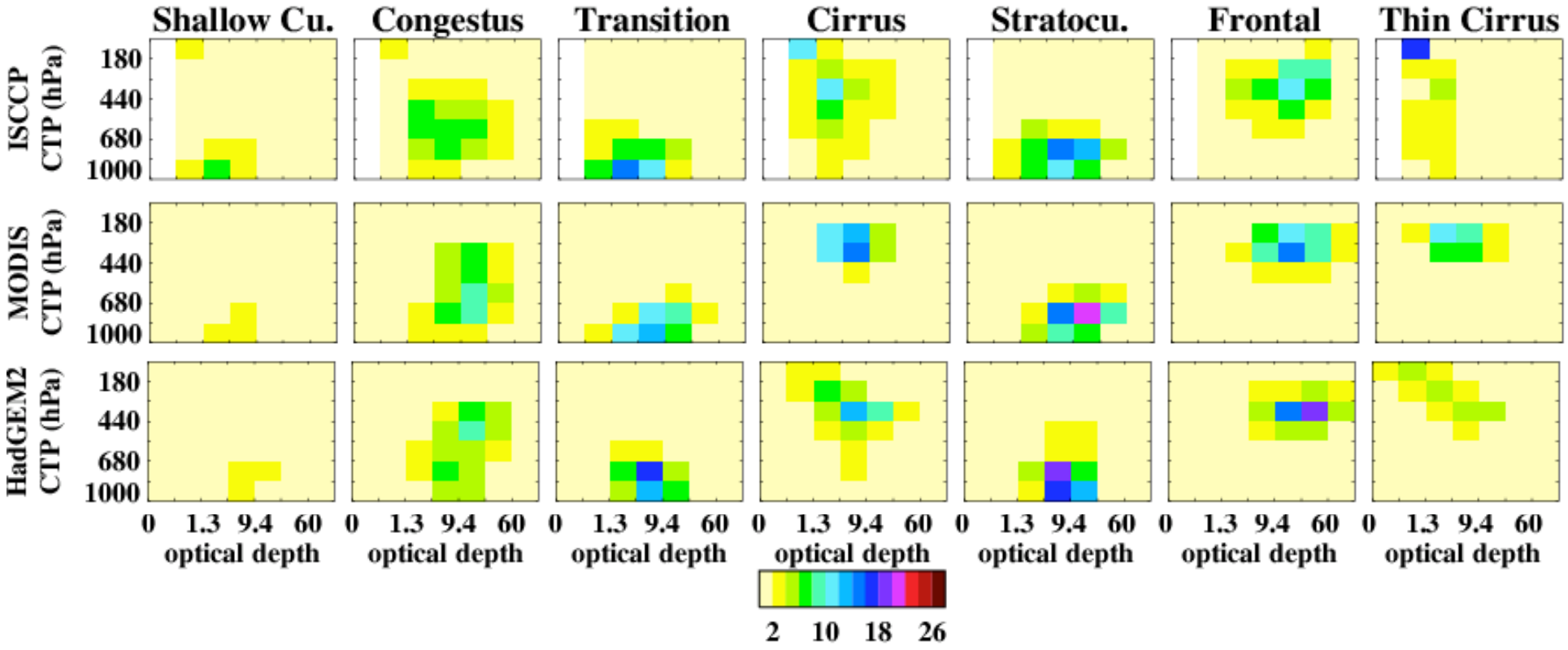
Observed and simulated mid-latitude cloud regimes



Williams and Webb (2009, Clim Dyn)

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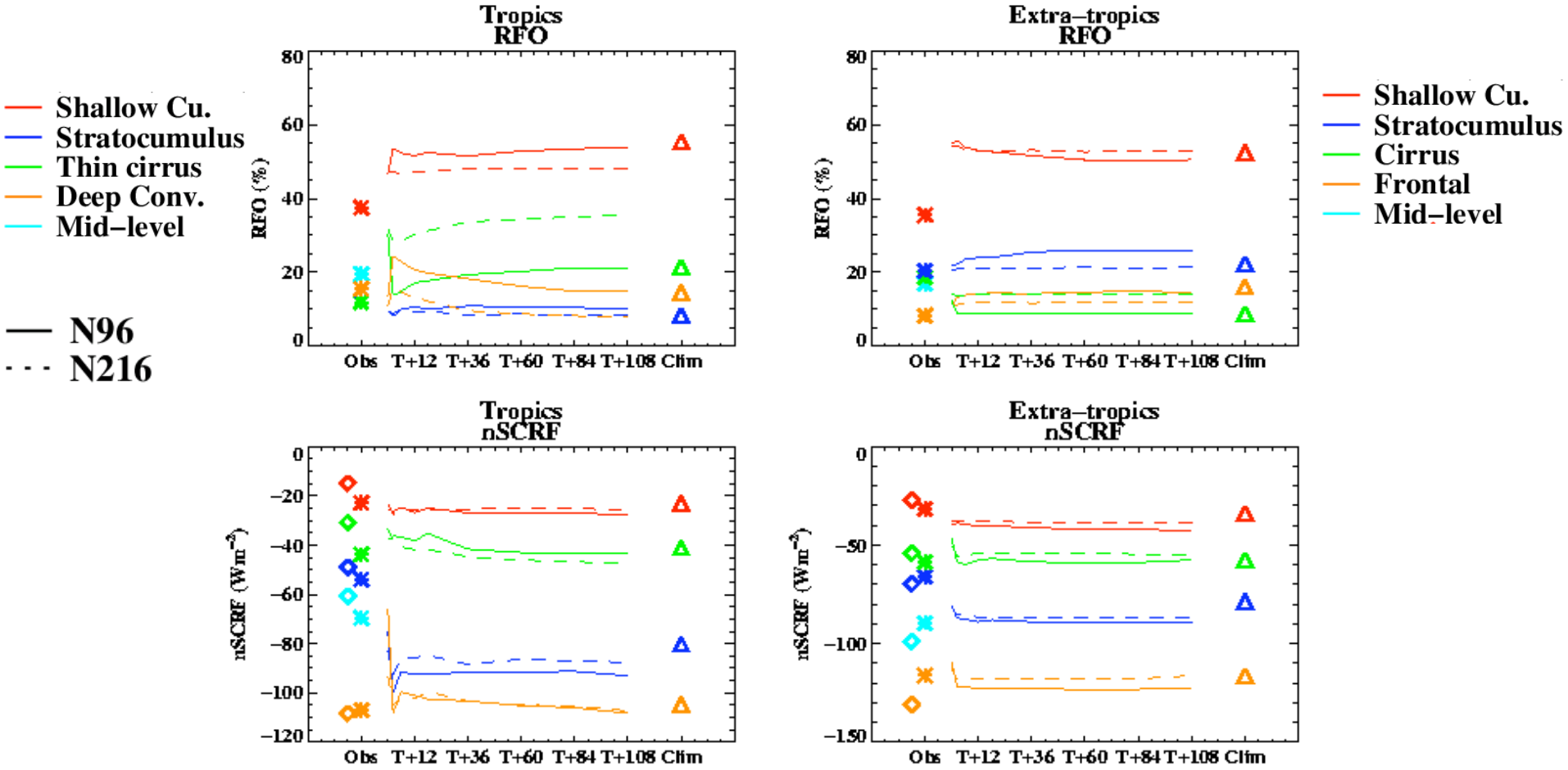
Cloud regime properties in short-range forecasts



