



Cornell University

The Geoengineering Model Intercomparison Project (GeoMIP): Past, present and future

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NOAA ERB Science Meeting
Wednesday, November 8

Role and scope of GeoMIP



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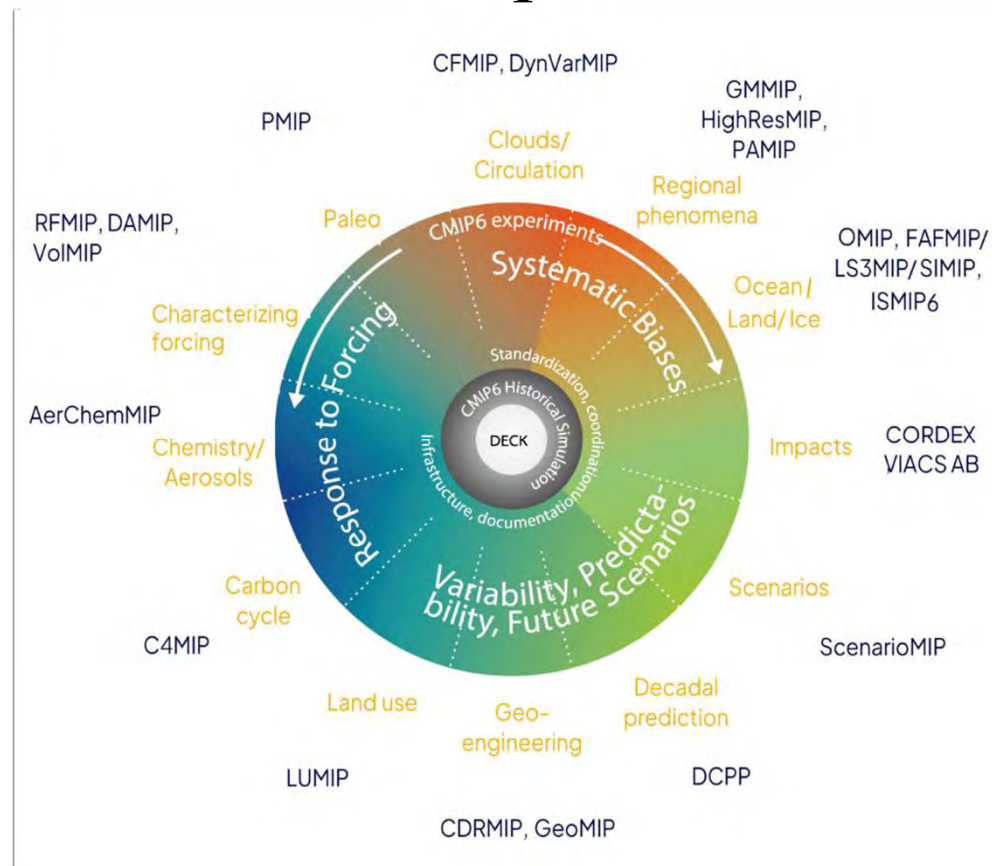


- Standardizing climate model experiments of Solar Radiation Modification



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- Standardizing climate model experiments of Solar Radiation Modification

WHY?

- Understanding sources of inter-model differences
- Offering a standardized framework of simulations for the purpose of SRM assessments
- Supporting a community of downstream users interested to understand impacts not included in climate models

