Some current work using ERB data at the Met Office

Mark Ringer, Alejandro Bodas-Salcedo,
Yoko Tsushima, Keith Williams

Contents

- Model evaluation & metrics
- A specific example: SST & cloud biases in the Southern Ocean
- Radiative feedback on the annual variation in global surface temperature

Why are we interested in using ERB data?

- Evaluate the physical processes most relevant to reducing uncertainty in climate predictions, e.g. clouds
- Inform & prioritise key areas for developing and improving climate models
- Constrain climate change predictions – or at least try and determine if this is possible
- Detection & attribution of observed variations to natural and anthropogenic forcings..?

Model evaluation & metrics

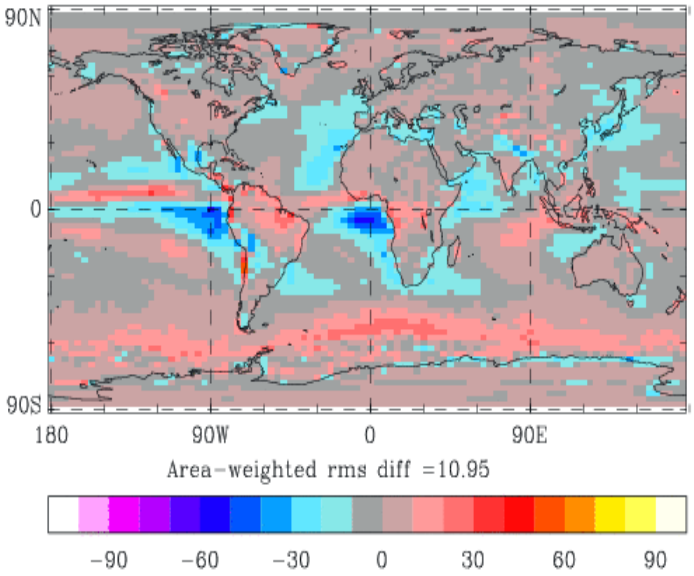
Biases compared to CERES – Annual Mean

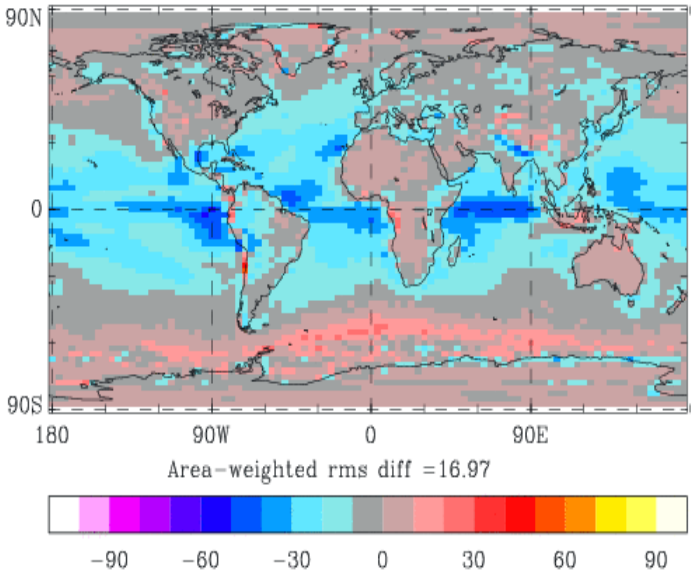
Met Office
Hadley Centre

New Cloud Scheme

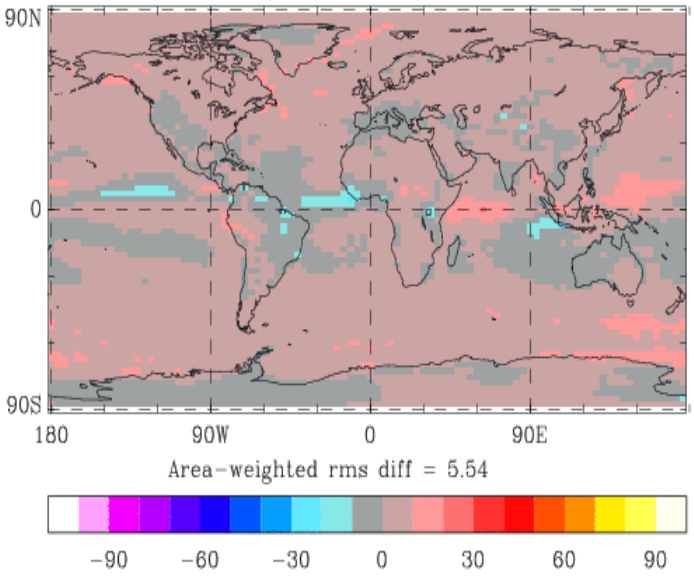
Old Cloud Scheme

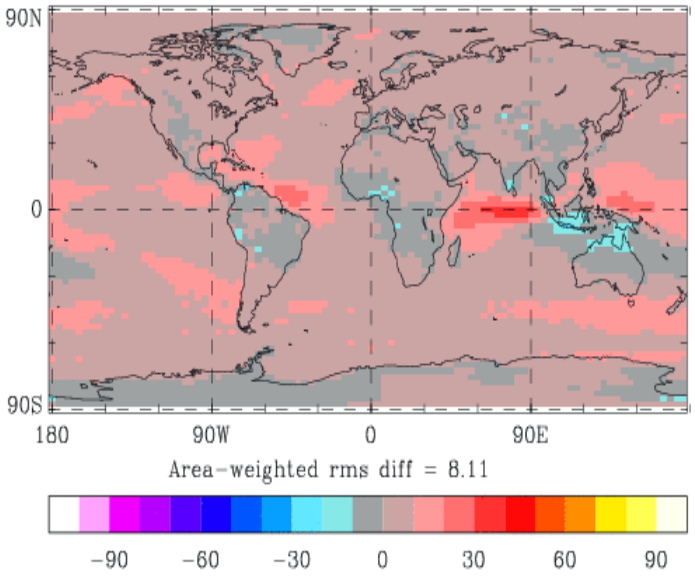
