

Partitioning climate projection uncertainty with multiple Large Ensembles and CMIP5/6



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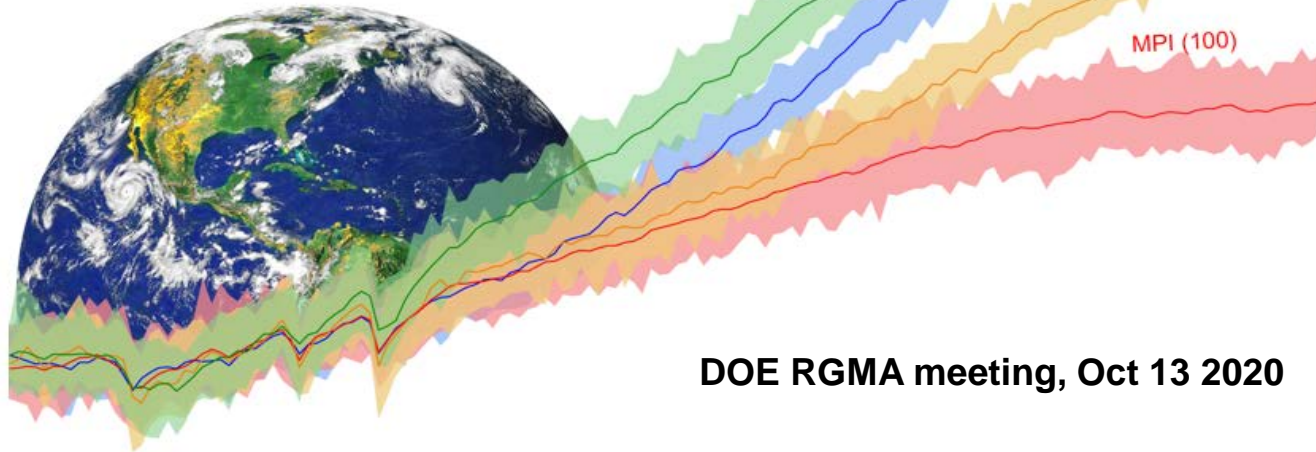
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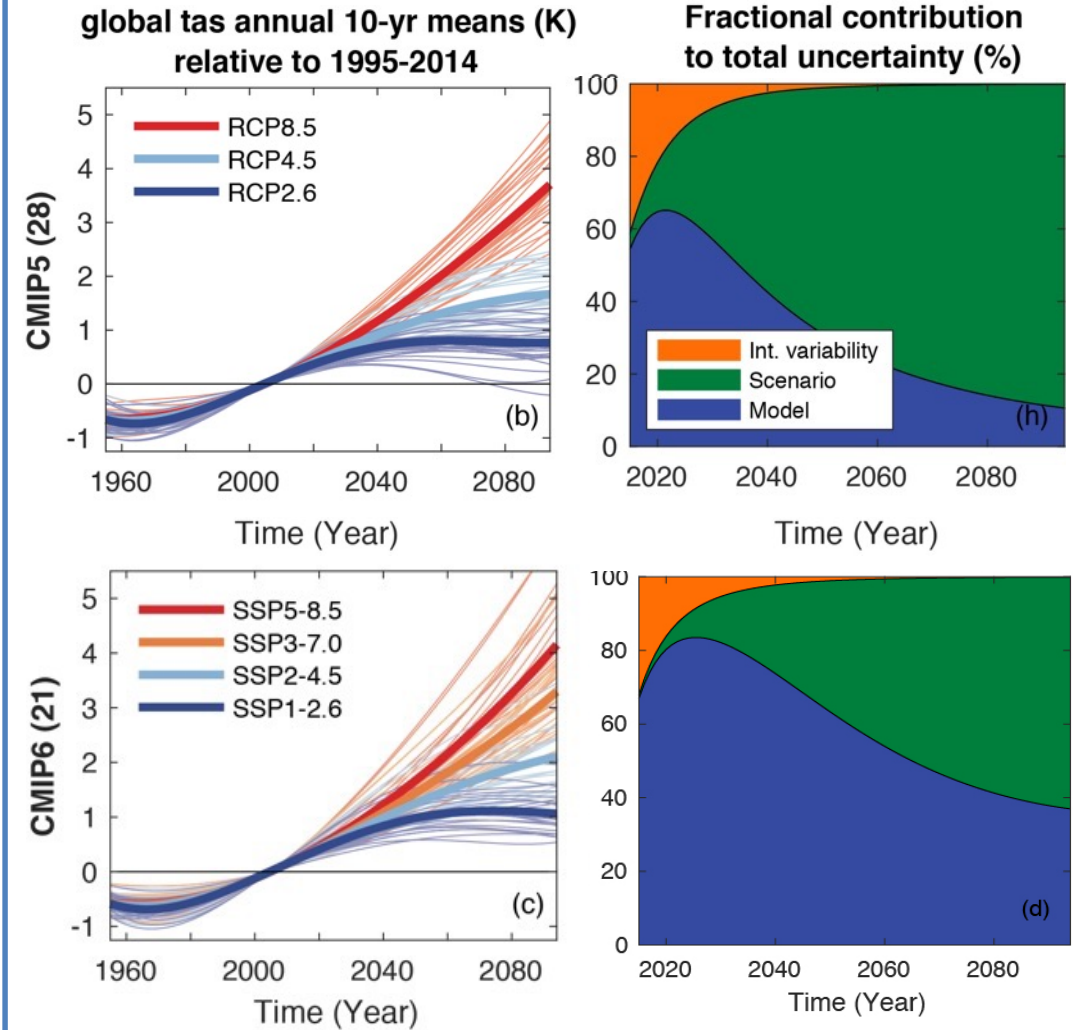
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In collaboration with Clara Deser, Nicola Maher, Jochem Marotzke, Lukas Brunner, Erich Fischer, Reto Knutti, Ed Hawkins, Andy Wood, Dave Lawrence, Martyn Clark, Julie Vano, Justin Mankin