Williams and Brooks (2008, J. Clim)

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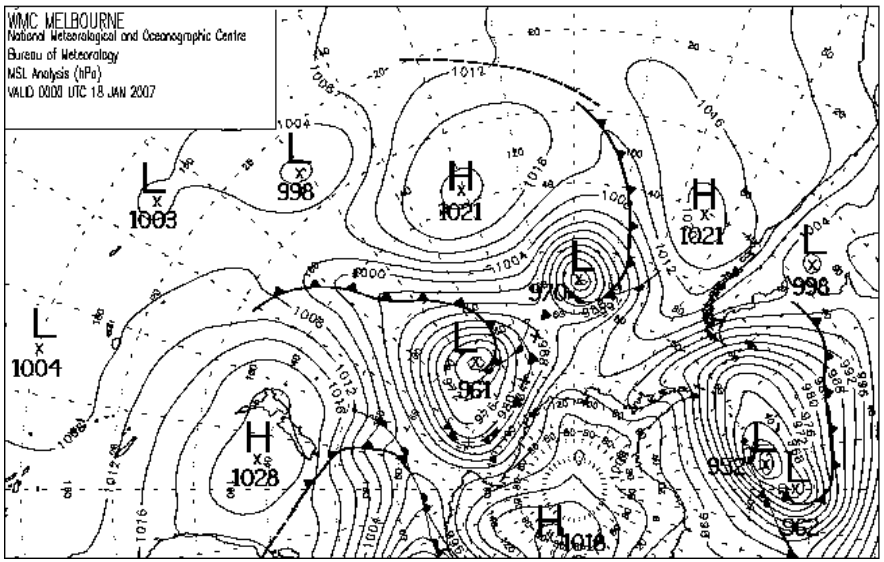
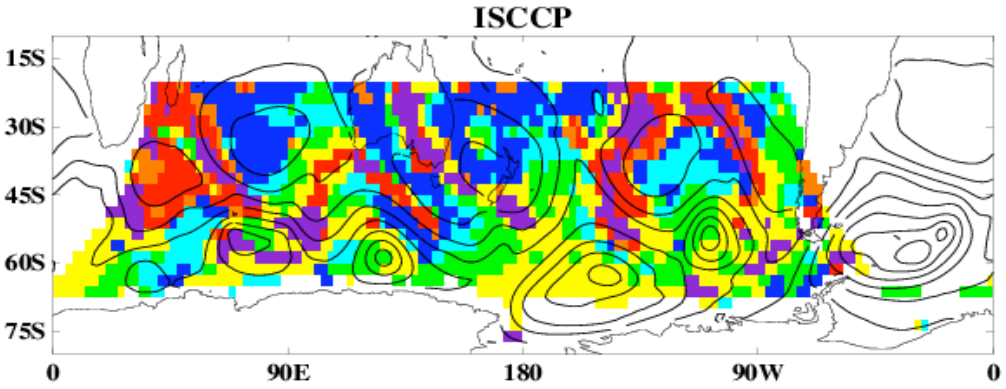
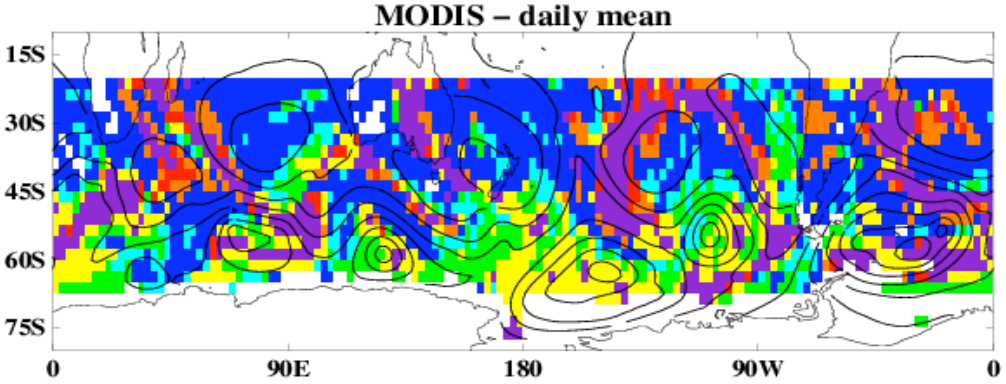
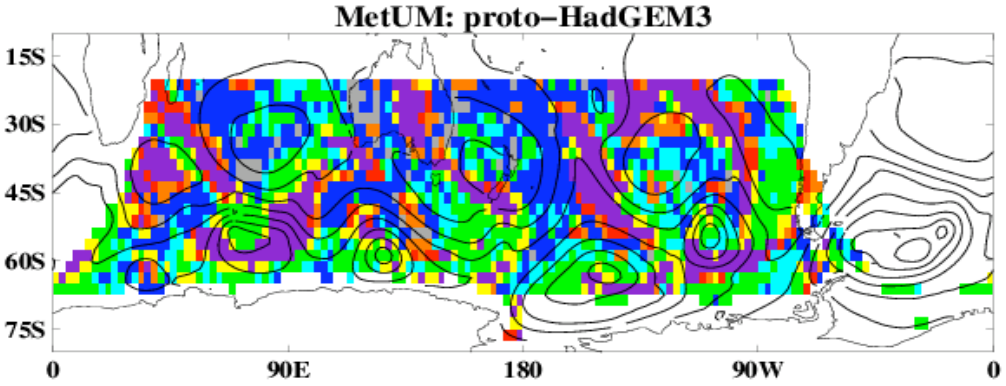
- Clear–sky
- Shallow Cu.
- Transition
- Stratocu.
- Mid–level
- Thin Cirrus
- Cirrus
- Frontal









