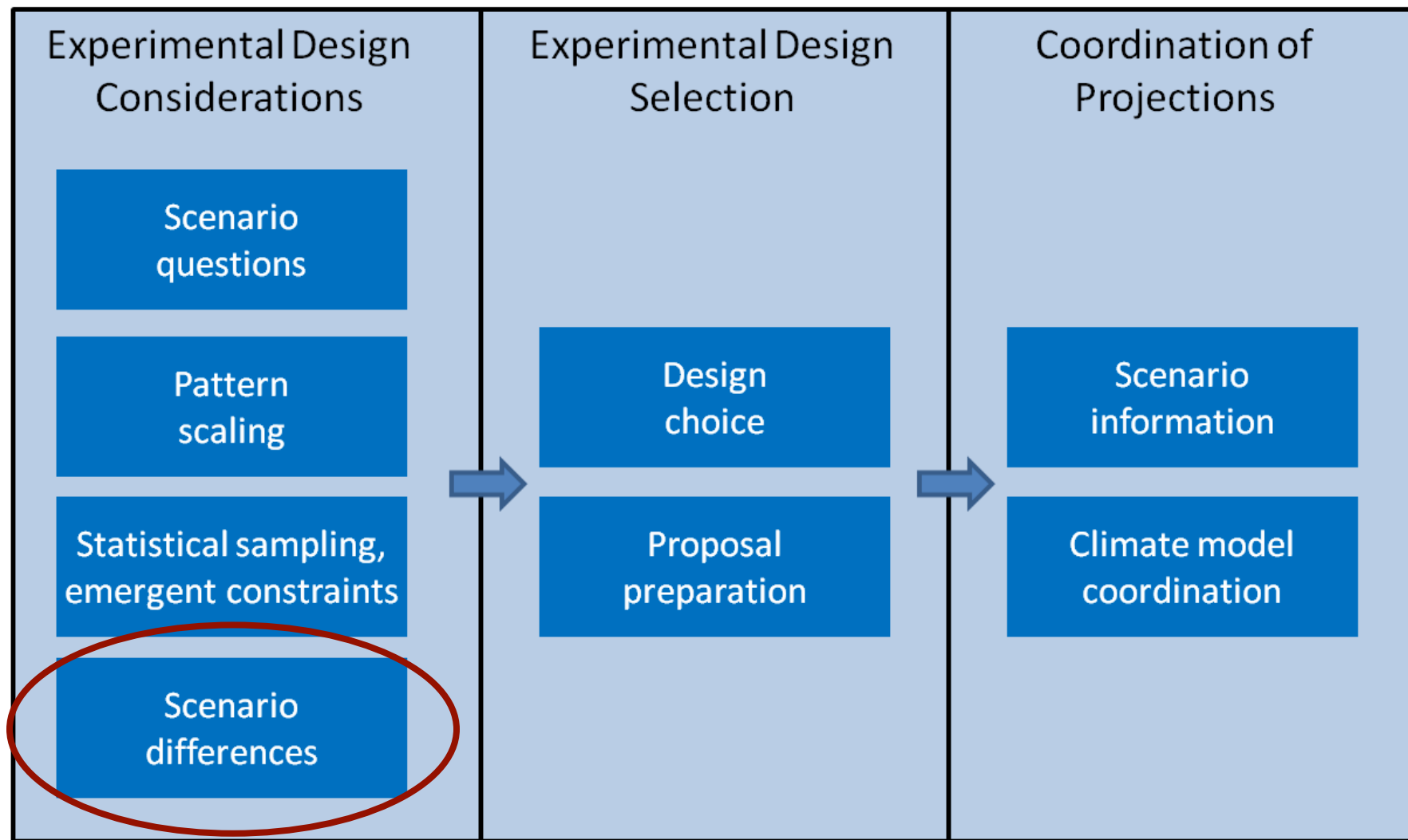


# **Scenario Differences: Sensitivity of local climate outcomes to global forcing or temperature change**

Claudia Tebaldi  
ScenarioMIP

AGCI  
ASPEN, August 5, 2014

# ScenarioMIP



Co-chairs: B. O'Neill, D. vanVuuren, C. Tebaldi

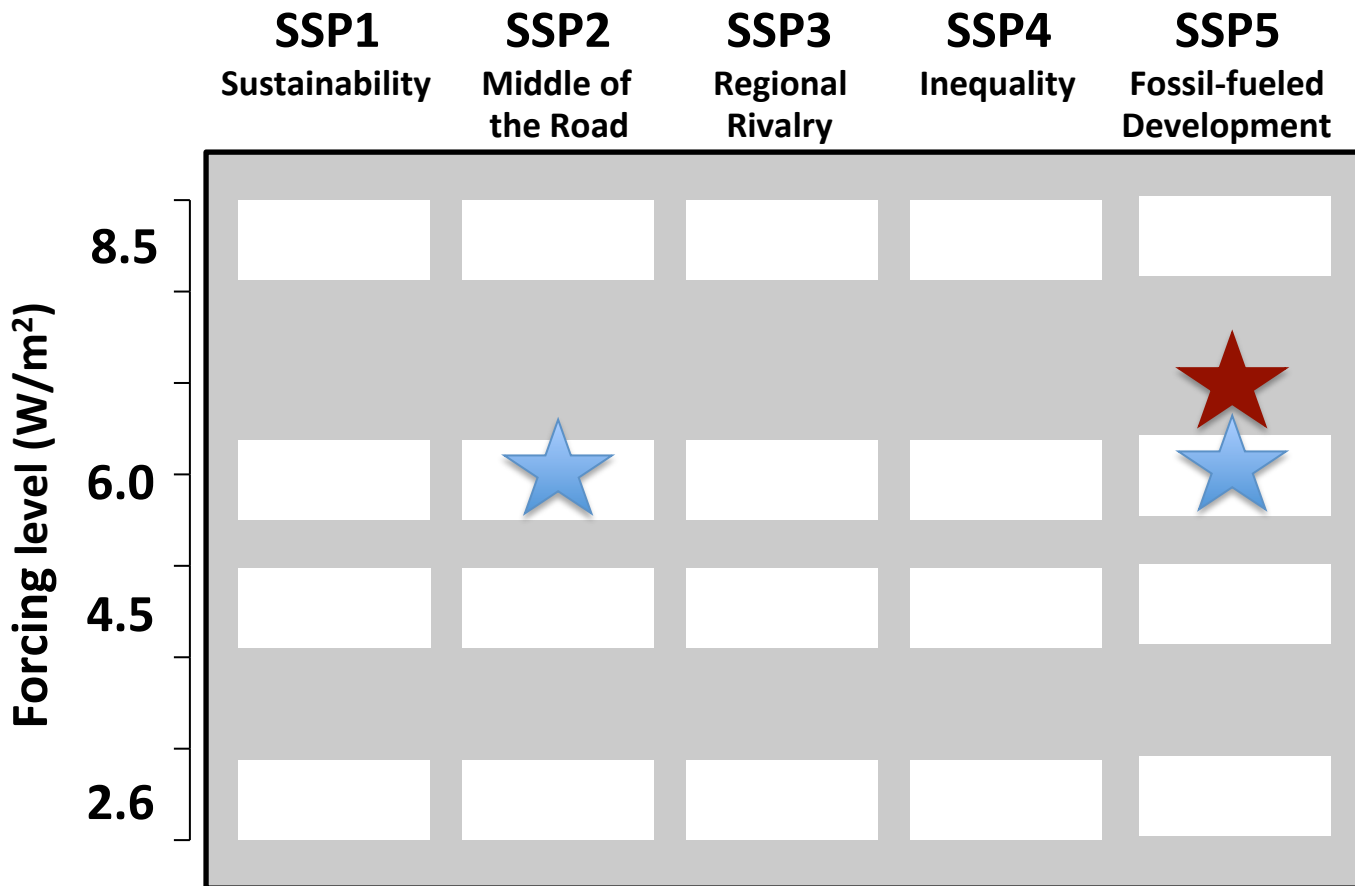
Scientific Steering Committee: P. Friedlingstein, G. Hurtt, R. Knutti, JF Lamarque, J. Lowe, J. Meehl, R. Moss, B. Sanderson.

How far apart do scenarios need to be to justify running them through ESMs?

Or

When are two scenarios close enough that climate information from one can be used in place of that from the other?

- We can answer by focusing only on differences between scenarios in terms of *global characteristics* (RF, GAT).
- We should also address other relevant but thornier questions, having to do with *differences in regional forcings* (LUC, Aerosols) even under the same level of global forcing.

