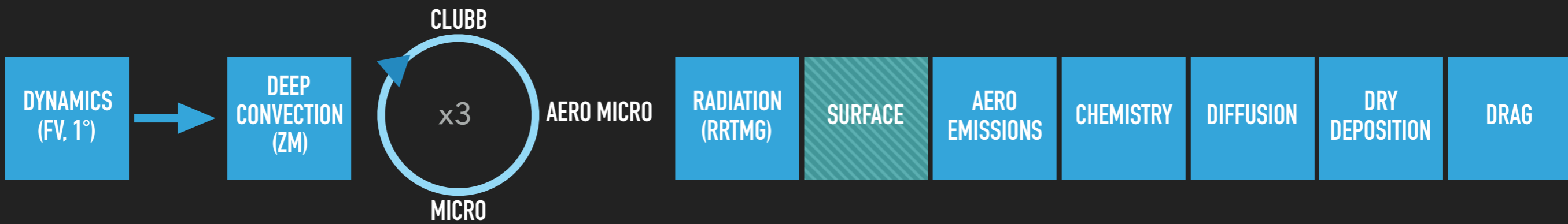


BRIAN MEDEIROS

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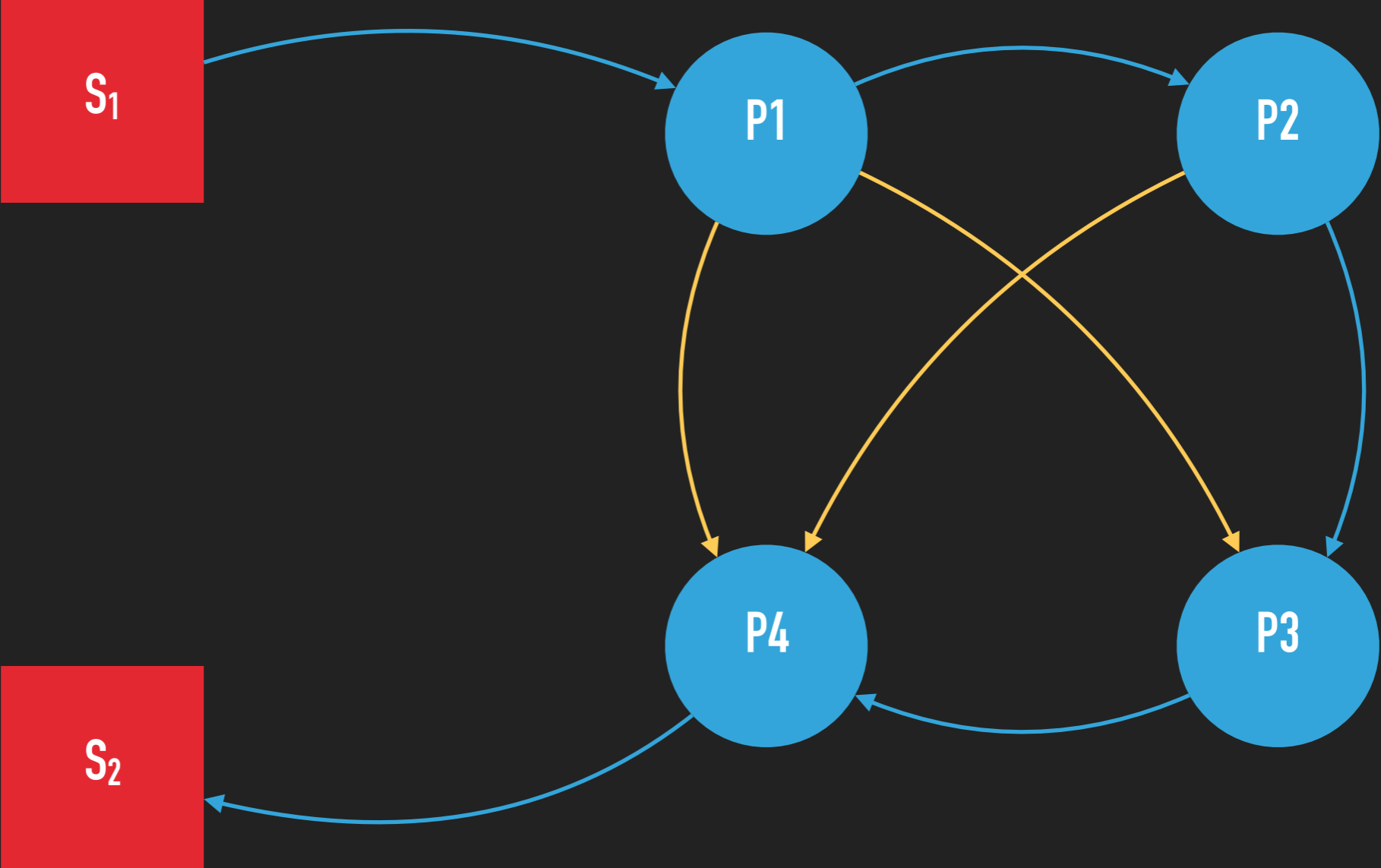
# GLOBAL RESPONSES IN IDEALIZED CLIMATE MODEL EXPERIMENTS

