RT4:
Understanding the processes governing climate variability and change, climate predictability and the probability of extreme events

Coordinators:

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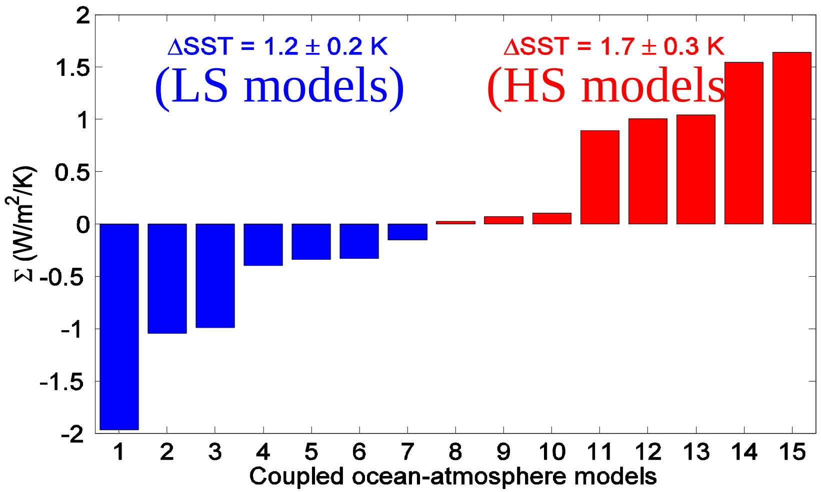
Deliverable D4.1.1: (continue)