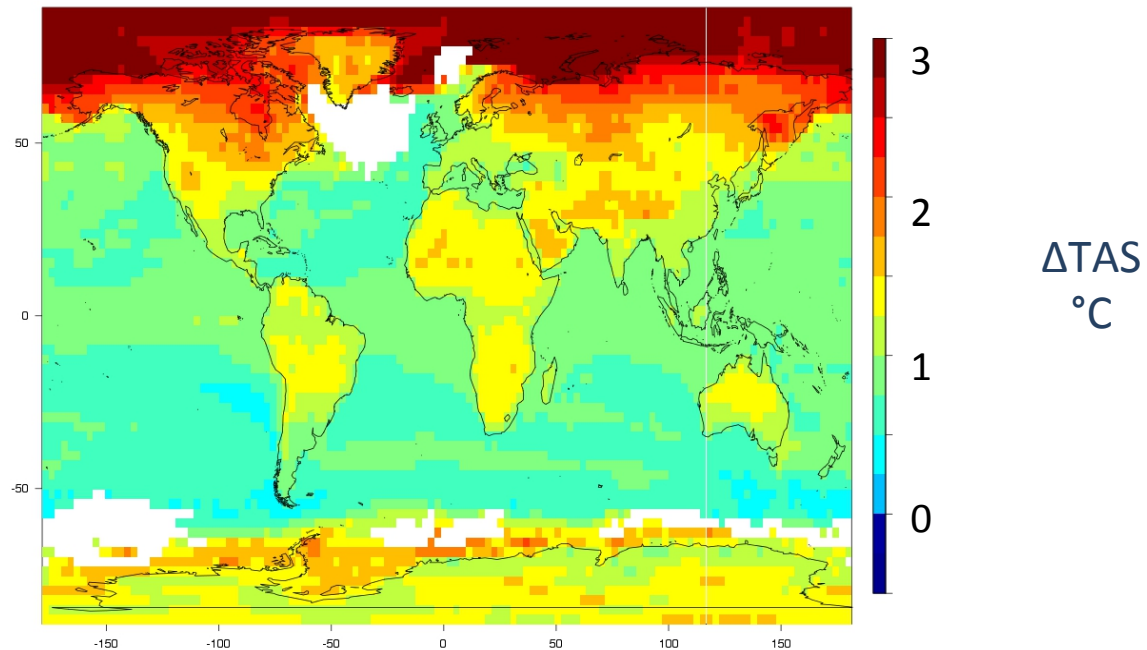


# Differences in climate outcomes from differences in global characteristics

At what magnitude of change in **Global Average Temperature** or **Radiative Forcing** do we start experiencing *significant* change “on the ground”?

# What happens when $\Delta GAT = 1.0^\circ\text{C}$ ?

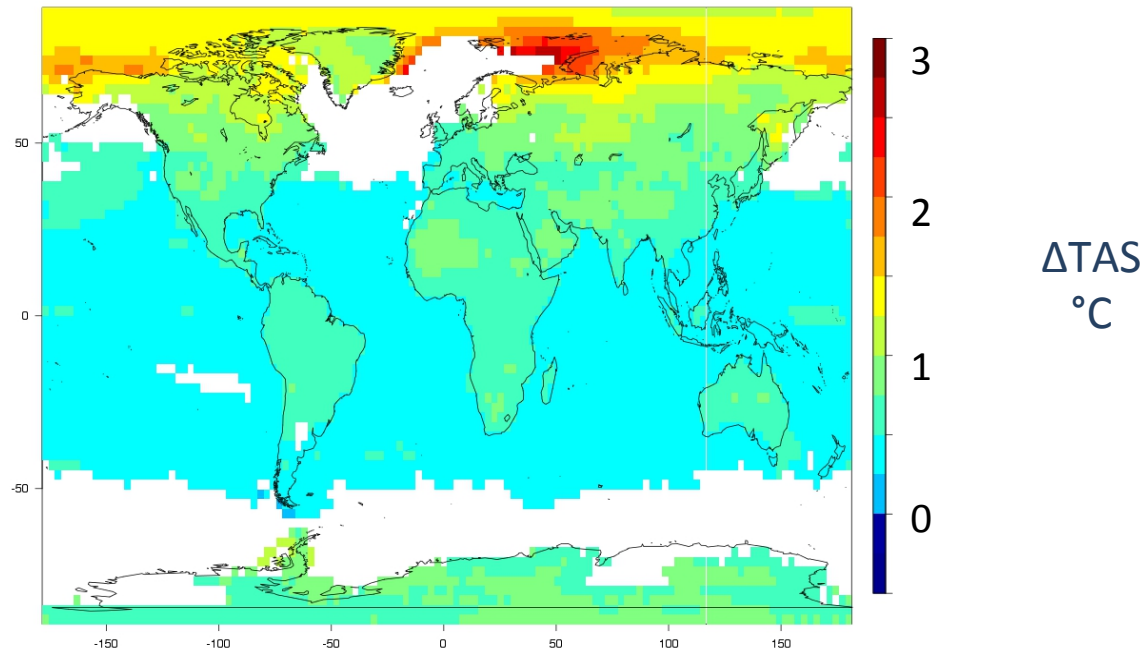
1%CO<sub>2</sub> Experiments  
Multimodel median change