SW CRF





LW CRF



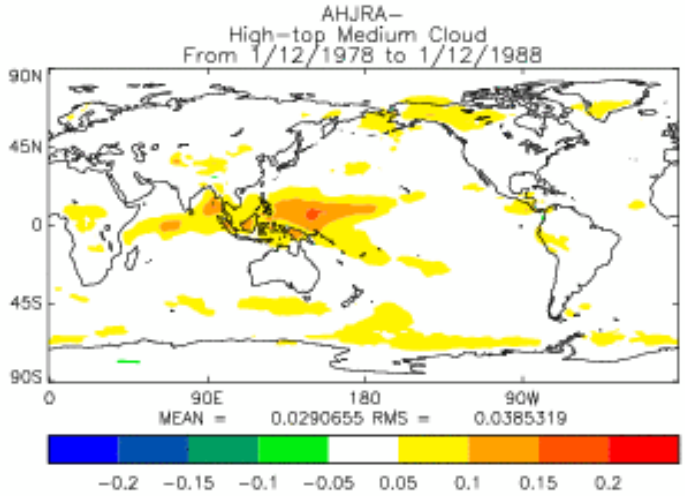


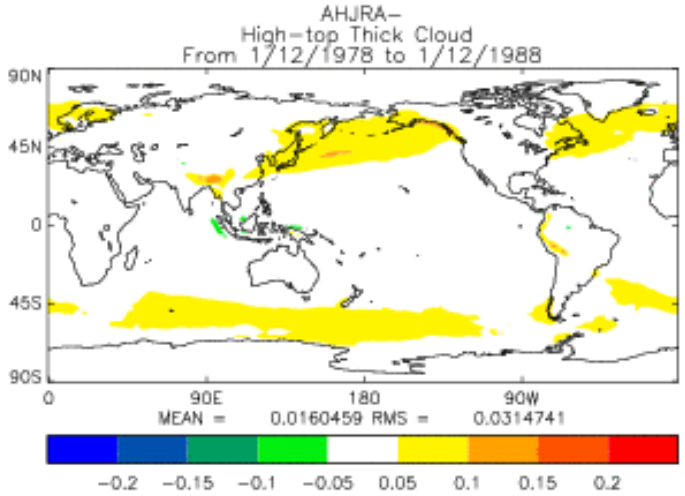
Biases compared to ISCCP – Annual Mean

High/Medium

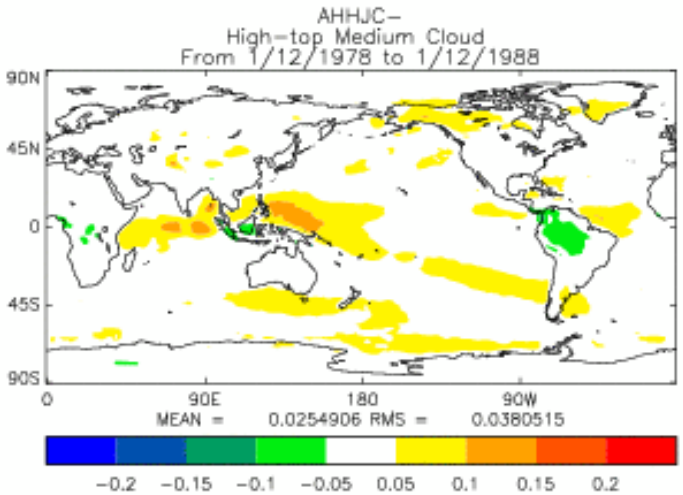
High/Thick

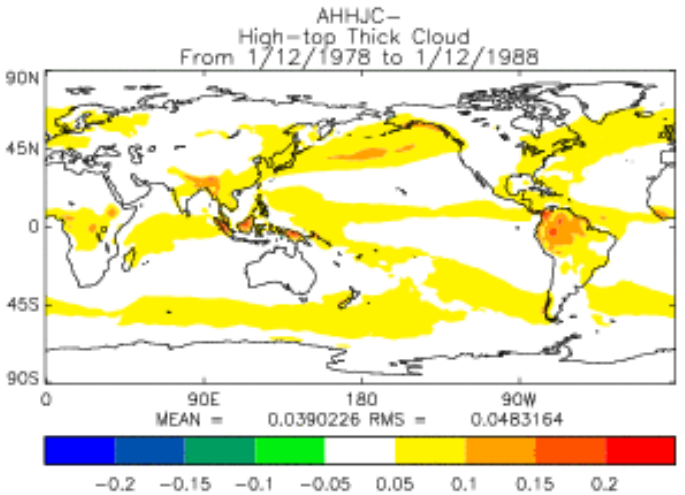
New Scheme



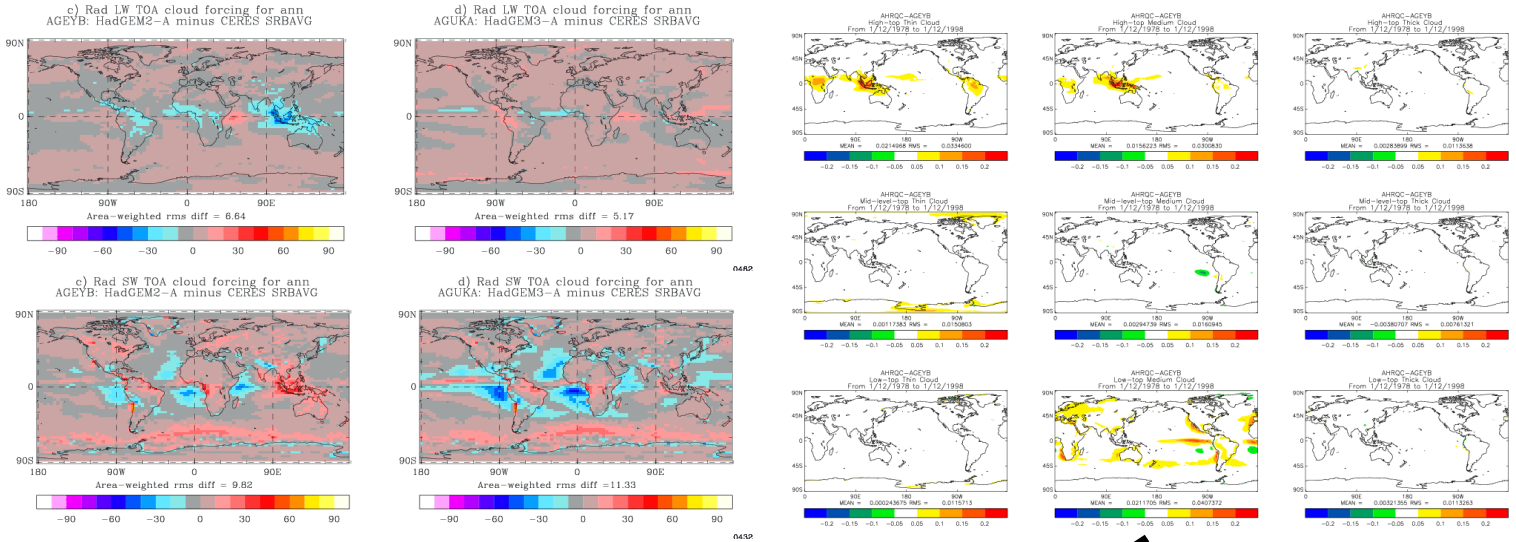


Old Scheme

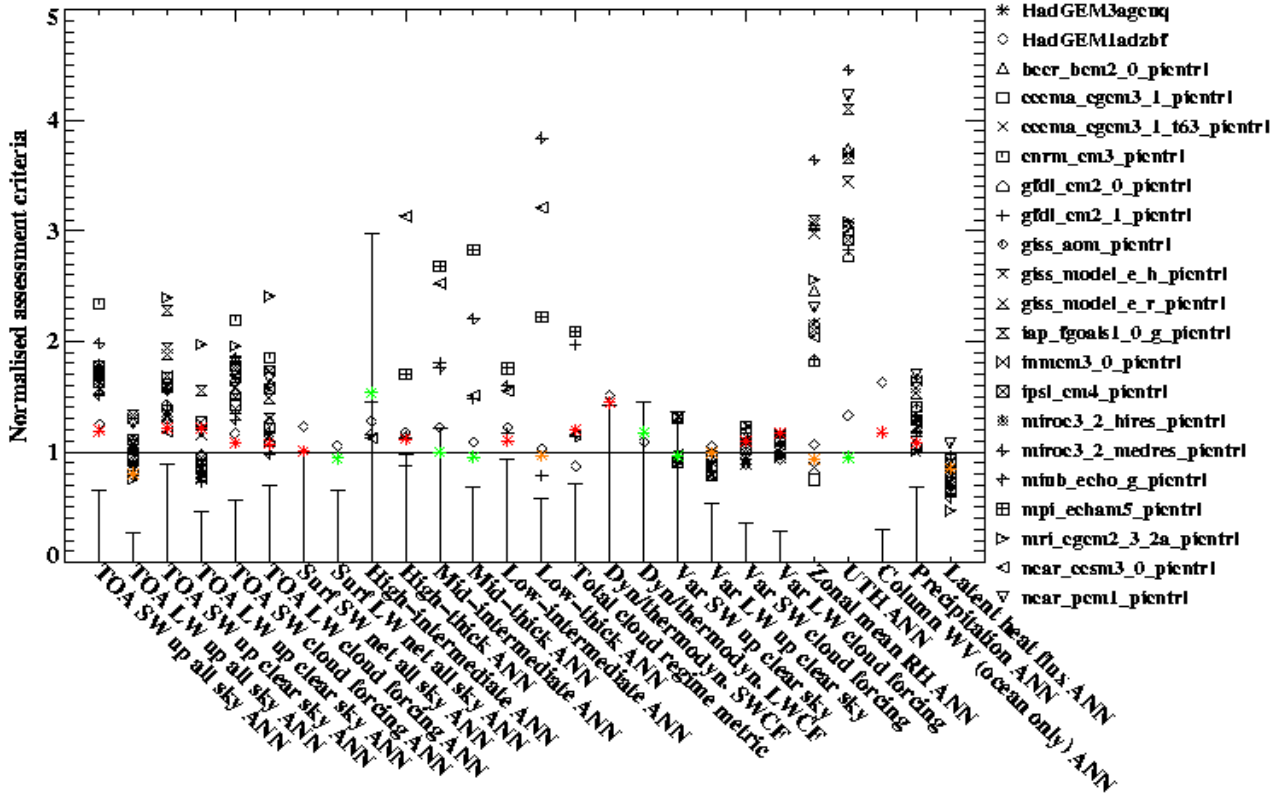




Met Office
Hadley Centre



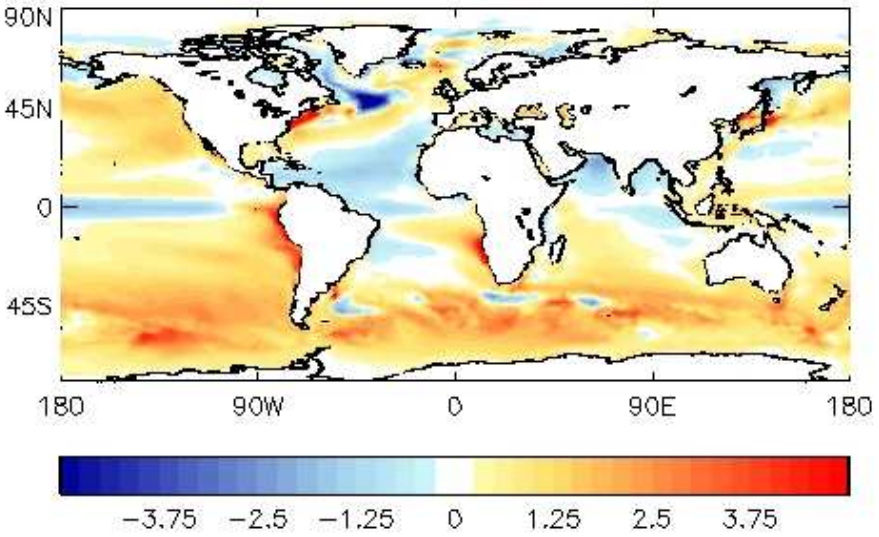
Development of a set of metrics to assess model performance