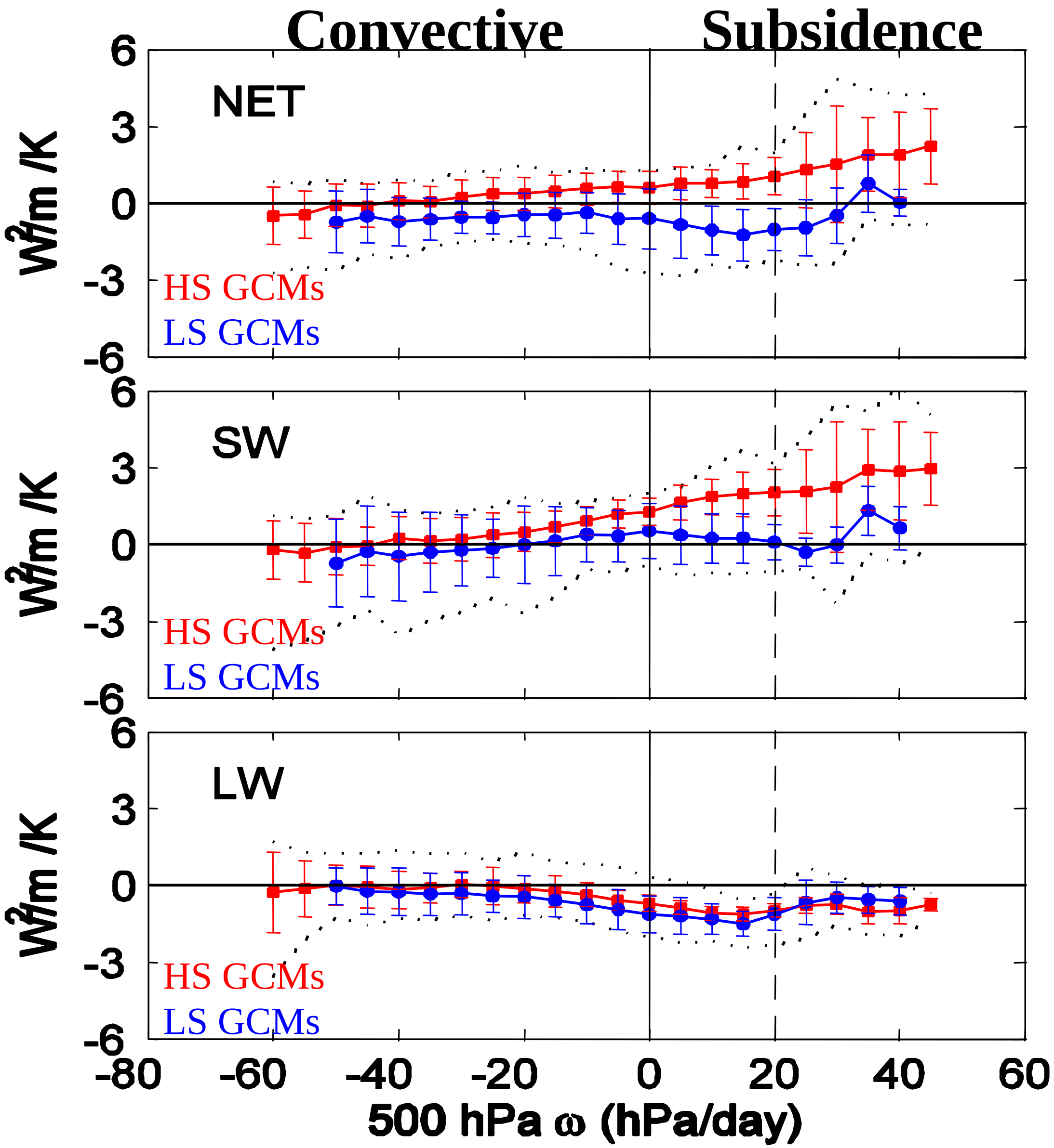
Tropically-averaged



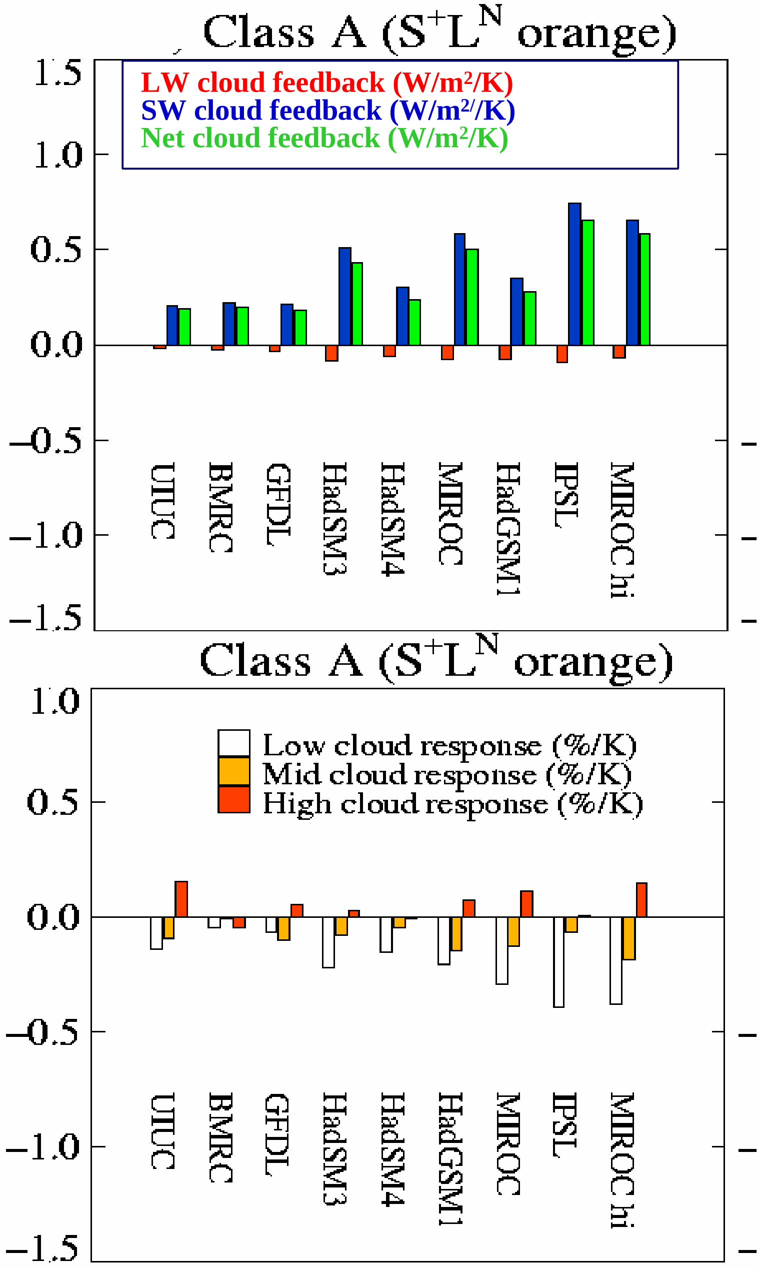
Currently, the **spread of climate change** cloud feedbacks stems primarily from differences in the **SW radiative response of boundary-layer clouds** to climate warming.