Color: at least 1/2 of models say it is significant

# What happens when $\Delta GAT = 0.5^\circ\text{C}$ ?

1%CO<sub>2</sub> Experiments  
Multimodel median change

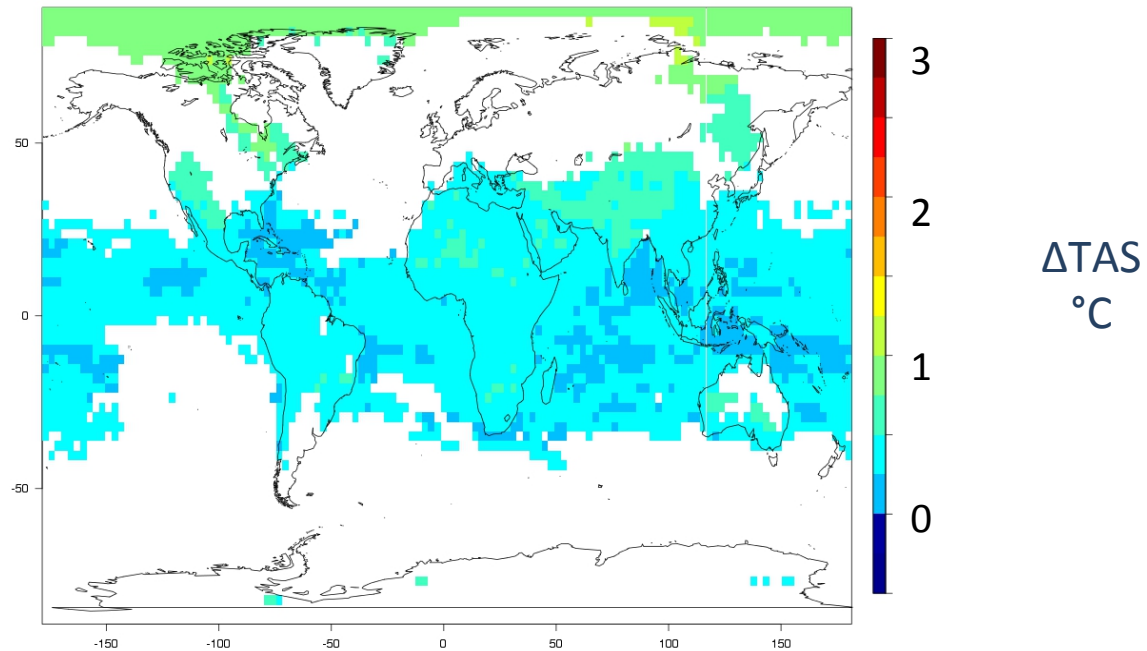


Color: at least 1/2 of models say it is significant



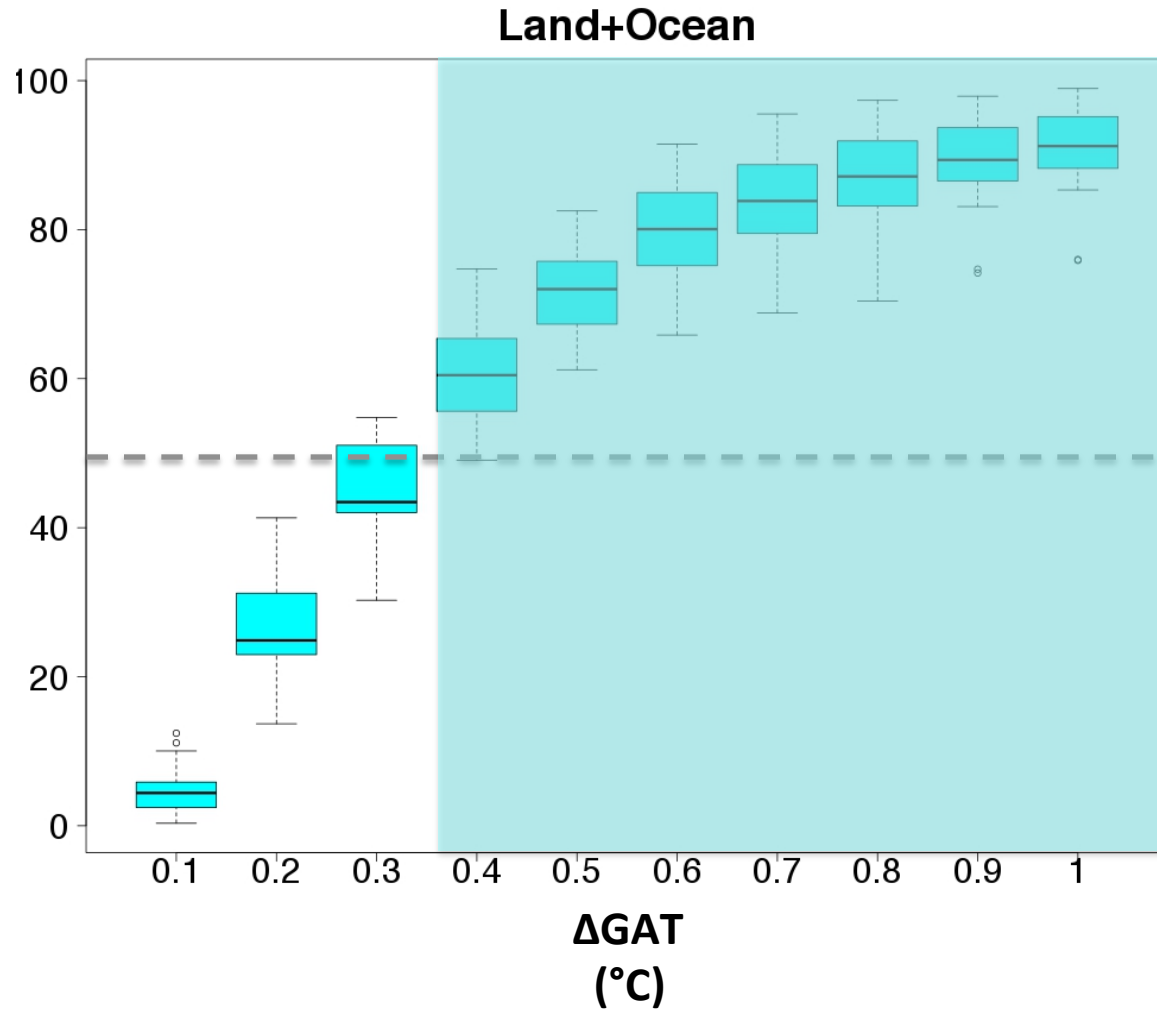
# What happens when $\Delta GAT = 0.3^\circ\text{C}$ ?