# CESM2 - CAM6



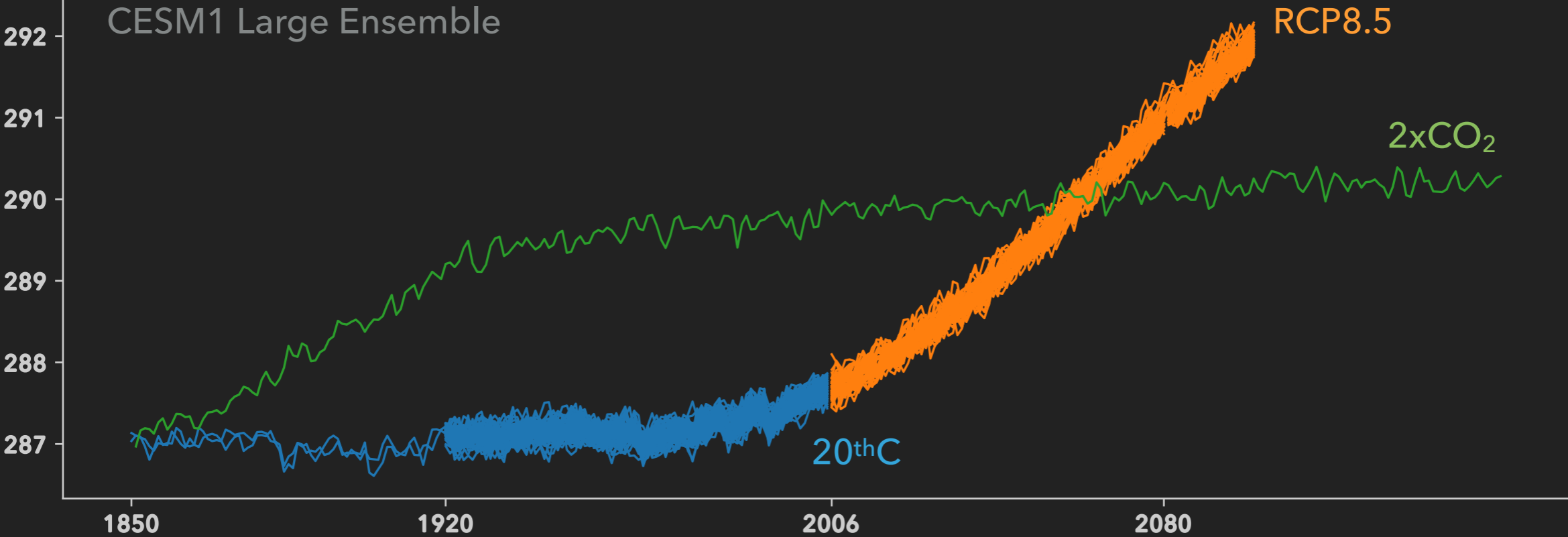
# COMPLEXITY

---

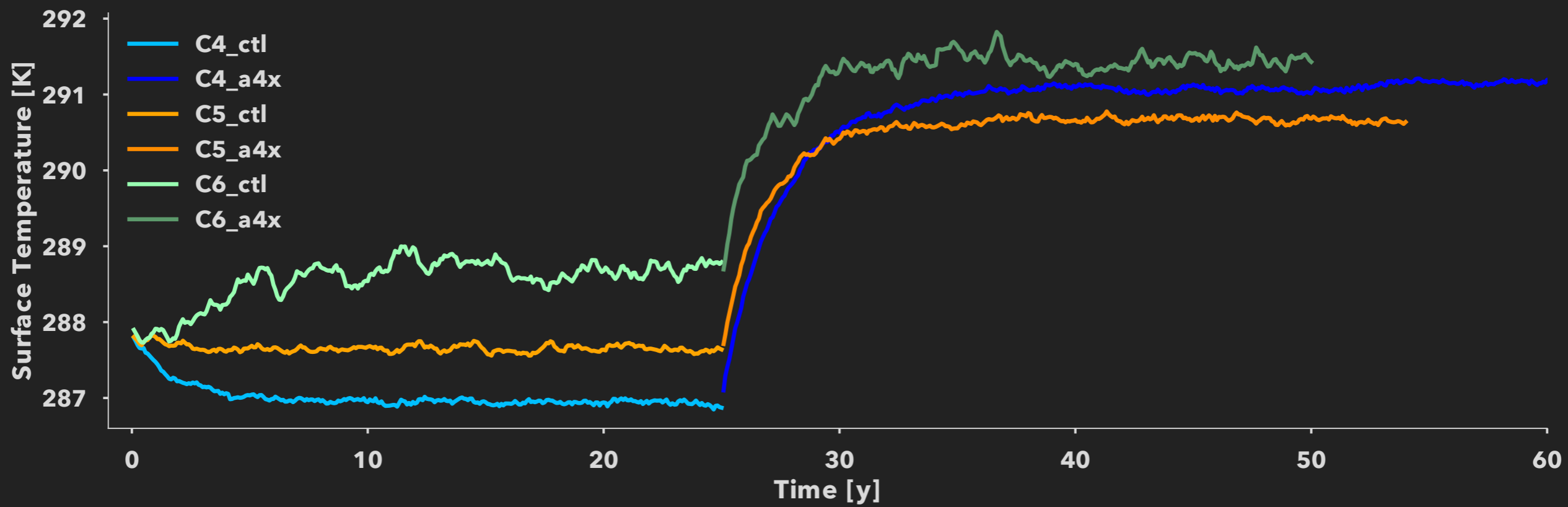


# CLIMATE SENSITIVITY

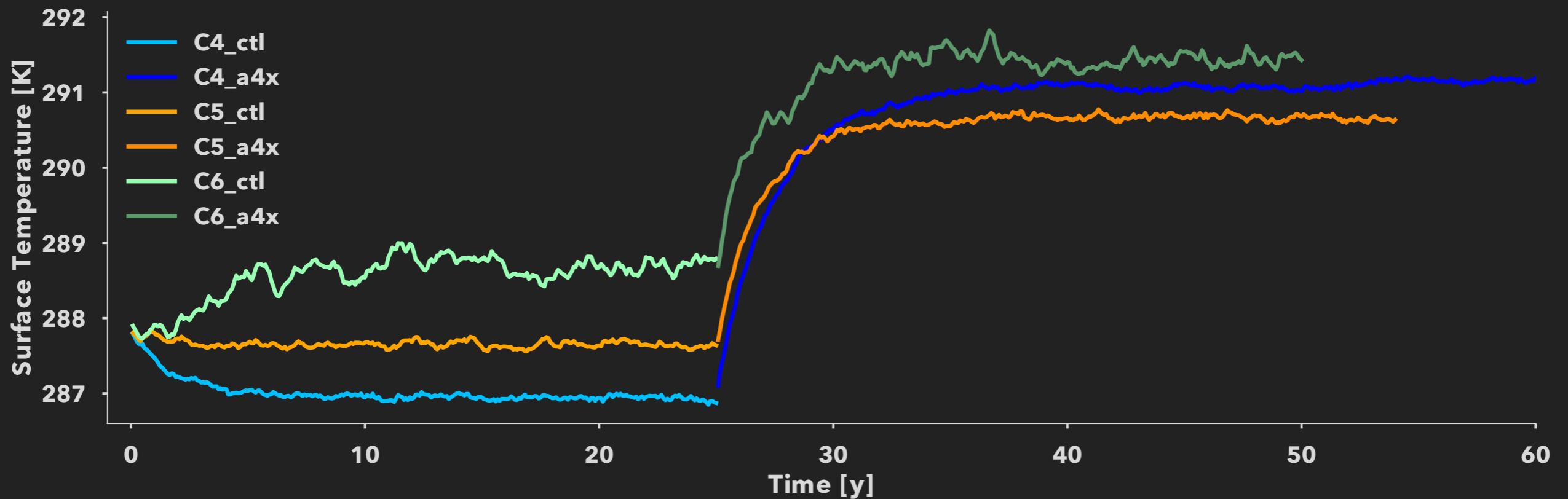
$$ECS \equiv \Delta T_S = \frac{F_{2 \times CO_2}}{\lambda}$$