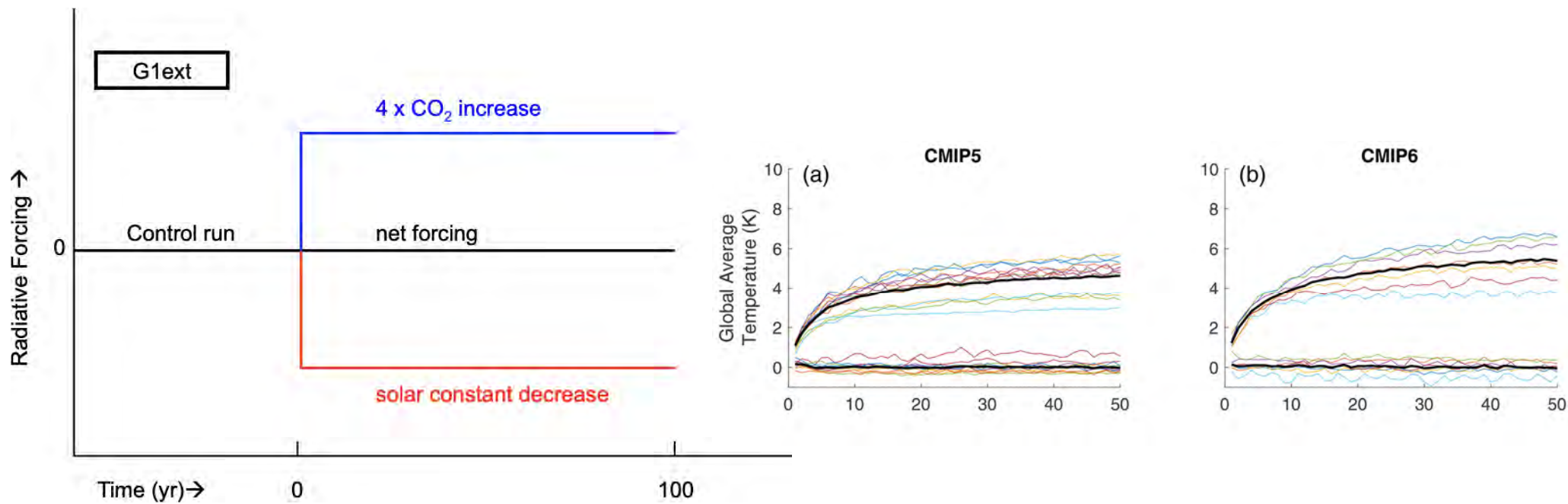


GeoMIP experiments until now

Tier 1 GeoMIP experiments

	Solar Dimming	Sulfate	Surface Albedo	Cloud brightening	
Constant Forcing	G1	G4	G1 ocean-albedo	G4cndc G4sea-salt	<ul style="list-style-type: none"> -Models' response to a step function input -Easier to set up and define across models
Time-varying Forcing	G2 G3S G6solar	G3 G6sulfur		G3-SSCE	<ul style="list-style-type: none"> -Varying level of intervention allows for exploration of emerging signal -Better-defined temporal baseline against which to compare -More "realistic" deployment scenario -May depend on models' sensitivity
	<ul style="list-style-type: none"> -Easy to replicate across models' complexities and models' versions -Comparison with more complex global methods 	<ul style="list-style-type: none"> -Models' spread in latitudinal distribution of aerosols -Contribution of aerosol perturbation to surface climate and stratosphere 	<ul style="list-style-type: none"> -Idealized representation of spatially heterogeneous methods -Comparison with more complex regional methods 	<ul style="list-style-type: none"> -Good first step in simulating other, more regional, methods -Models used might not be simulating all relevant processes happening at a lower spatial scale -Unrealistic assumptions over size of aerosols injected 	