1%CO<sub>2</sub> Experiments  
Multimodel median change



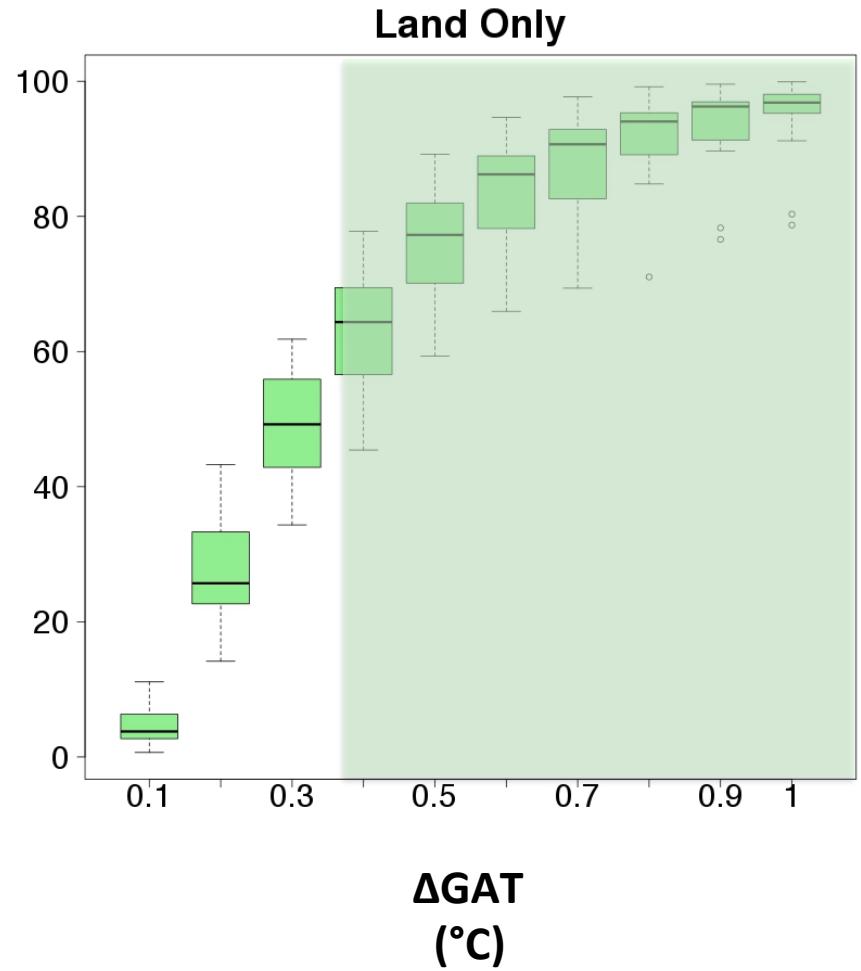
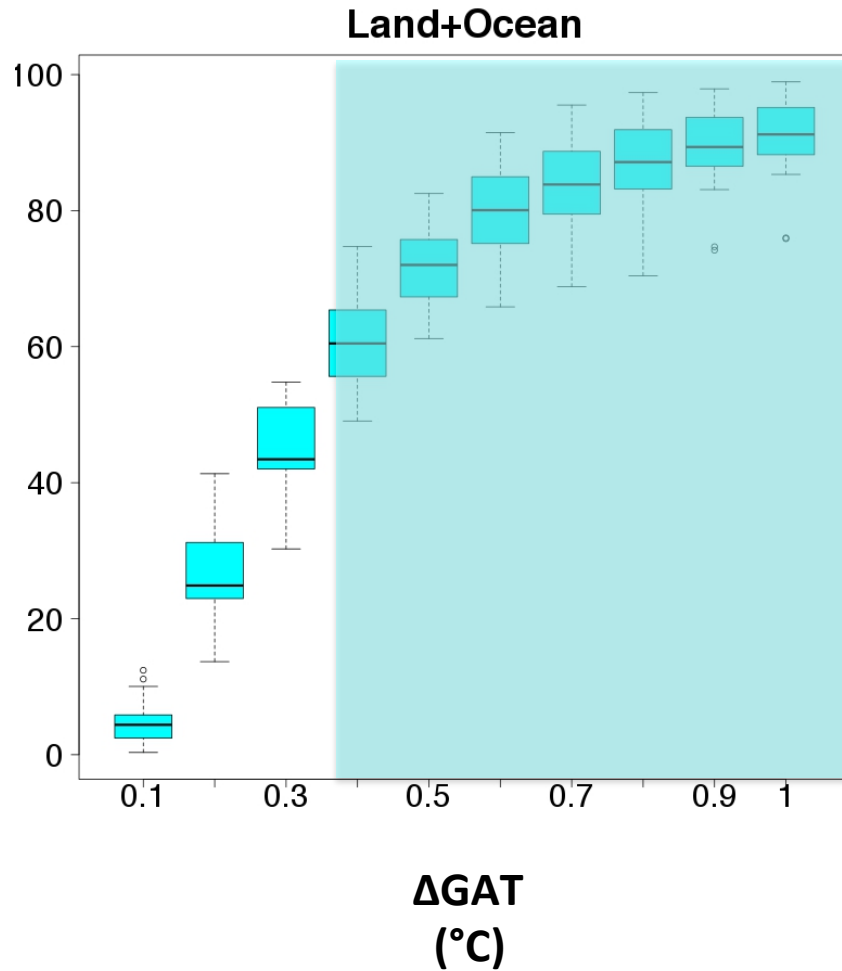
Color: at least 1/2 of models say it is significant