# AQUAPLANET ABRUPT 4CO<sub>2</sub>

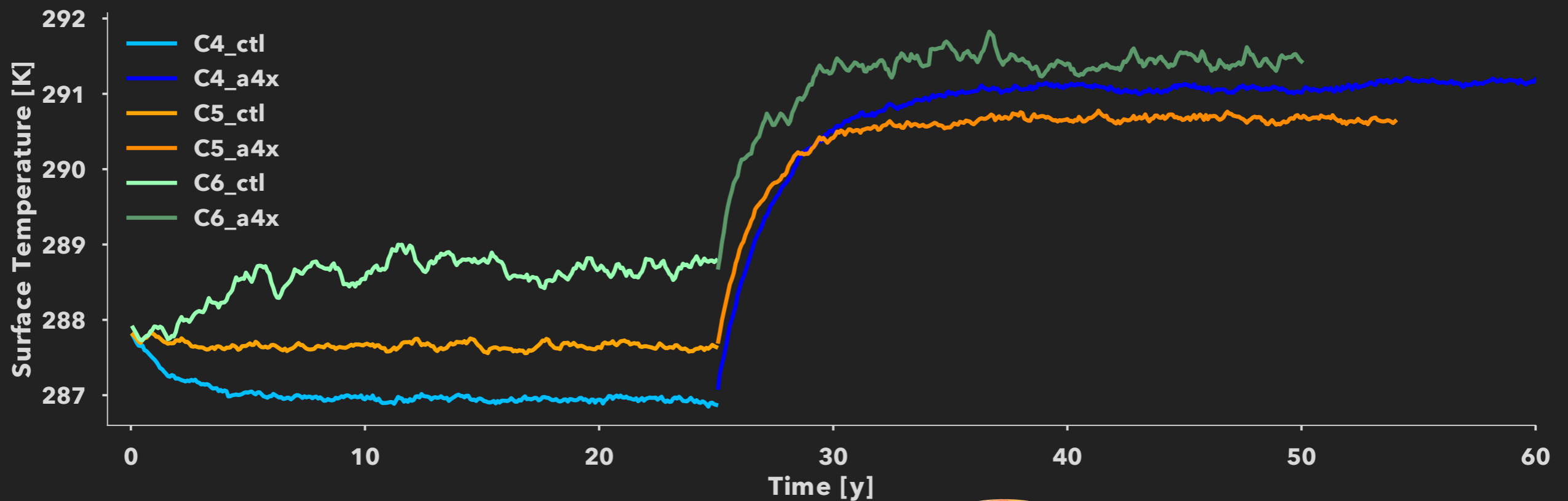


# AQUAPLANET ABRUPT 4CO<sub>2</sub>



- ▶ Different physics => different ECS
- ▶ Same physics + same perturbation for earth v. aqua can have different ECS
- ▶ prescribed warming v. 4xCO<sub>2</sub> can also have different response for same physics.