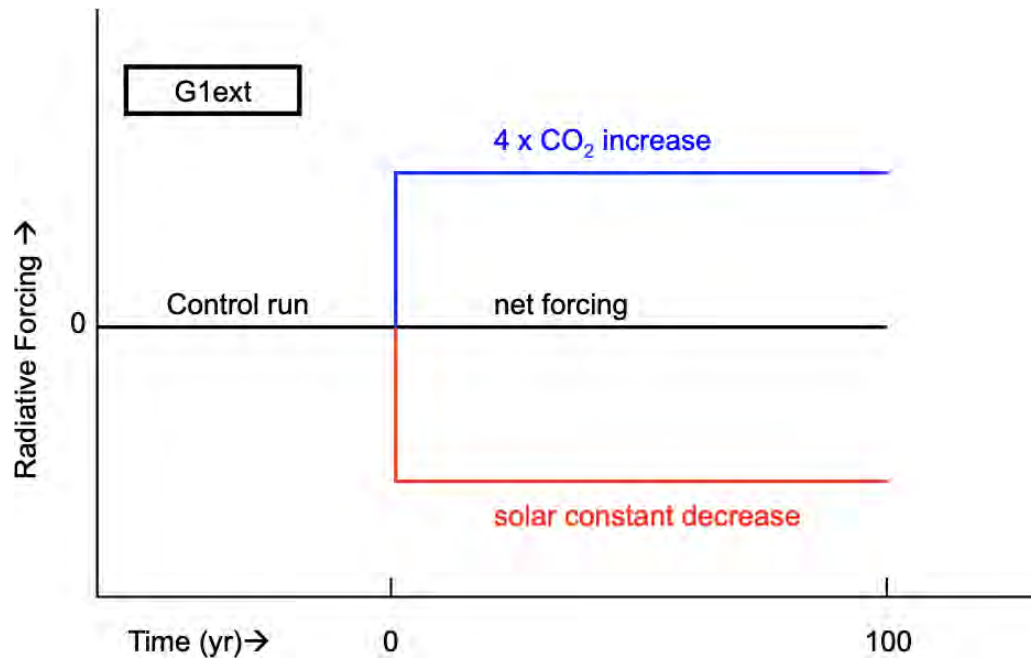
Example 1: the G1 experiment



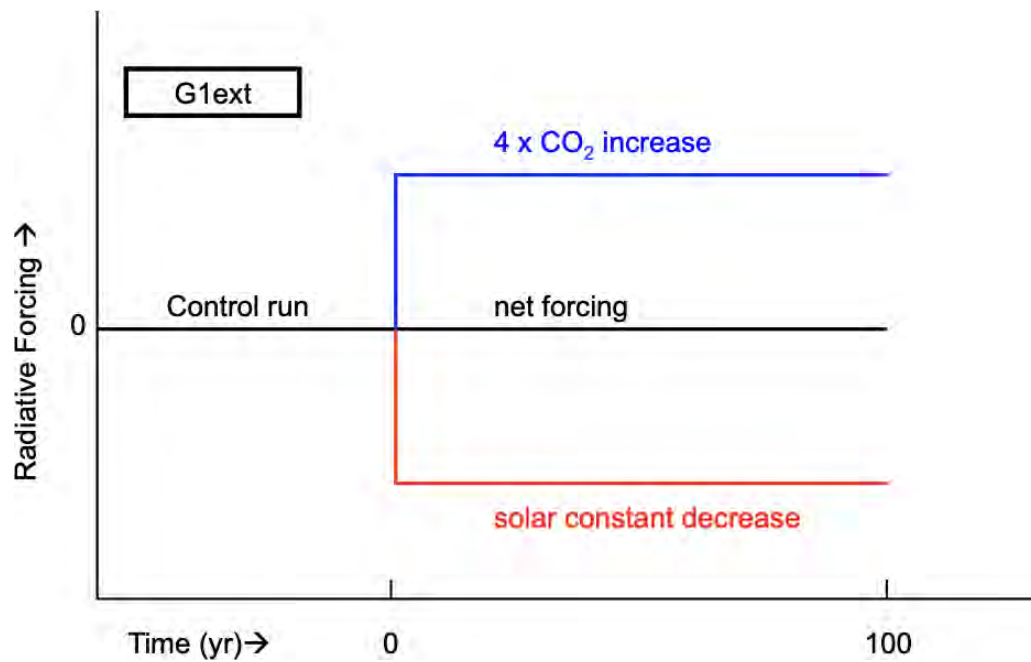
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- High signal-to-noise ratio