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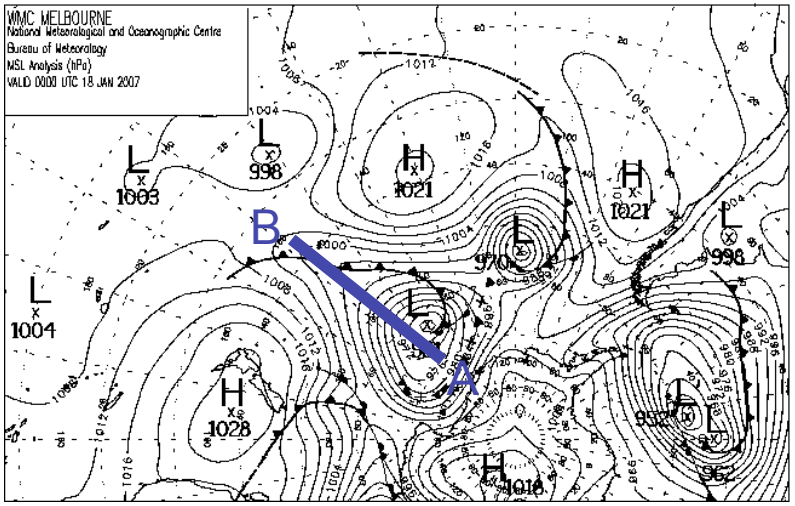
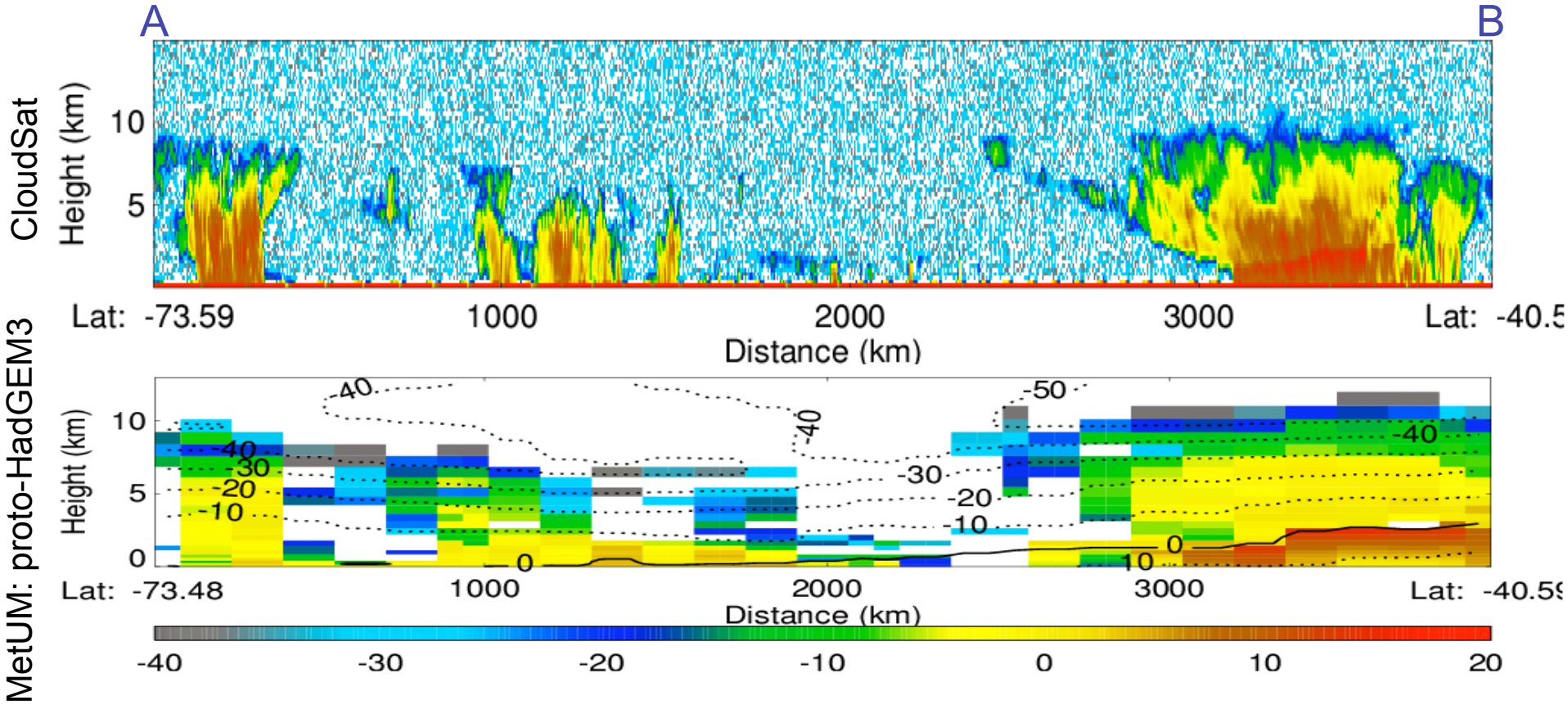
Comparison with CloudSat using COSP