# AQUAPLANET ABRUPT 4CO<sub>2</sub>

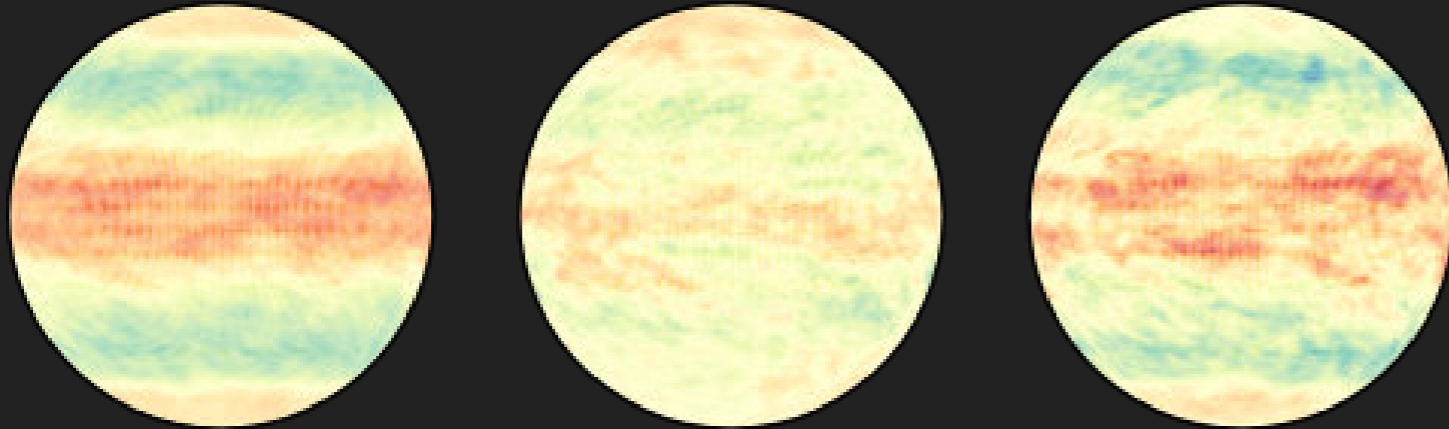


- ▶ Different physics => different ECS
- ▶ Same physics + same perturbation for earth v. aqua can have different ECS
- ▶ prescribed warming v. 4xCO<sub>2</sub> can also have different response for same physics.