# Percentage of grid-points showing significant change in TAS for different values of $\Delta GAT$

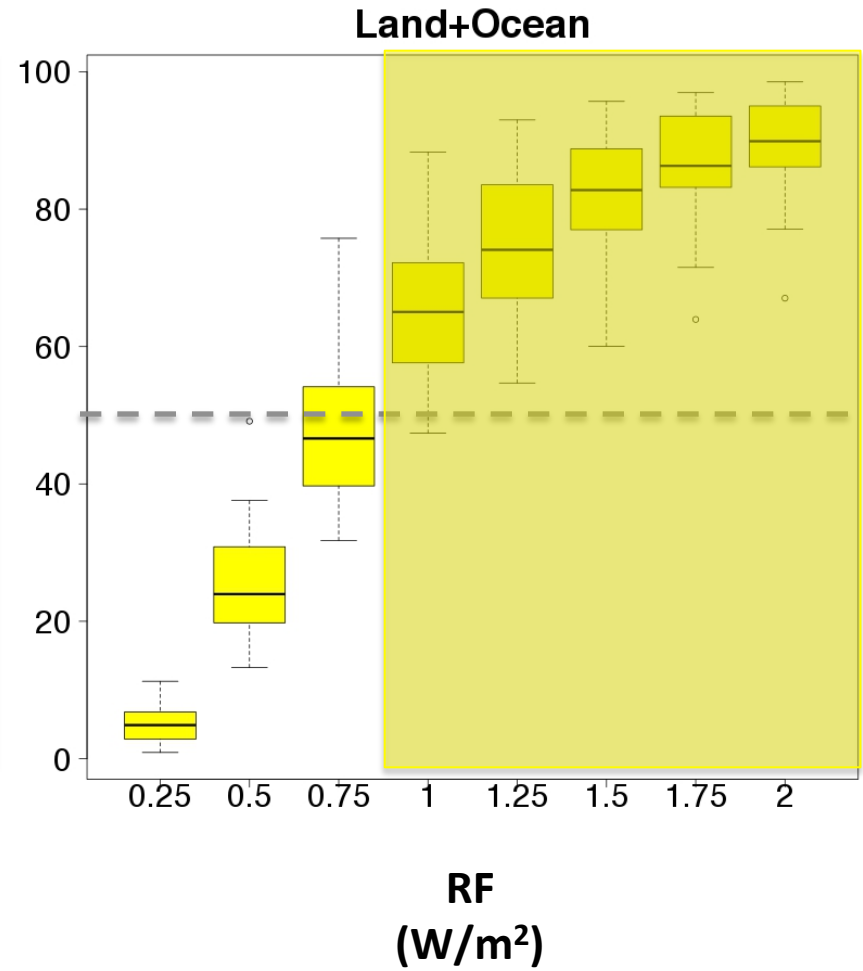
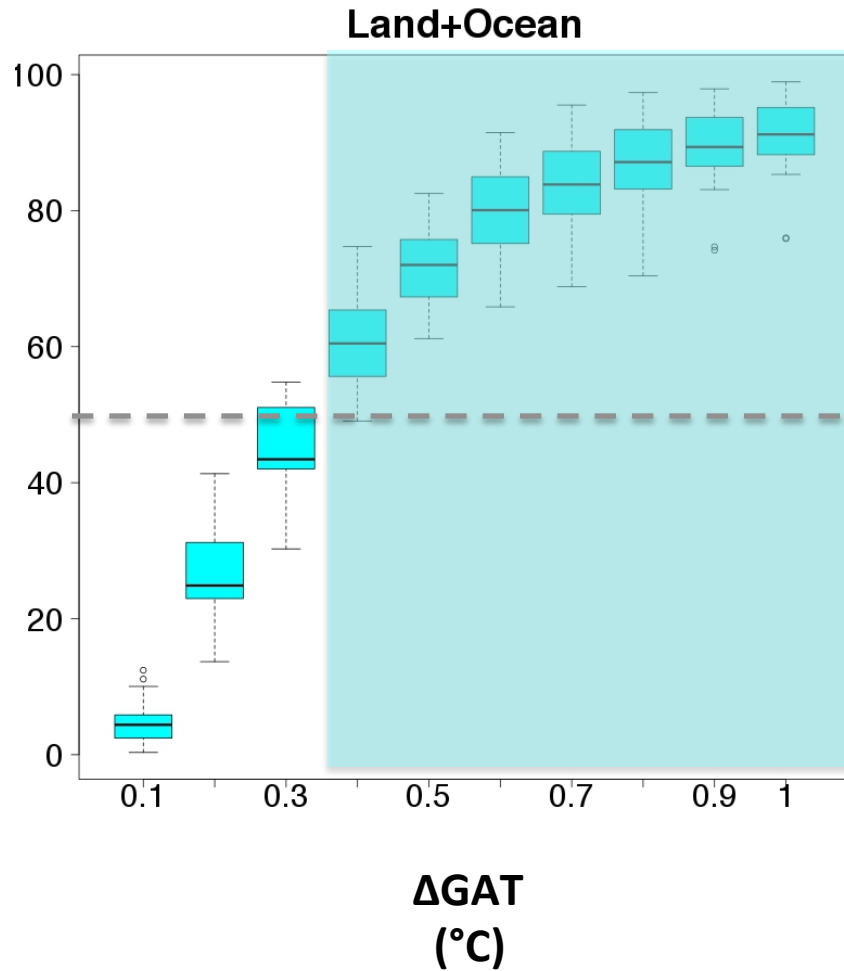