DOE RGMA meeting, Oct 13 2020

Challenges and Current Research in RGMA



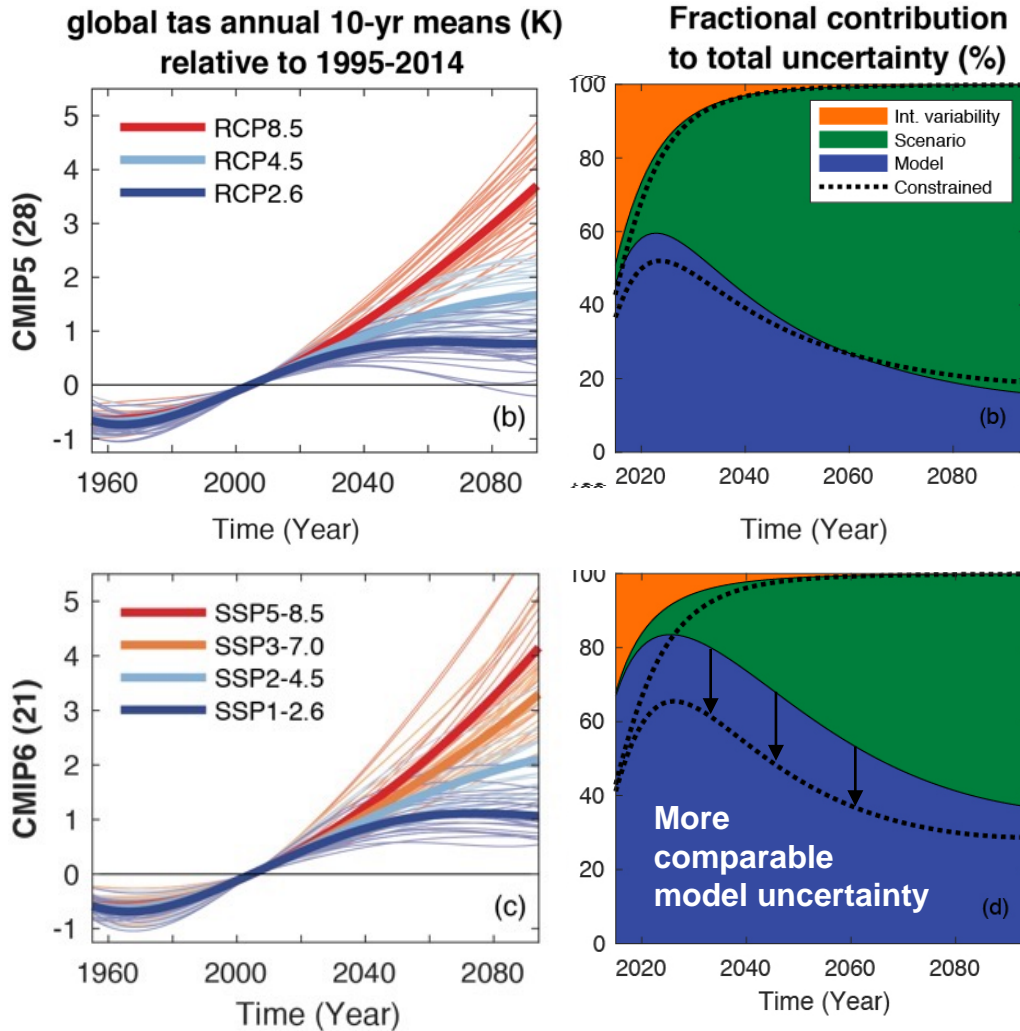
Lehner et al. (2020, Earth System Dynamics)