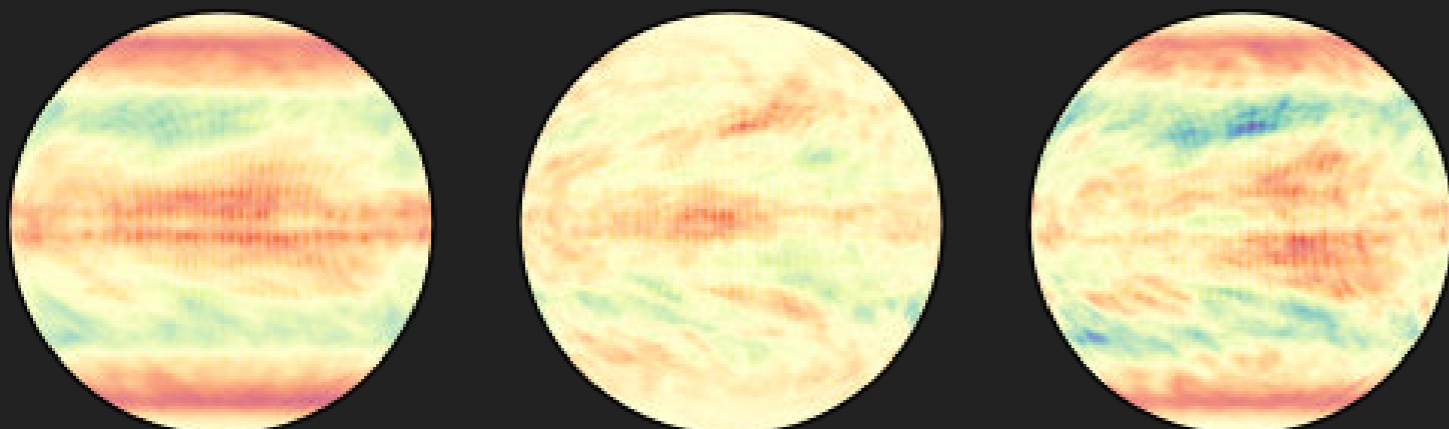


# CLOUD RADIATIVE EFFECT RESPONSES

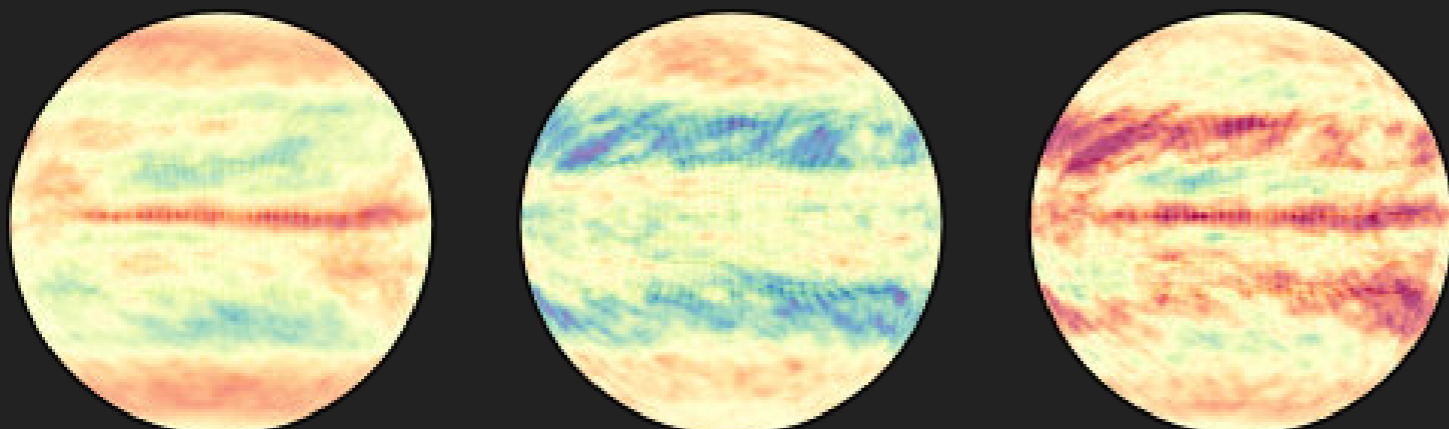
CAM4



CAM5



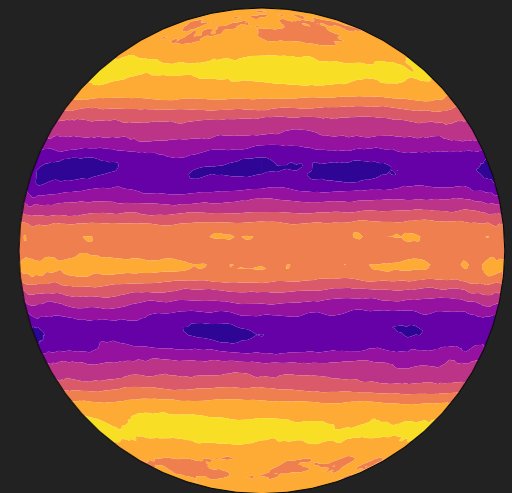
CAM6



TOTAL

FAST

SLOW



Example cloud fraction from CAM5.

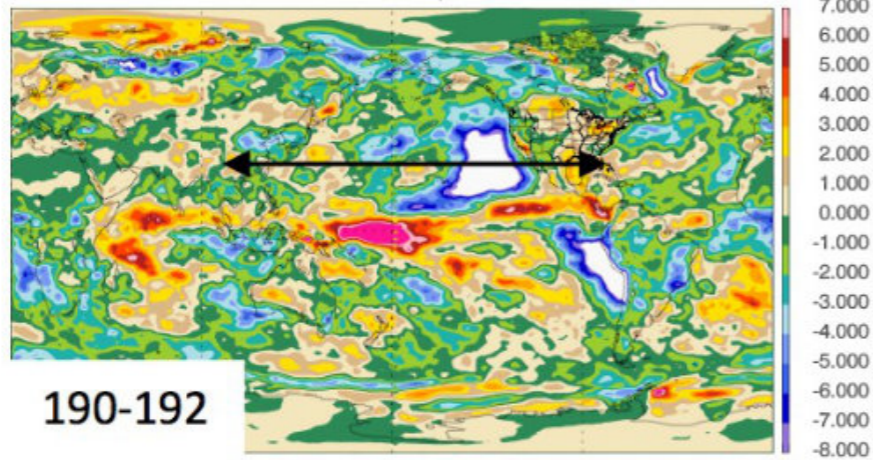