Looks like between 0.3 and 0.5C things start to get interesting

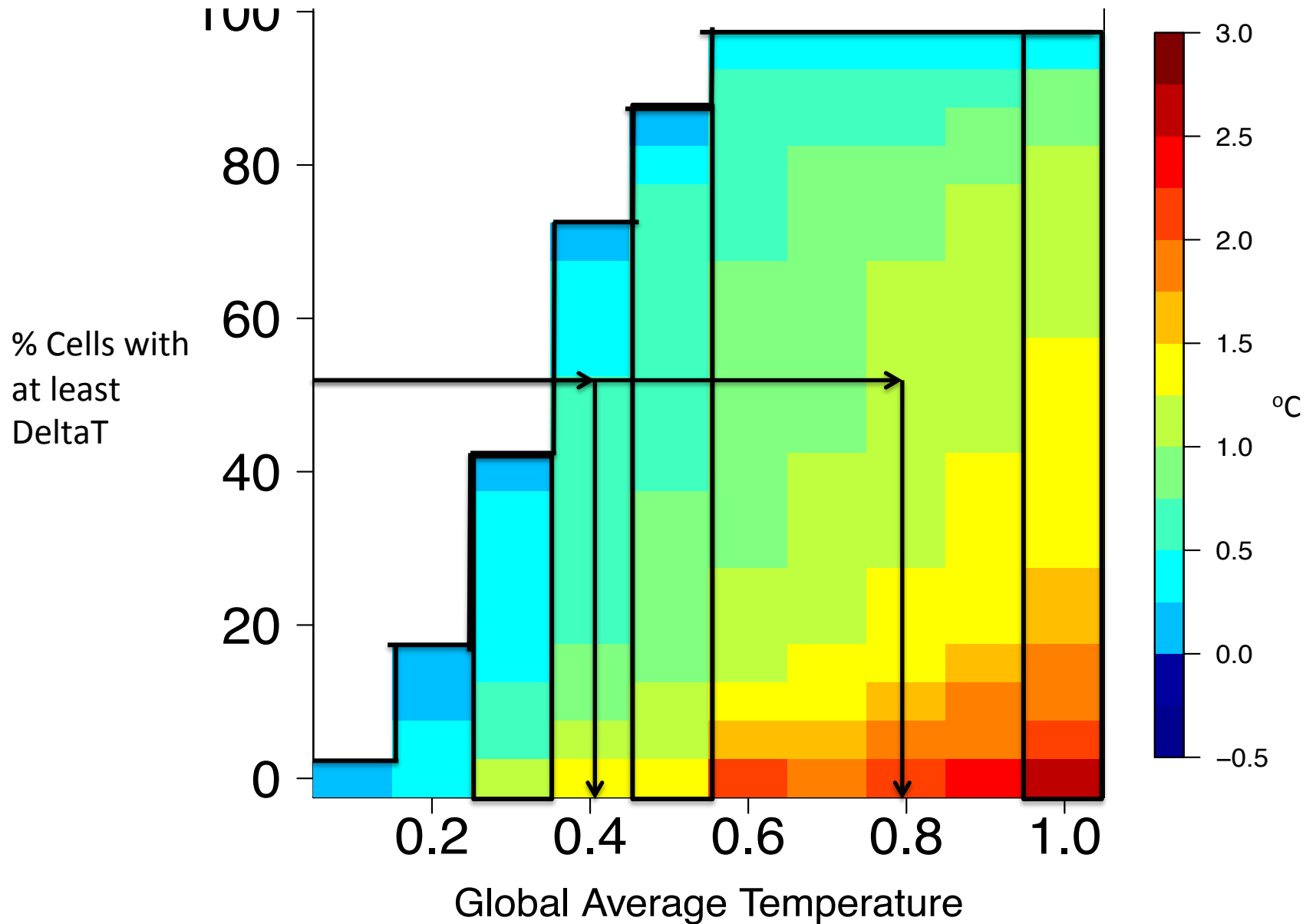
# Percentage of grid-points showing significant change in TAS for different values of $\Delta GAT$