[Bony and Dufresne, 2005]

Composited by dynamical regimes



Deliverable D4.1.1: (continue)



CFMIP
Cloud Feedback and Cloud Response

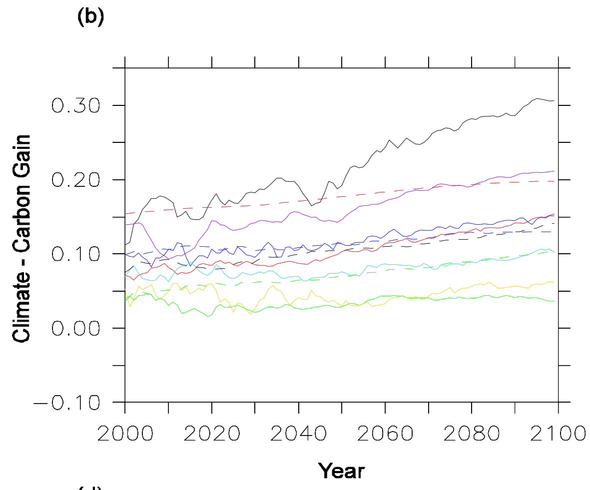
Areas with positive SW and neutral LW cloud feedbacks explain more than half the variance in the global NET cloud feedback.

Cloud feedbacks in these areas are dominated by reductions in **low-level cloud amount**.

(Webb et al., 2006, Clim. Dynamics)

Recommendation: OAGCM use ISCCP simulator to generate clouds diagnostics

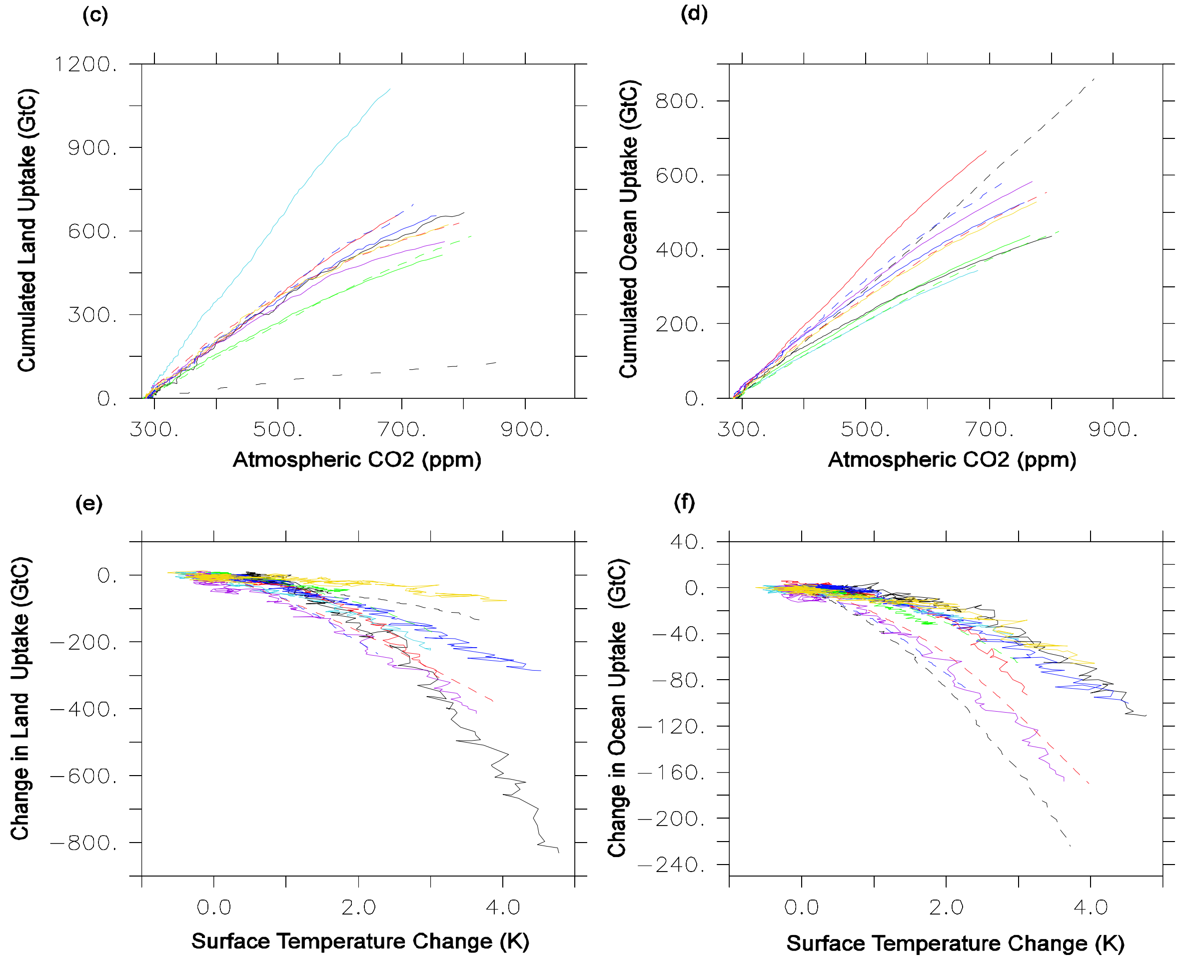
Deliverable D4.1.2:
Analysis of the results from the first phase of the Coupled Climate Carbon Cycle Intercomparison Project (C4MIP)