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Example analysis 2: Dry lower troposphere (NCAR CAM)

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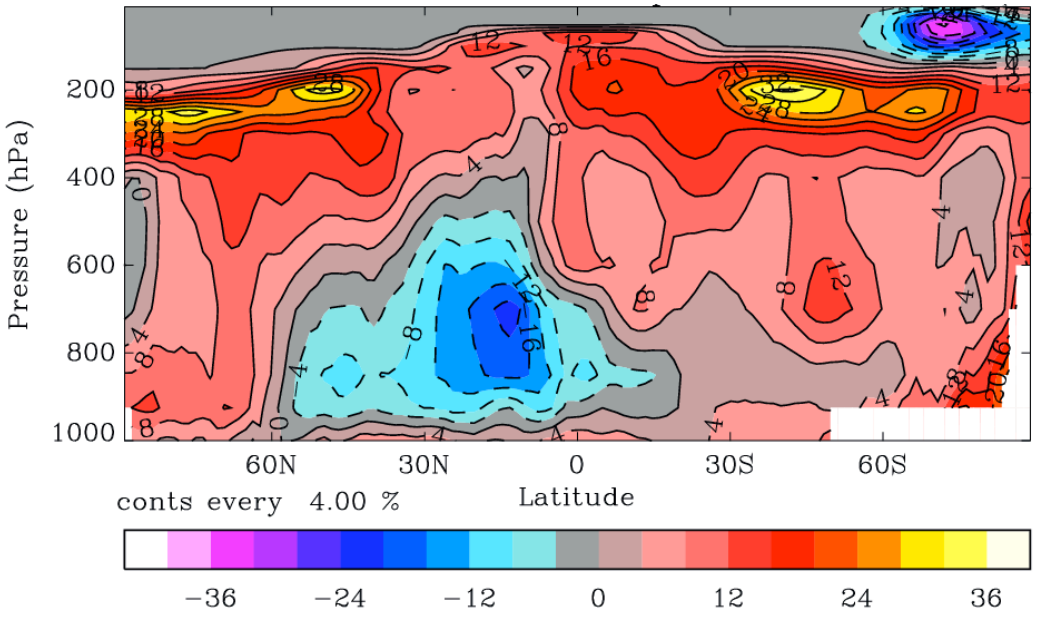
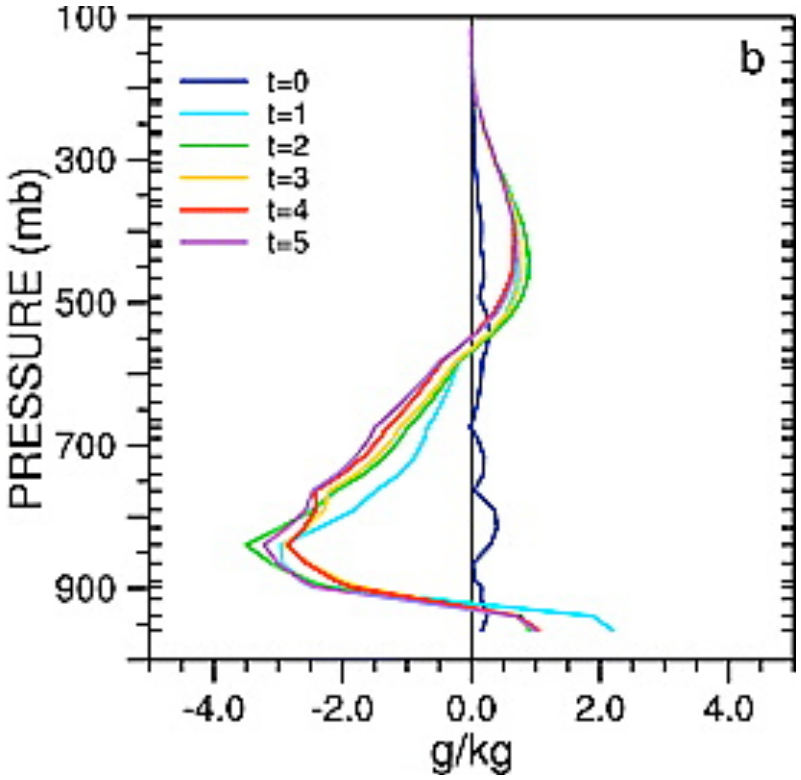
CAM humidity errors