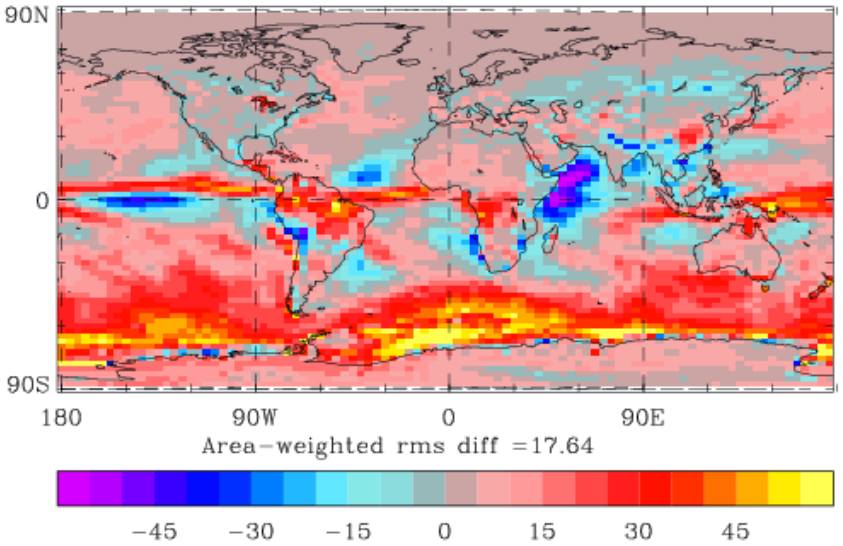
Met Office
Hadley Centre

SST and cloud biases over the Southern Ocean

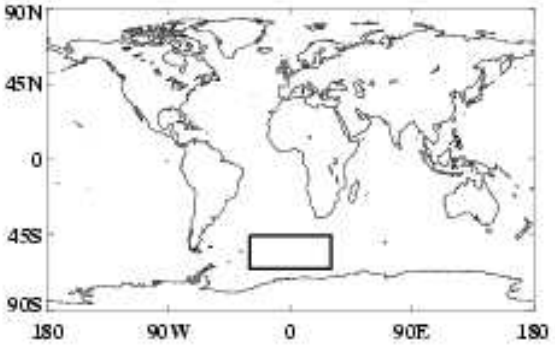
SST bias

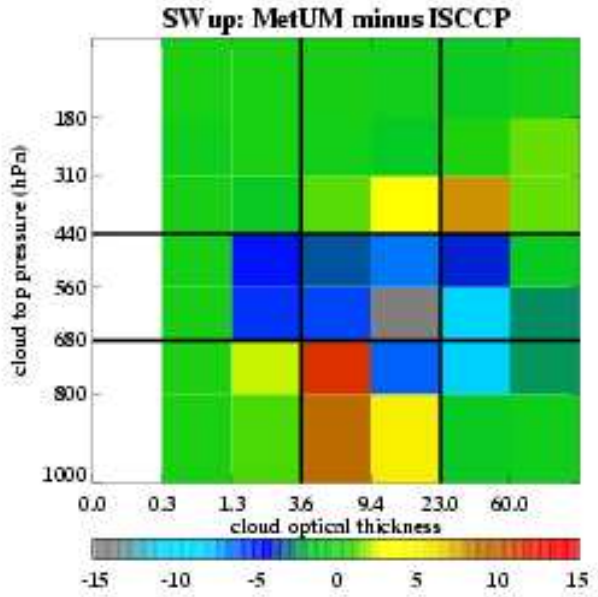


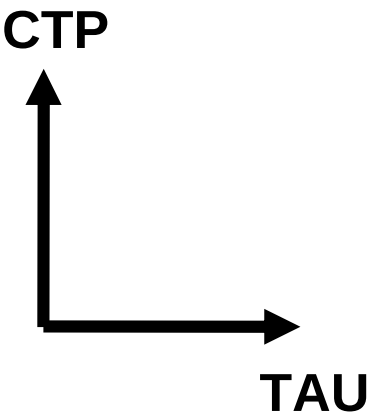
SW CRF bias