Climate change will tend to release land and ocean carbon to the atmosphere.

All but one model produce a positive climate-carbon gain in the range 0. to 0.2.

For most models climate induced reduction of land carbon uptake



Deliverable D4.2.1:
Characterization of modes of large scale, low frequency climate variability in existing climate model control simulations.

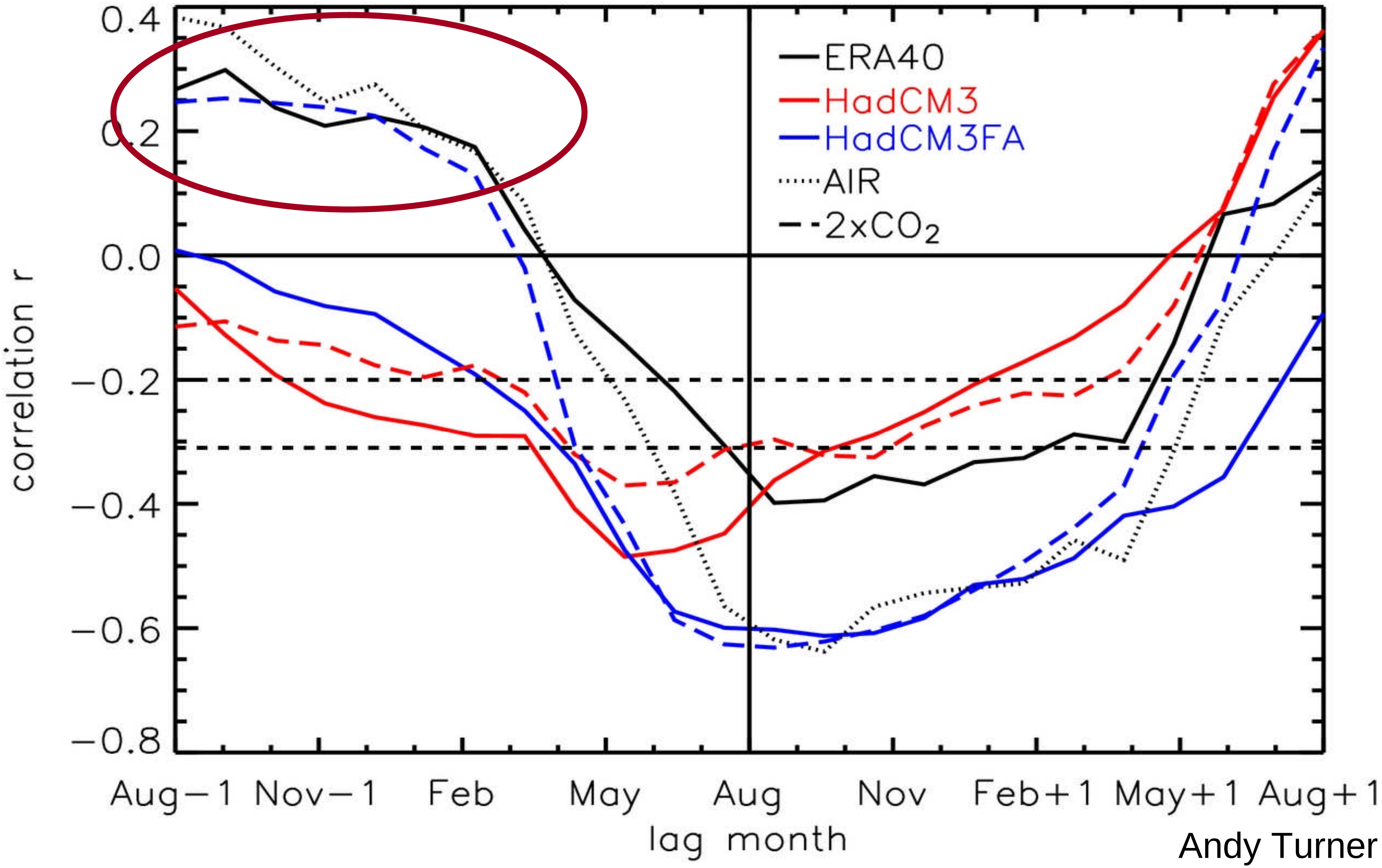
1) N**atural variability in the Tropics**