Zonal mean climatological RH bias



Hindcast evolution of q biases over SGP site



Williamson et al. (2005)

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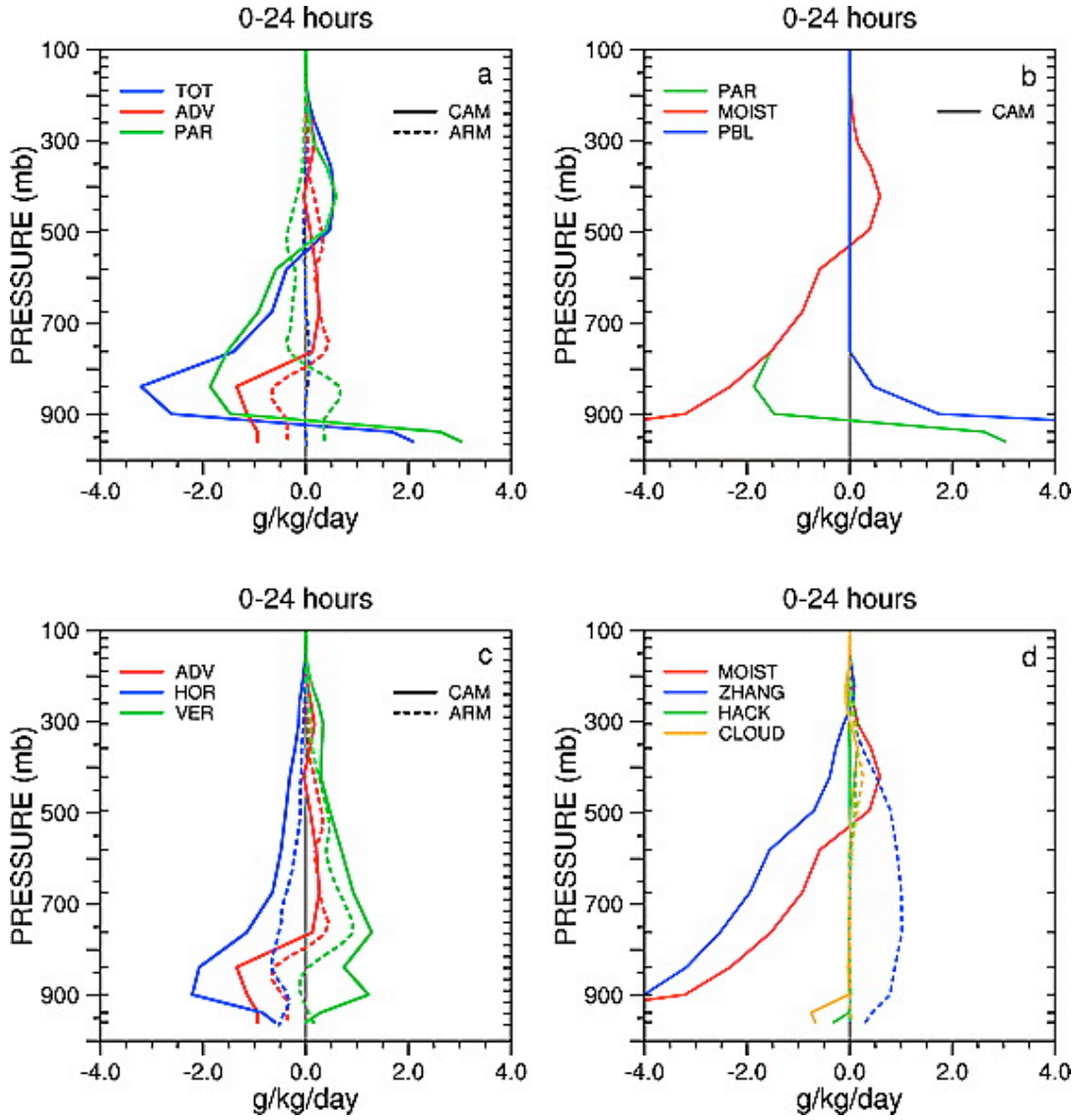
Breakdown of hindcast tendencies



Williamson et al. (2005)

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Example analysis 3: SE Pacific Stratocumulus (CAM, GFDL, ECMWF)