Reflected SW Model minus ISCCP



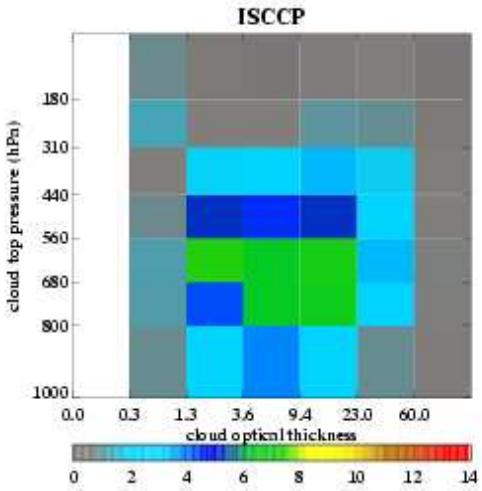


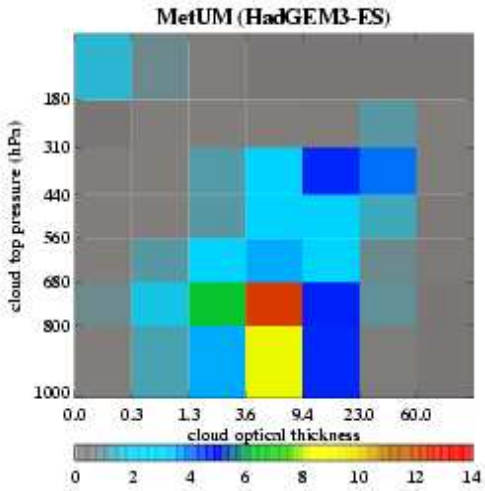


Met Office
Hadley Centre

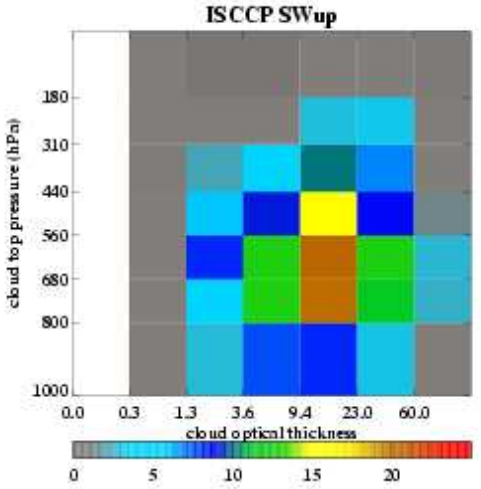
ISCCP MODEL

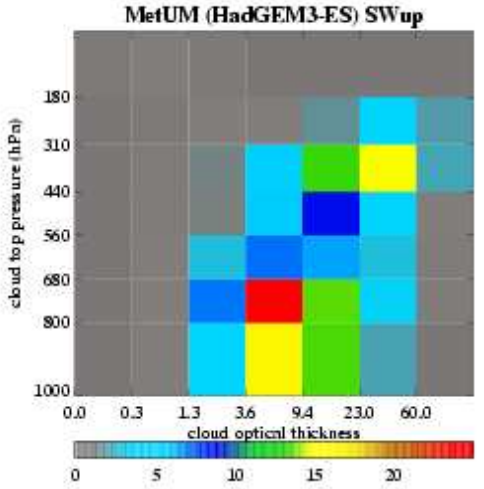
Cloud Amount