- the mechanisms that might determine the characteristics of ENSO are explored. For example, interaction between ENSO- the mean state and the seasonal cycle

- the impact of the atmospheric model component horizontal resolution on the characteristics of the simulated ENSO

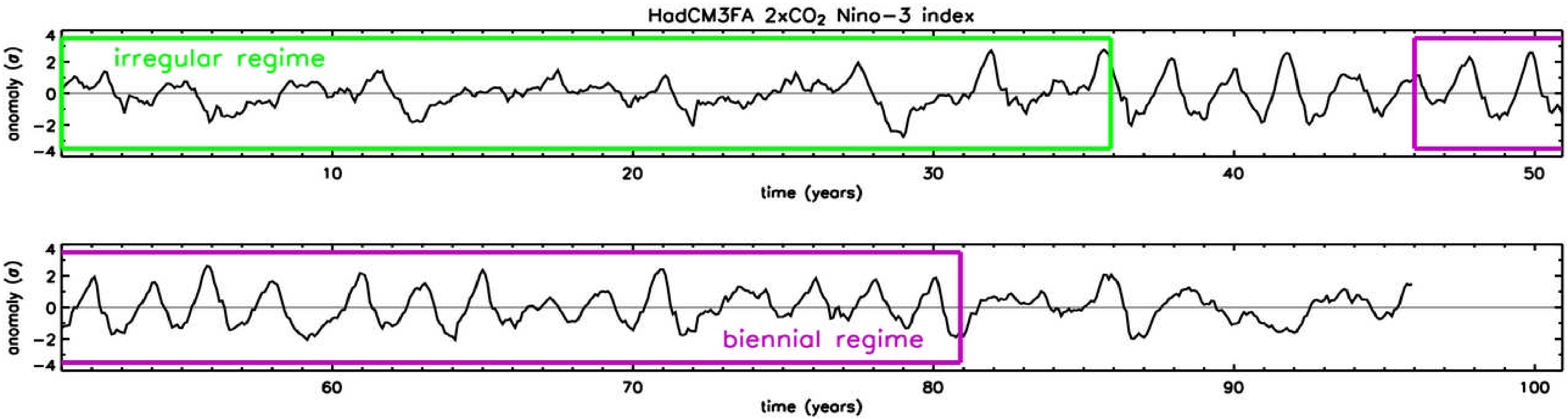
- the relationship between Tropical Indian Ocean (Indian sub-continent and monsoon) and Tropical Pacific is also discussed.

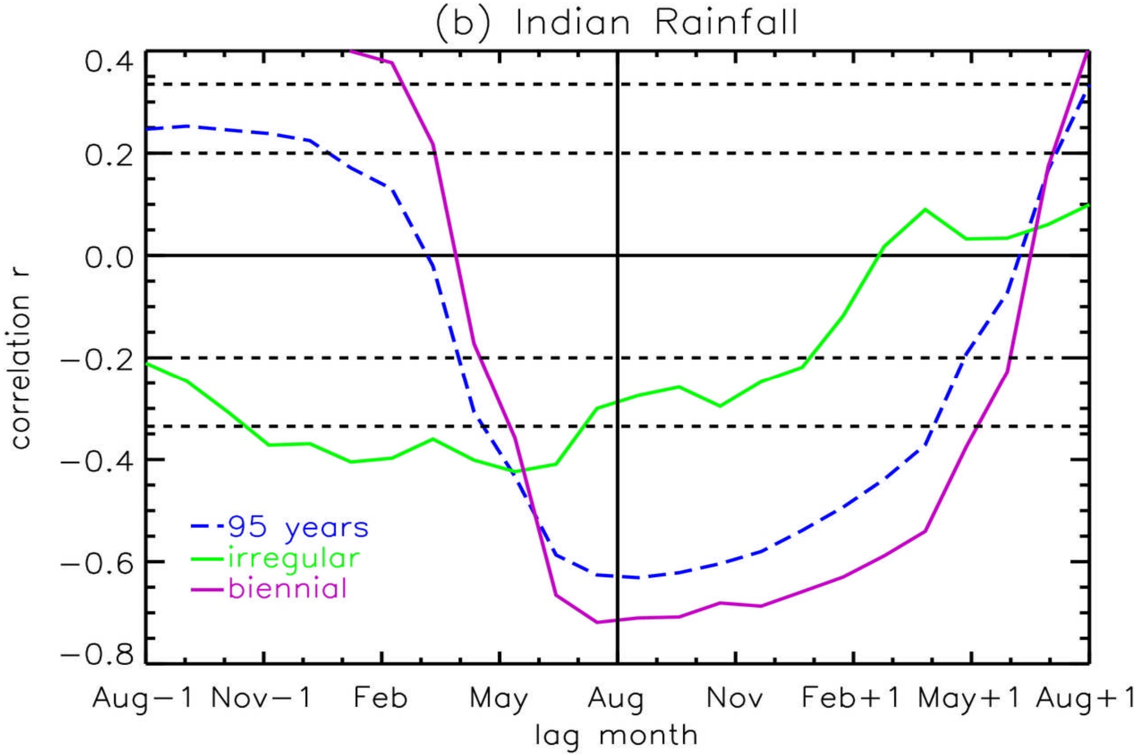
Impact of doubling CO_2 on ENSO-Monsoon Teleconnections