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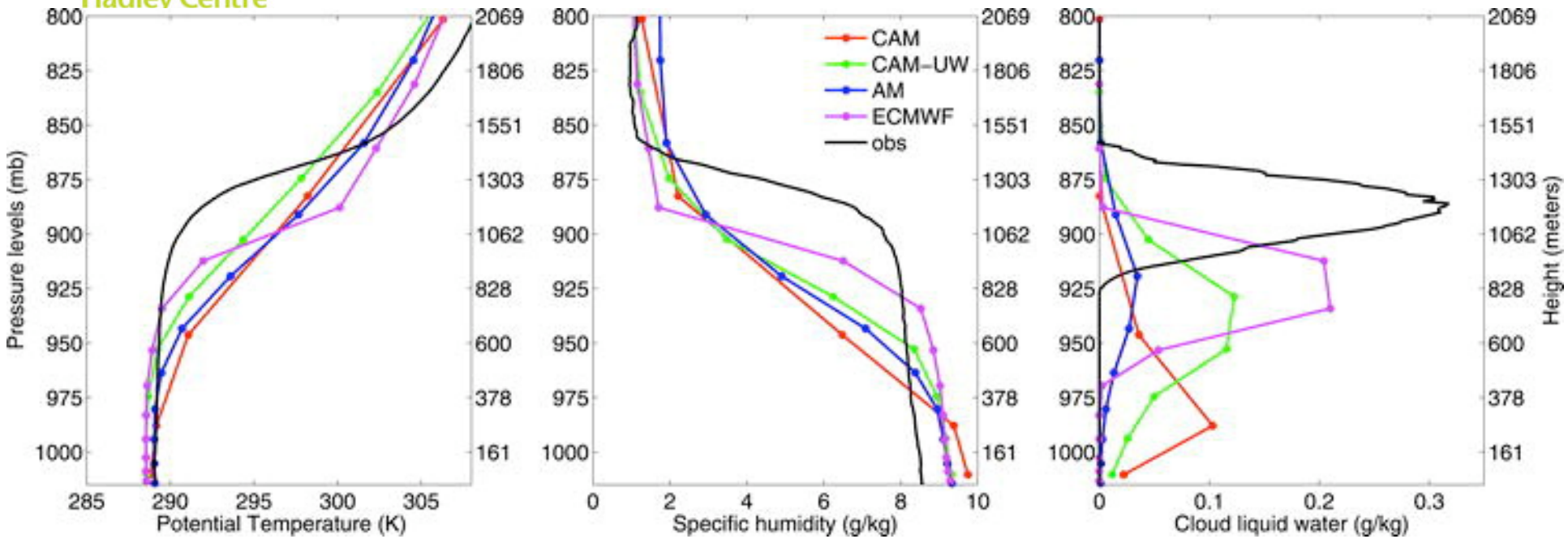
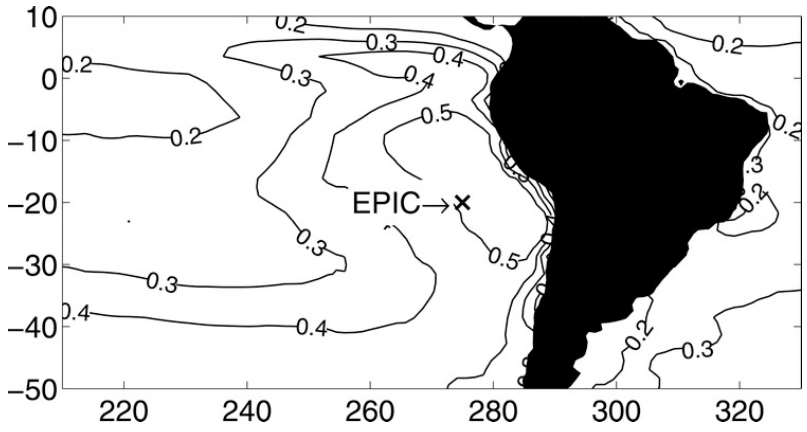
Investigation of PBL height against EPIC





Hannay et al. (2009)

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Example analysis 4: Analysis of the MJO (MetUM)

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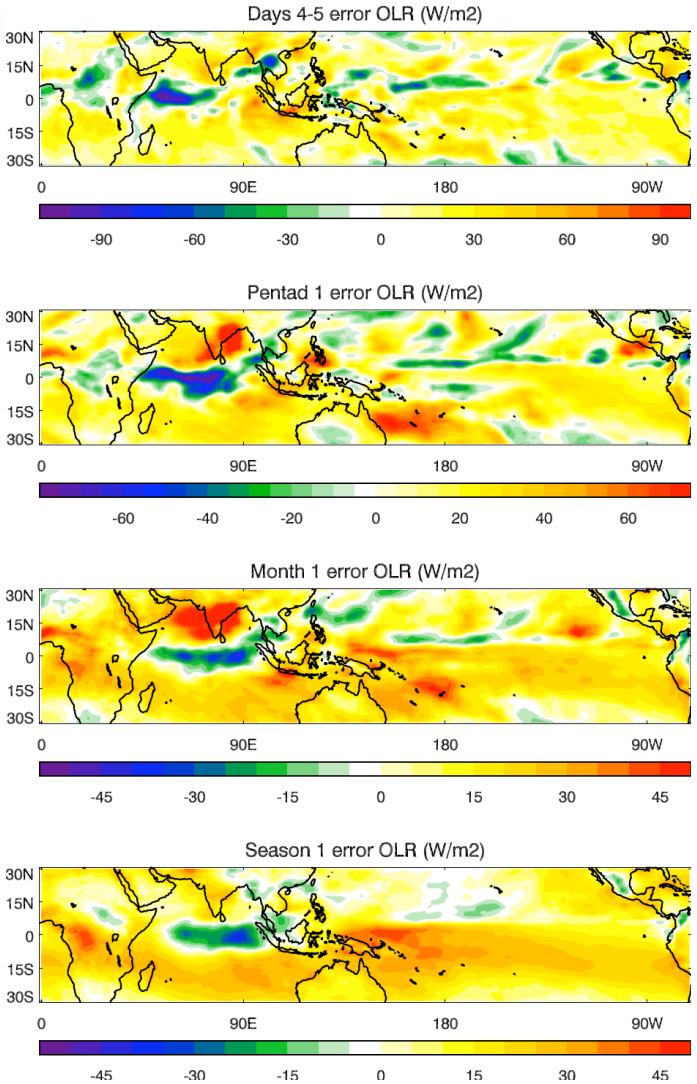
Coupled model errors in seasonal forecast