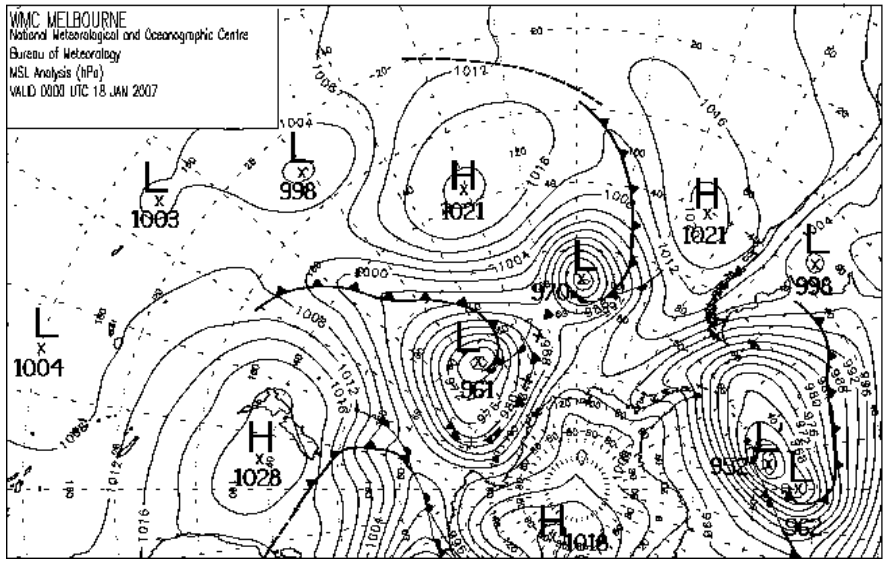
Reflected SW

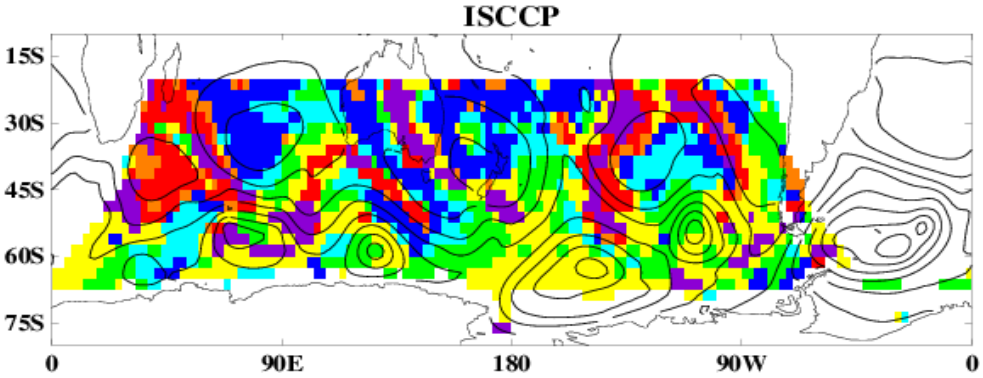


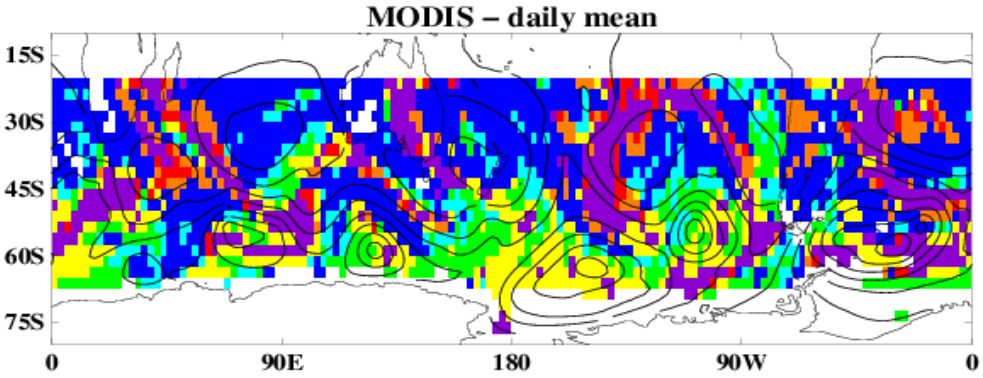


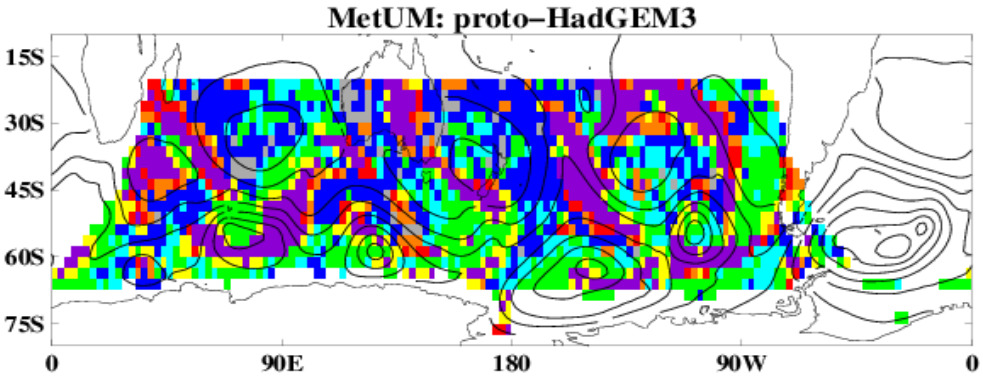
Global NWP Model

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