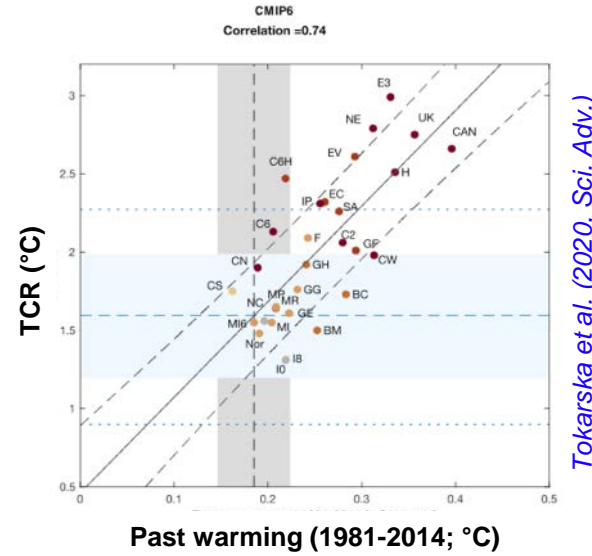
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Gaps in Current Research



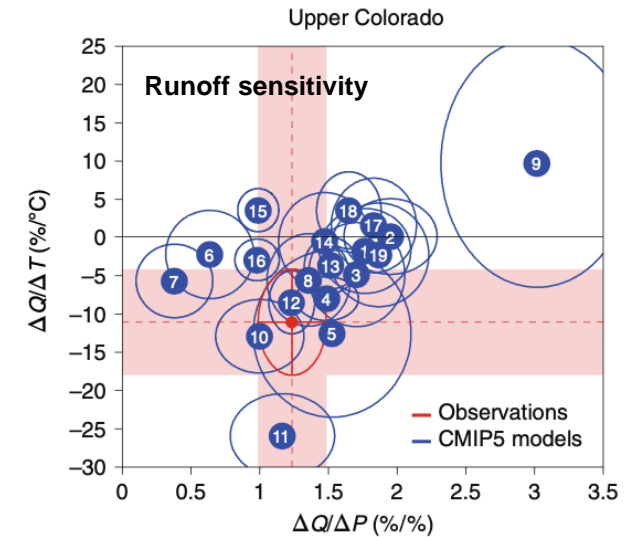
Lehner et al. (2020, Earth System Dynamics)



Models with too much historic warming show higher TCR.

An observational constraint is possible, similar to Hawkins&Sutton (2009):