# HOW DO AEROSOL EFFECTS DEPEND ON EMISSIONS?

Northeast Pacific stratocumulus region showed more low clouds changing from "CMIP5" to "CMIP6" emissions

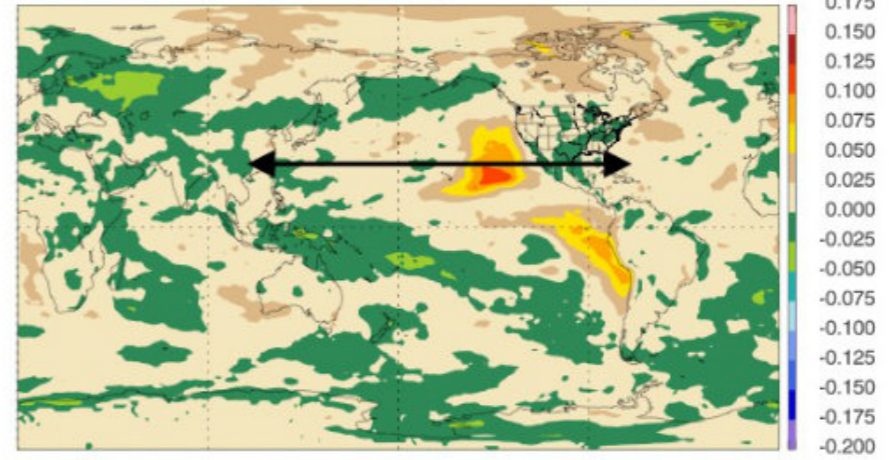


OCEAN: CORR= 0.99; DEV=1.02; RMSE=3.08; BIAS=-0.53  
LAND: CORR= 1.00; DEV=1.01; RMSE=1.90; BIAS=-0.47  
GLOBAL: CORR= 0.99; DEV=1.02; RMSE=2.77; BIAS=-0.51  
middle-top