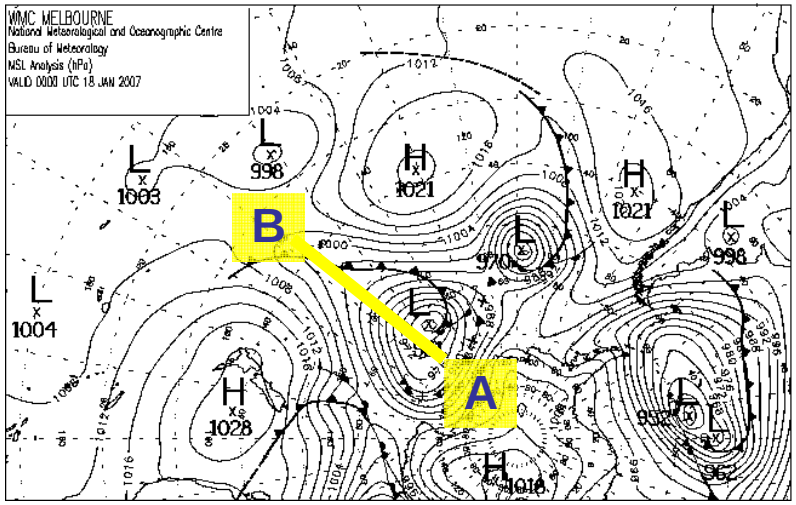


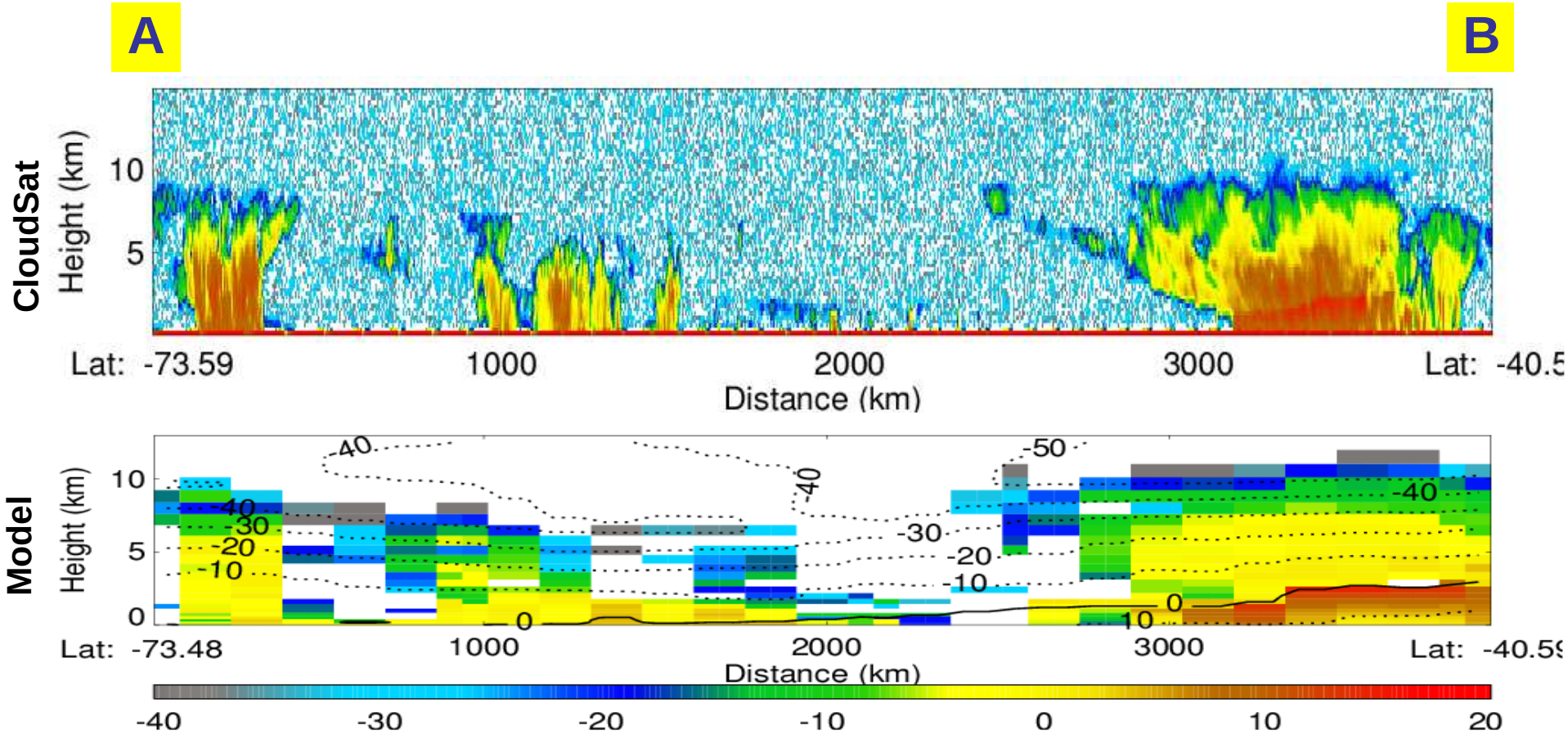






Comparison with CloudSat using COSP





Met Office
Hadley Centre

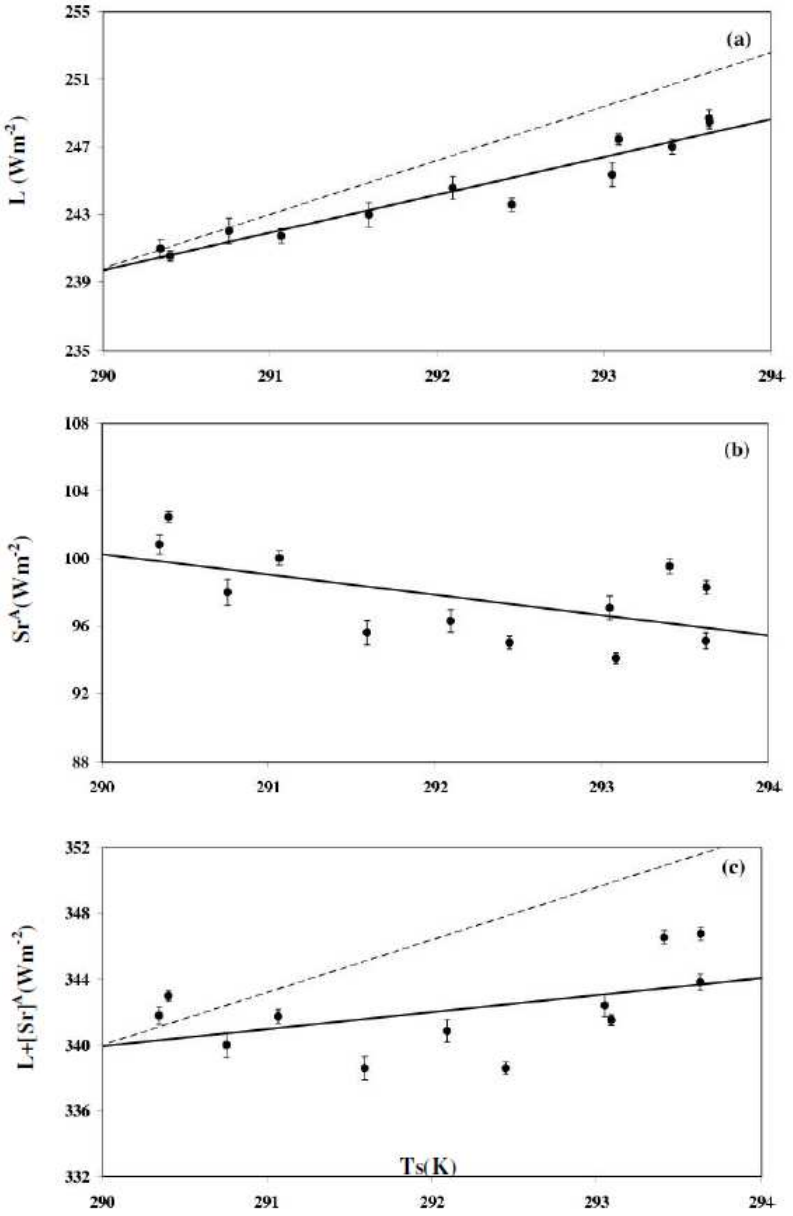
Radiative feedback on the annual variation in global surface temperature