$$W_m = \frac{1}{x_{obs} + |x_m - x_{obs}|}$$

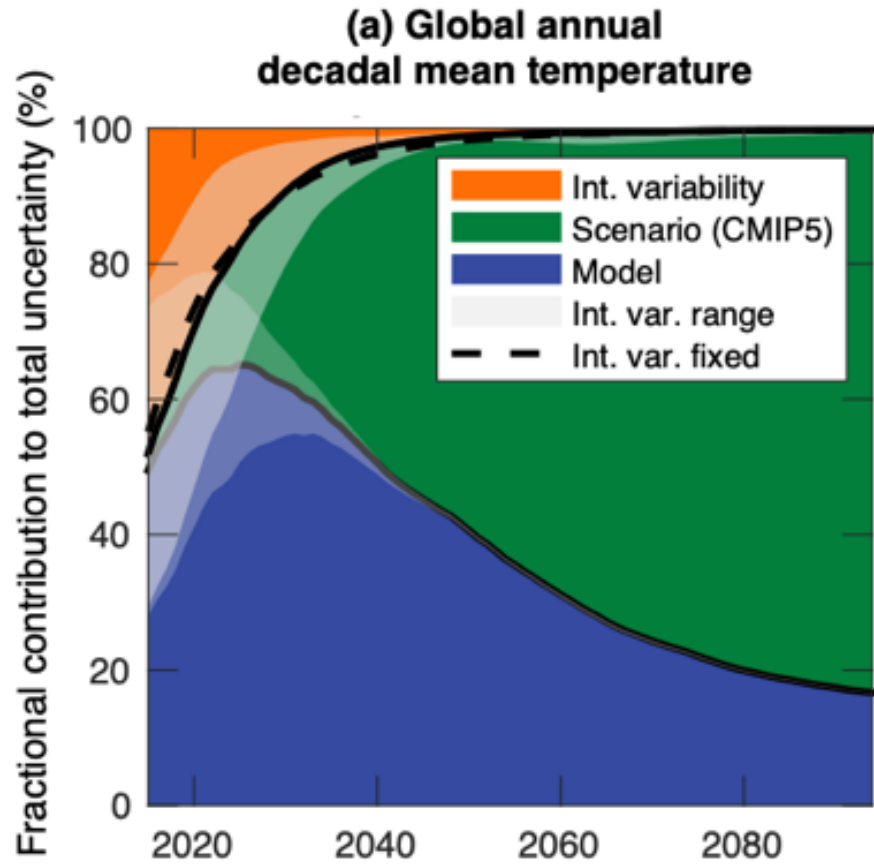


Lehner et al. (2019, Nature Climate Change)

- **Model uncertainty continues to be large**
- **Observational constraints help us, but much work remains**
- **True also at regional scales**



Gaps in Current Research

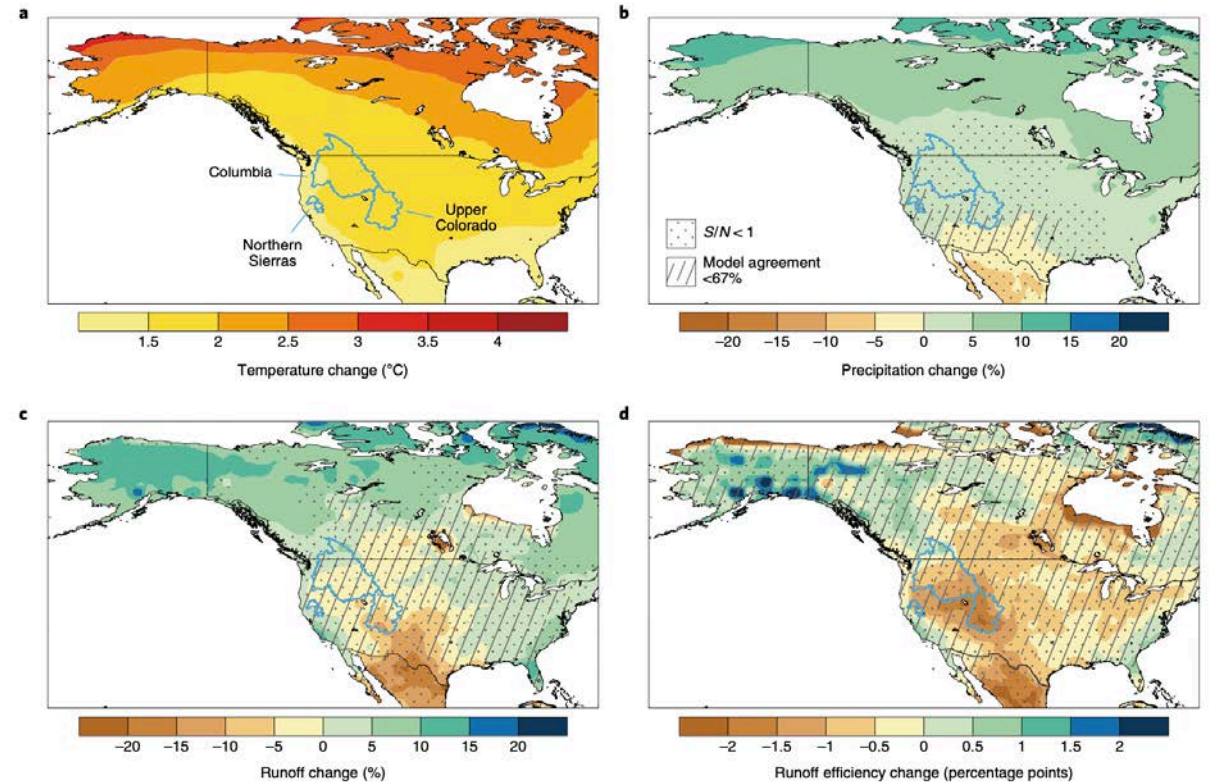


Lehner et al. (2020, Earth System Dynamics)

- Large Ensembles reveal that internal variability and its change is uncertain

Future directions

- Evaluate modes of internal variability and their change in E3SM1, CESM2 and CMIP6
- Assess downstream effects of biases and forced changes in modes of variability



Lehner et al. (2019, Nature Climate Change)



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