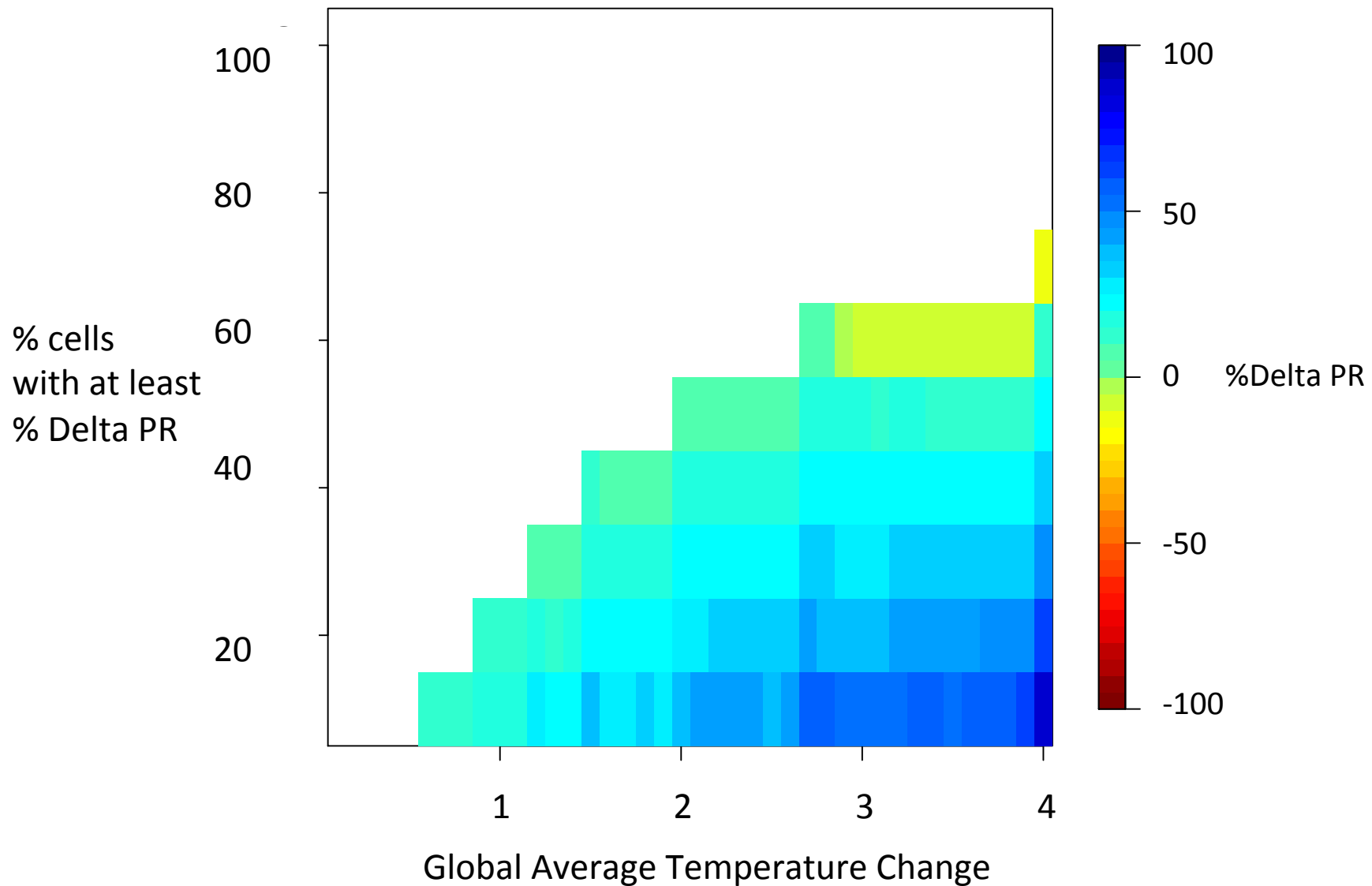
# Percentage of grid-points showing significant change in TAS for different values of $\Delta GAT$ or RF



# Temperature Changes (land-only)



## Percent Precipitation changes (land-only)



# Implications

Above  $1^{\circ}\text{C}$  of  $\Delta\text{GAT}$  or  $2 \text{ W/m}^2$  of  $\Delta\text{RF}$  more than 80% of the surface experiences statistically significant change in temperatures.

Above  $0.3^{\circ}\text{C}$  of  $\Delta\text{GAT}$  or  $1 \text{ W/m}^2$  of  $\Delta\text{RF}$  more than 50% of the surface experiences statistically significant change in temperatures.

Above  $0.8^{\circ}\text{C}$  of  $\Delta\text{GAT}$  more than 50% of the surface experiences a statistically significant change in temperature of more than  $1^{\circ}\text{C}$ .

Results based on RF differences are more uncertain due to the effect of climate sensitivity and path-dependency.

Variables affected by higher noise from internal variability will show less sensitivity to  $\Delta\text{GAT}$ . E.g., Precipitation changes are significant over only about 30% of cells for a change of  $1^{\circ}\text{C}$ .

# **Differences in climate outcomes from differences in regional forcings**

- Lack of experiments available to systematically address the question
- Collaboration with AerChemMIP and LUMIP to identify useful idealized experiments in order to explore these sensitivities is desired