Annual SWCF (W/m<sup>2</sup>)

OCEAN: CORR= 1.00; DEV=1.00; RMSE=0.02; BIAS=0.01  
LAND: CORR= 1.00; DEV=1.02; RMSE=0.01; BIAS=0.00  
GLOBAL: CORR= 1.00; DEV=1.01; RMSE=0.02; BIAS=0.01  
middle-top



Annual Low Clouds (%)

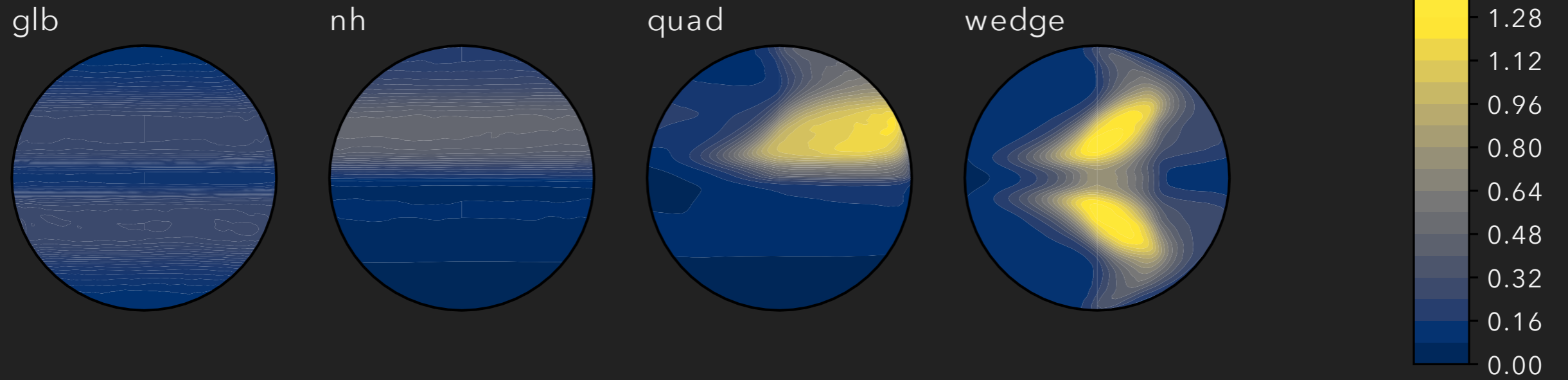
## EXPERIMENTAL DESIGN

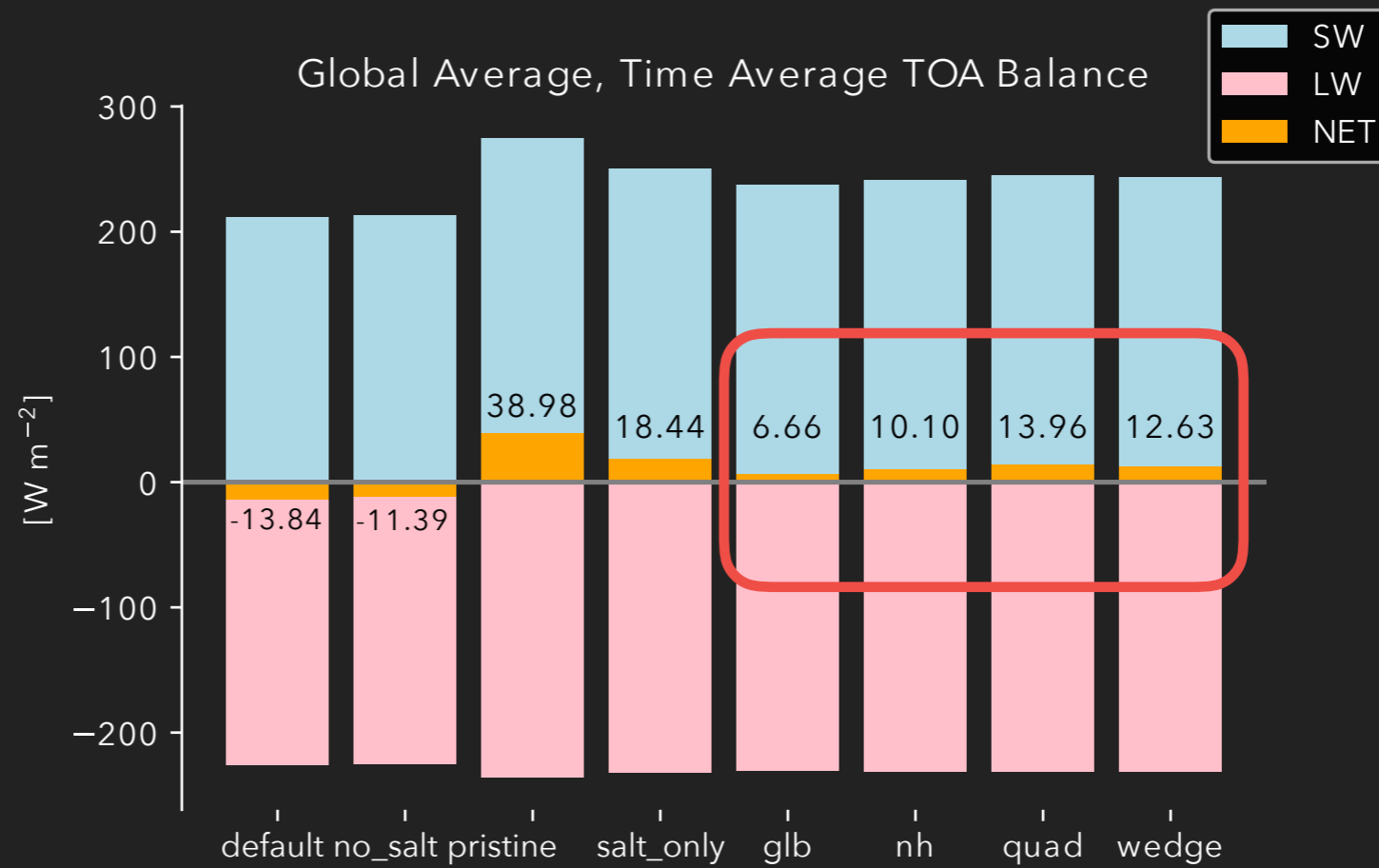
# REGIONAL EMISSIONS

- ▶ Basis: CMIP6 pre-industrial emissions.
- ▶ **glb**  
uniform global average emissions