Andy Turner 2006

Regime Behaviour in Flux-Adjusted Model





- Model shows ability to flip between biennual and irregular ENSO behaviour
- Monsoon-ENSO teleconnections strongest in biennual regime
- Will climate change manifest itself as a change in regime behaviour?

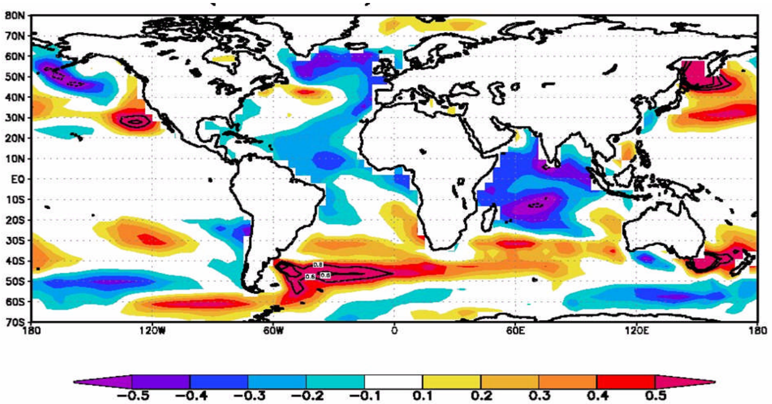
Deliverable D4.2.1: (continue)

2) Natural variability in the extra-tropics

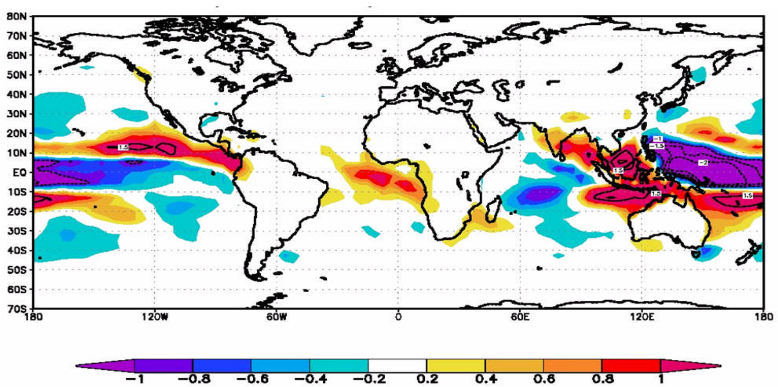
Impact of tropical climate variability on the Atlantic THC. Run where the inter-annual variability in the tropical (20S-20N) Pacific (TP) is suppressed

Annual mean changes (500 years means, TP-control) of

(a) SST (K) and



(b) precipitation (mm/day).



Deliverable D4.3.1:

Software for exploring extreme events in gridded data sets

Software has been developed to perform analysis of extreme climate and weather events in gridded datasets (part of the RCLIM intiative, R software for CLIMate analysis) and is freely available at http://www.met.reading.ac.uk/cag/rclim/.

These tools allow :

- exploratory analysis of spatial patterns of extremes,
- investigation of dependence of extremes on factors such as ENSO,
- analysis of clusters of extremes and also spatial extreme dependence analysis (teleconnection patterns of extremes).