- Largest seasonal hindcast errors over Indo-Pacific warm pool
- Region of strong air-sea interactions, initiation of MJO
- Errors develops at day 4-5 and propagates across time scales
- Initial errors can have strong impact on the MJO

Prince Xavier

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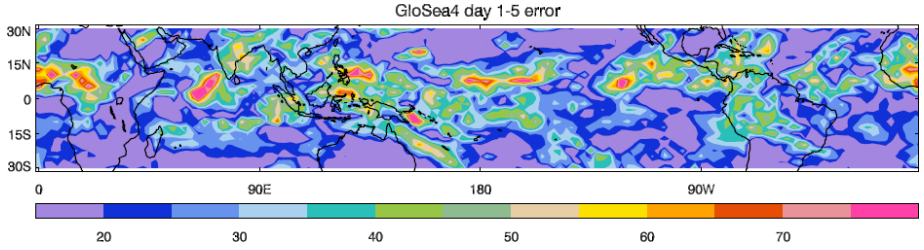
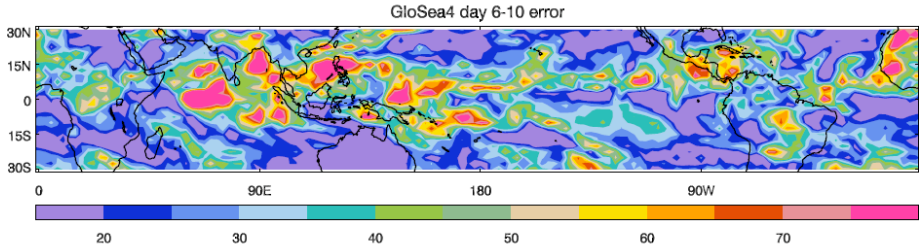
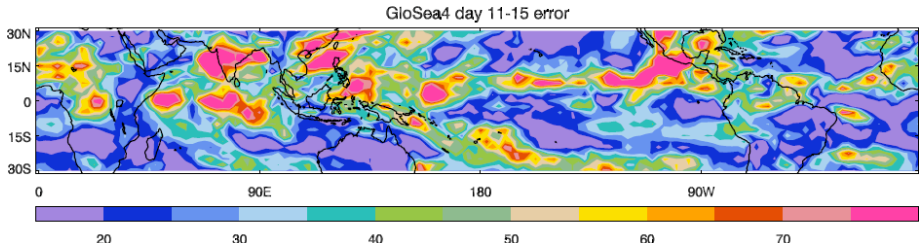
OLR errors (2009/06/08)

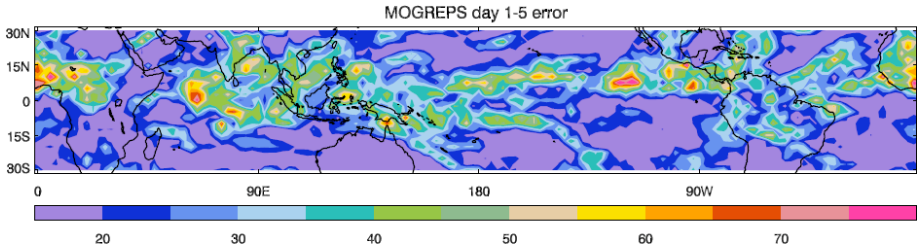
GloSea4 (Coupled)

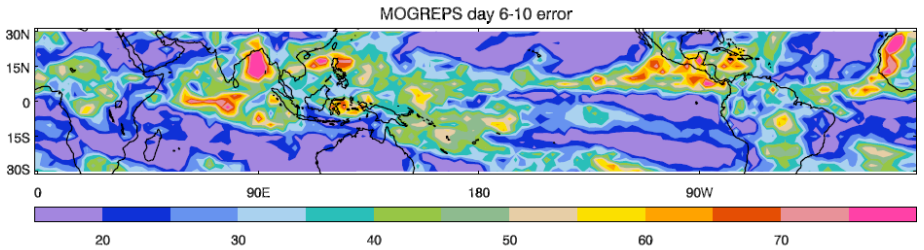


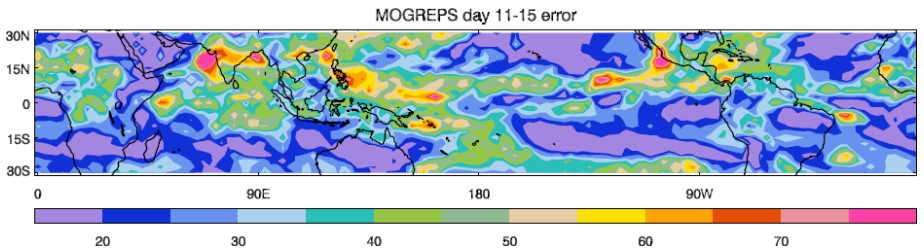




MOGREPS15 (Atmos-only)







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Example analysis 5: Initial tendency analysis of a PPE (ECMWF)