$$Q = \lambda \cdot \Delta Ts$$

$$\lambda = \lambda_0 \cdot (1 - g)$$

Use annual variation of net TOA fluxes and surface temperature to try and estimate "gain factor", g

Tsushima & Manabe 2010



LW

SW

NET

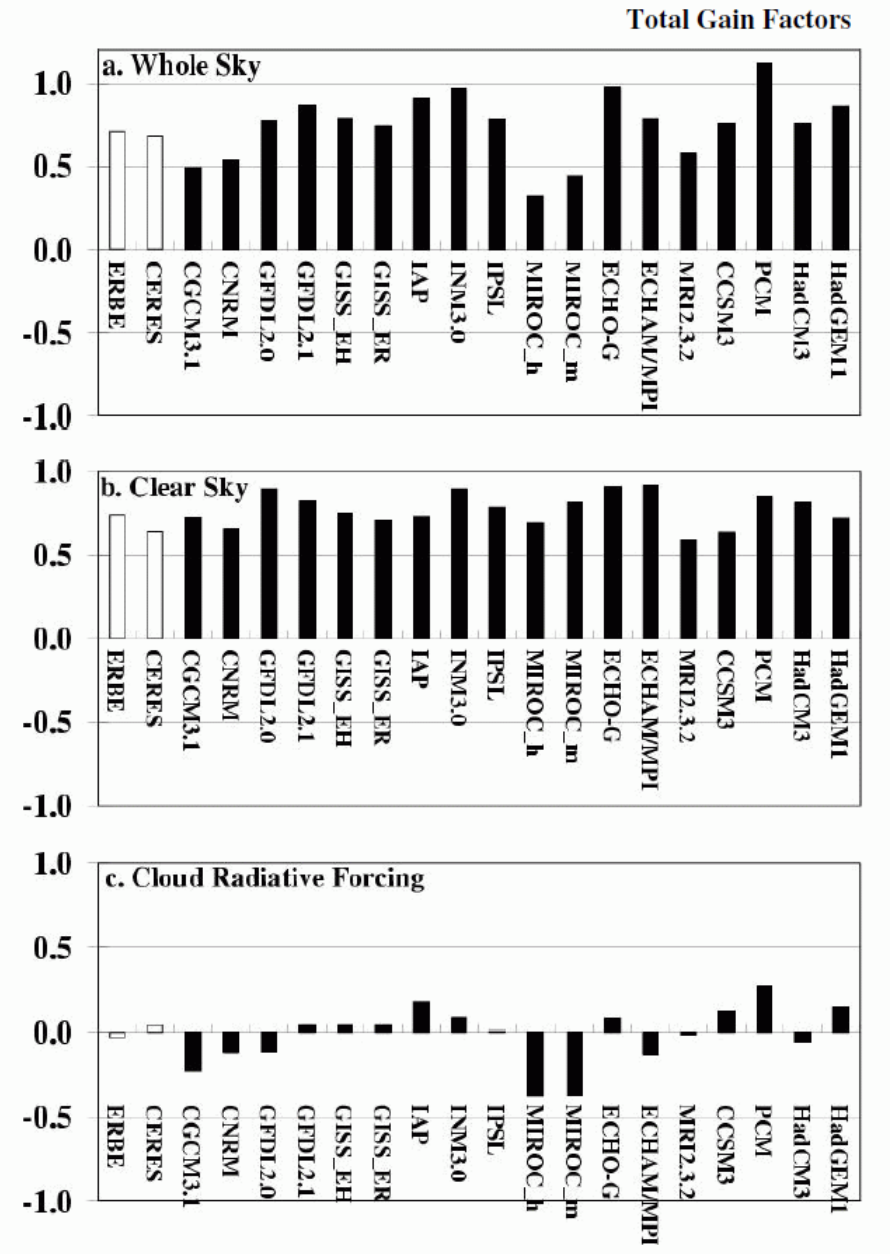
Ts →

Cloud radiative forcing gain factors

	ERBE/CERES	MODELS
NET	-0.03/0.04	-0.02 ± 0.18
SW	0.04/0.07	-0.11 ± 0.19
LW	-0.07/-0.04	0.09 ± 0.10

ERBE/CERES: SW, LW & NET gain factors are all small

MODELS: SW & LW gain factors vary considerably across models, particularly the SW.



ERB data are used…

- For basic model evaluation as part of the model development process
- As part of a wider effort to define a set of metrics for model assessment
- In combination with other data to address specific model errors
- To examine if observational constraints can be placed on radiative feedbacks