RT4 coordinated experiments

1. Broad aims:

- **Understanding climate, and climate forecast uncertainty (WP4.4), at a mechanistic/process level, particularly in terms of the role of specific feedbacks (WP4.1), the regional patterns of climate change (WP4.2), and the factors governing the frequency and characteristics of extreme events (WP4.3).**
- **Add value to information available from core ENSEMBLES hindcasts, forecasts and scenario integrations.**
- **Need a simple core set of computationally cheap experiments so that they can be done by all groups (including where possible different model resolutions etc).**
- **RT4 coordinated experiments focus on understanding model uncertainty (rather than scenario uncertainty or initial condition uncertainty).**

2. Proposed experiments

- **AGCM experiments**

  a. Core set: control and $2xCO_2$ experiments using common time invariant, SST and ice fields as lower boundary conditions, taken from a coupled experiment with the Hadley Centre model.

  b. Enhanced set: additional experiments to involve perturbations which may influence, e.g., cloud or land-surface feedbacks, effect of SST or sea-ice anomalies etc.

- **AGCM-slab experiments: Selected experiments from the core set to be repeated with the same AGCM coupled to slab ocean model to examine impact of interactive SST.**

3. Status of the RT4 coordinated experiments

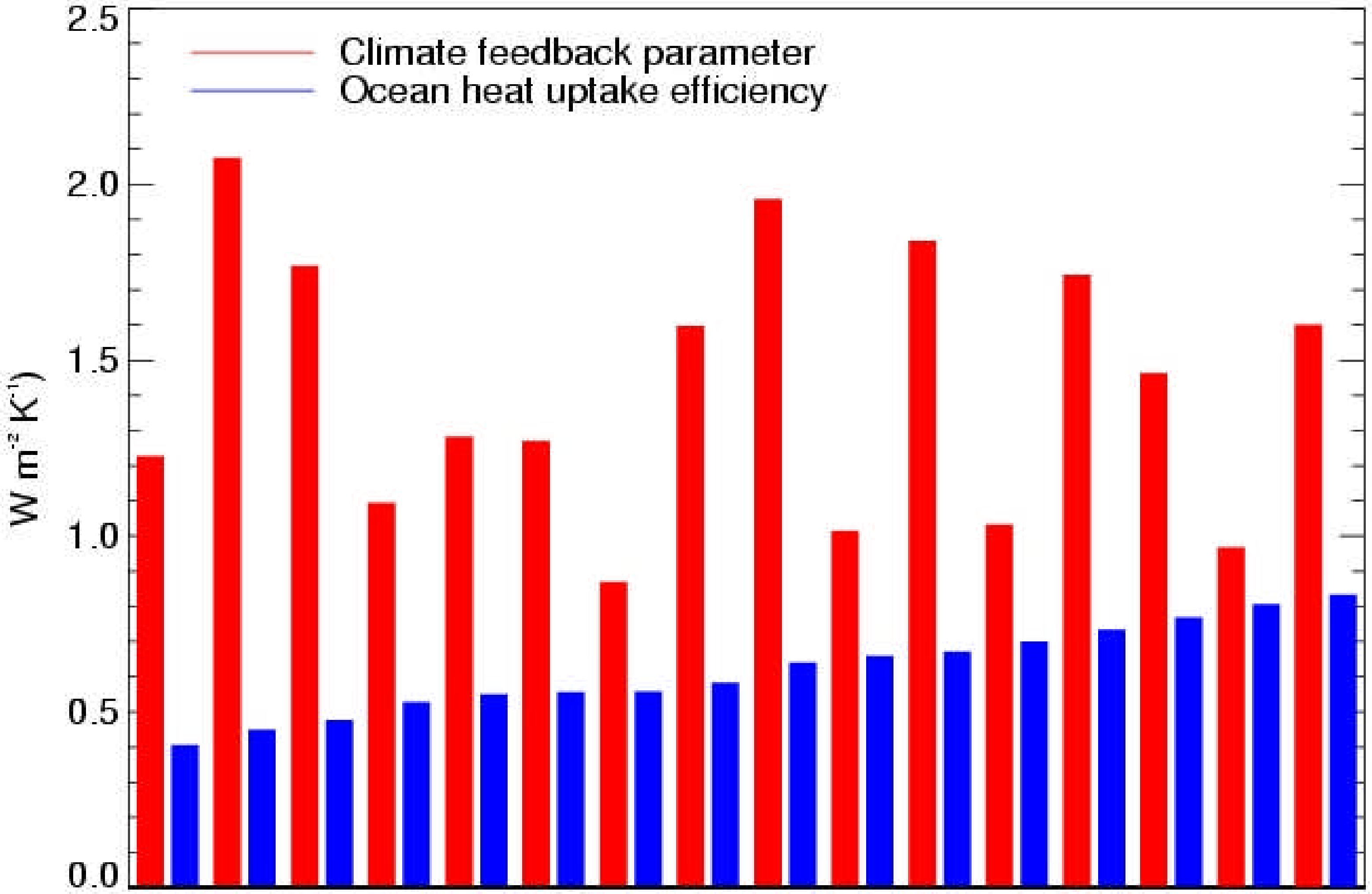
- **http://www.cgam.nerc.ac.uk/research/ensembles-rt4/coord_exp/design.html, has been launched to provide coordination and data for the coordinated experiments activity. Contains detailed description of the experimental design, requested diagnostics and data format.**