- ▶ **nh**  
2x global average emissions  
northern hemisphere
- ▶ **quad**  
8x global average emissions  
[0 – 90° N, 0 – 90° E]
- ▶ **wedge**  
12x global average emissions  
[-90 – 90°N, 0 – 30° E]



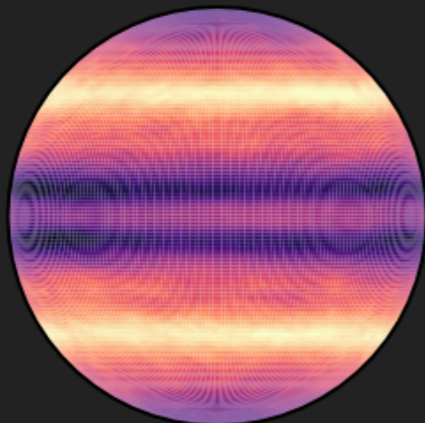
# Sulfate burden [mg m<sup>-2</sup>]



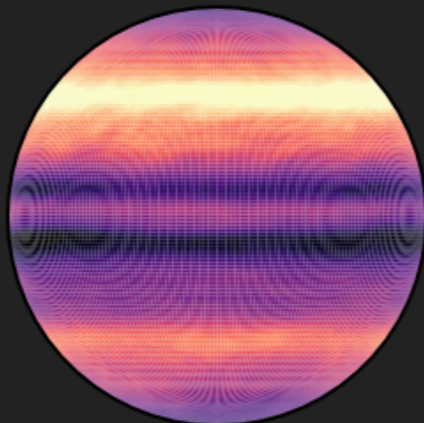


## Albedo Change

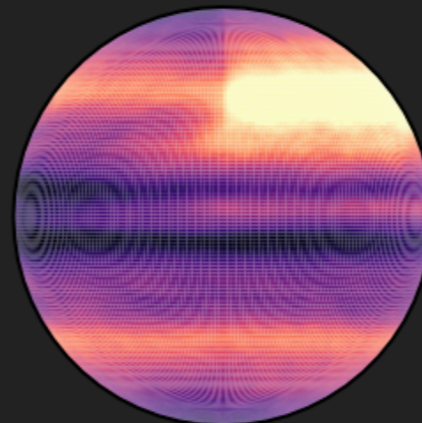
glb



nh



quad



wedge