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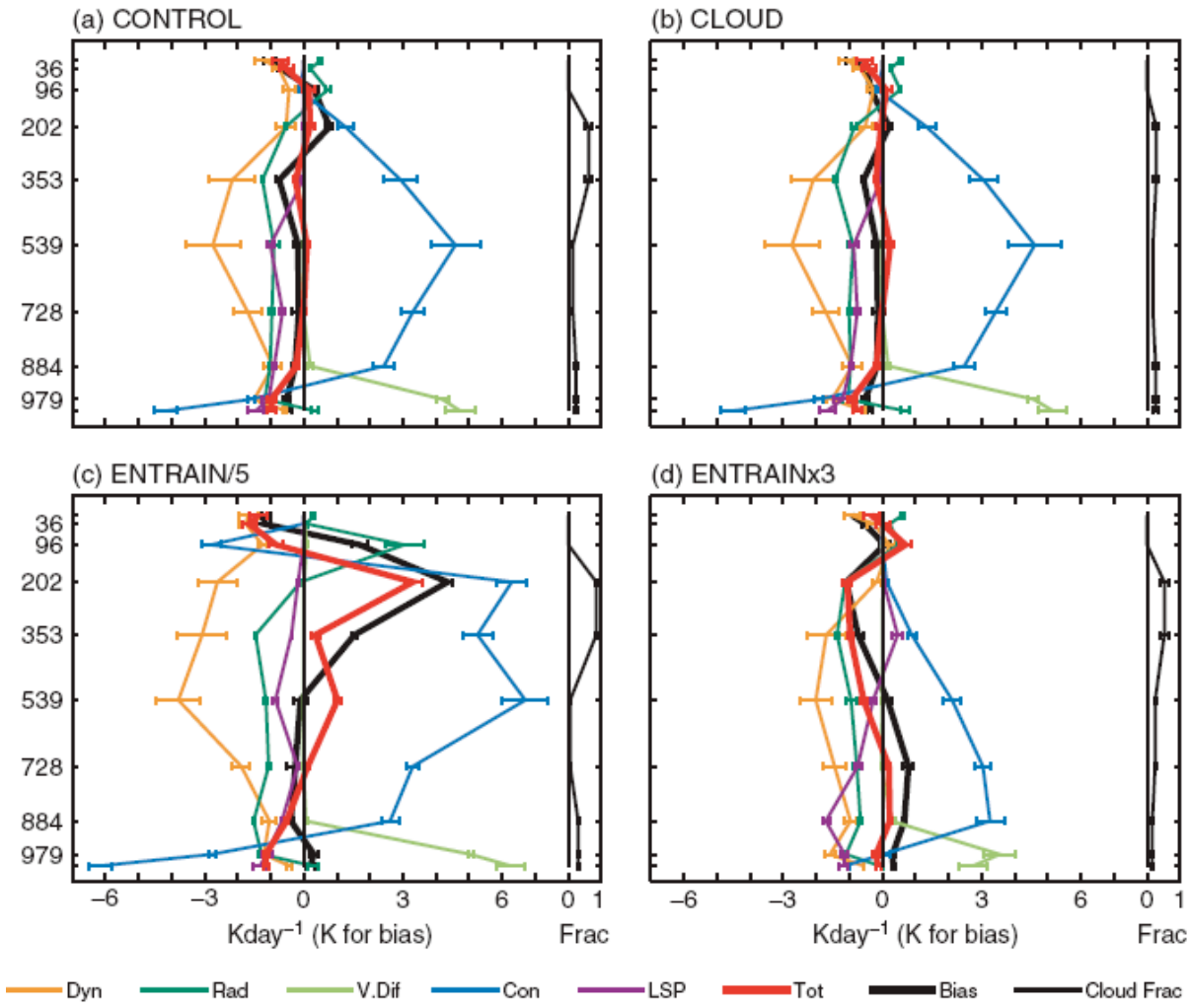
Drift Minimisation using Initial Tendencies in PPE



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Rodwell and Palmer (2007)

Transpose-AMIP

Steering committee: Keith Williams (chair), David Williamson, Steve Klein, Christian Jakob, Catherine Senior

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What is Transpose-AMIP?

- Basically, running climate models in NWP mode.
- Joint WGNE-WGCM endorsed activity
- Core expt for Transpose-AMIP II is to run 64 hindcasts, each 5 days long, initialised from ECMWF YOTC analysis.
- Optional expt to repeat the same set of hindcasts with NASA MERRA re-analysis or own analysis.
- The hindcasts are spread through the annual and diurnal cycles during 2008/9 and were chosen to tie in with YOTC and coincide with some of the IOPs in:
  - VOCALS
  - AMY
  - T-PARC
- Any global modelling centre (NWP or climate) can submit data. Those taking part in CMIP5 should use the same model as is being used for their AMIP simulation.

www.transpose-amip.info

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Aims of the project

- To test model's parametrizations while the circulation is still close to observed.
- To evaluate processes operating in the model against observations for particular events (e.g. ARM/Cloudnet sites, actual A-train passes, etc.)
- To compare SCM case study results to full GCM.
- To be able to comment on the ability of models taking part in CMIP5 to accurately represent fast processes.

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More information

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Summary

- Many systematic errors in climate models develop quickly.
- Analysis of short range forecasts where the dynamics are still well constrained can provide a useful testbed for understanding the cause of these biases.
- The development of climatological errors in coupled phenomena can be analysed in the initial period of a seasonal forecast.
- Having a Unified Model helps, but much can be done with climate models without their own DA system. Transpose-AMIP aims to provide an intercomparison of climate models in the short range framework.

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Discussion question: Would similar types of analysis be useful in the stratosphere?

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