- **Seven groups have committed to undertake the experiments. Most groups have finished their experiments and are in the process of preparing data for the database.**

- **Data produced by the coordinated experiments can be downloaded from the web site for analysis for subprojects.**

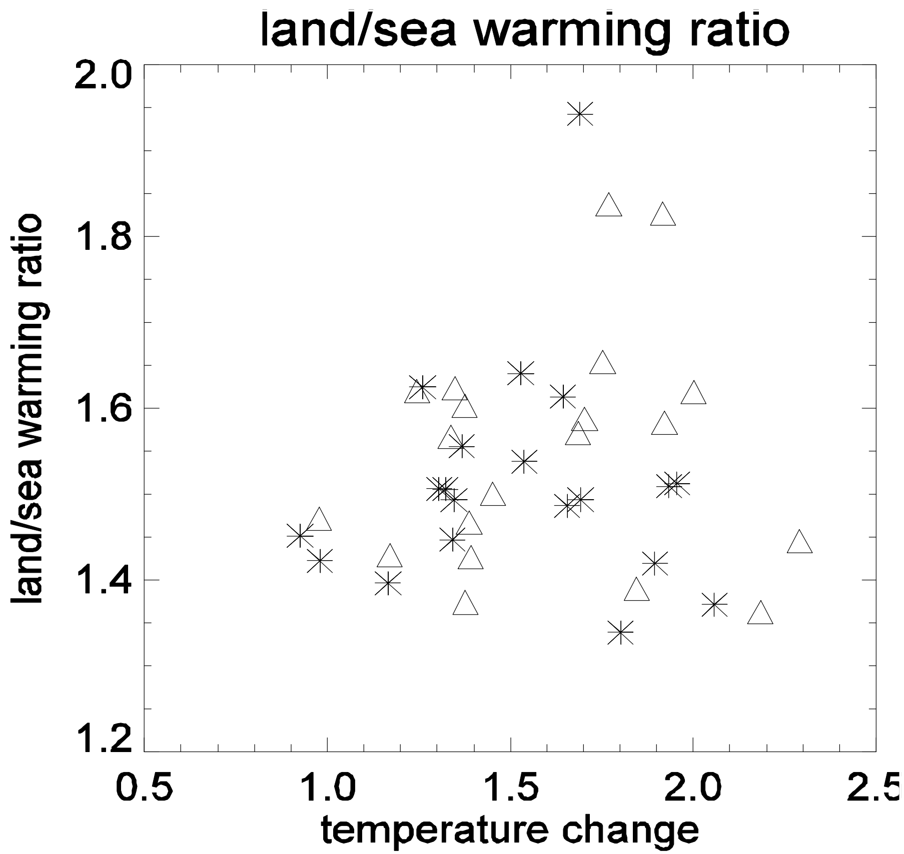
- **One major subprojects is understanding the factors that determine the land sea-warming contrast.**

Like climate feedback, ocean heat uptake efficiency (ratio of heat flux into ocean to surface temperature change) is uncertain by a factor of 2. Together they determine the rate of climate change. Ocean heat uptake is generally less important, but in some models they are roughly equal. (Unpublished results from AR4 1% CO2 runs.)



Jonathan Gregory, 2006

What factors determine the land/sea warming contrast in response to increasing greenhouse gases?



Scatter plot of land-sea warming ratio against area mean air temperature change for 20 models. Diamonds are for the global mean and stars for tropical-subtropical mean (40^{o}S-40^{o}N). This ratio varies between ~1.3-1.9 in AR4 models and is unrelated to global mean temperature change (i.e. climate sensitivity).