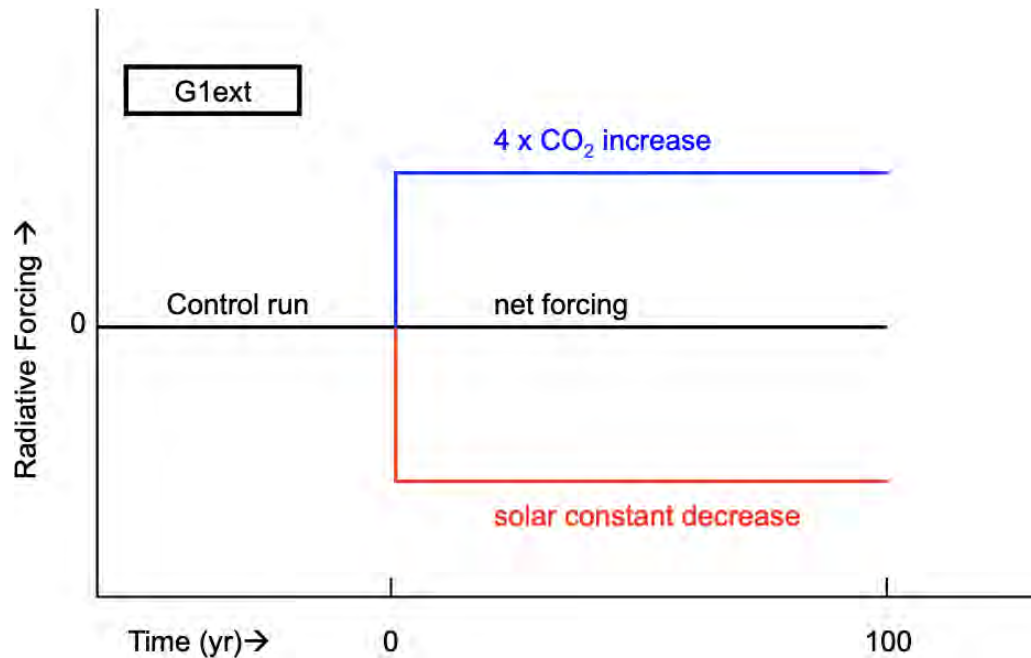


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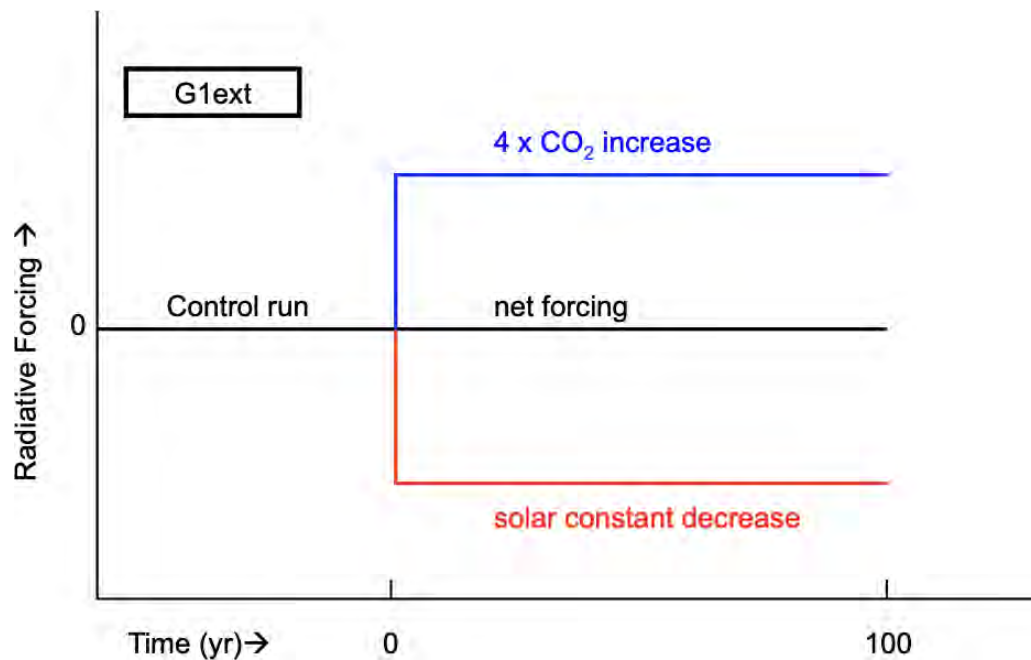
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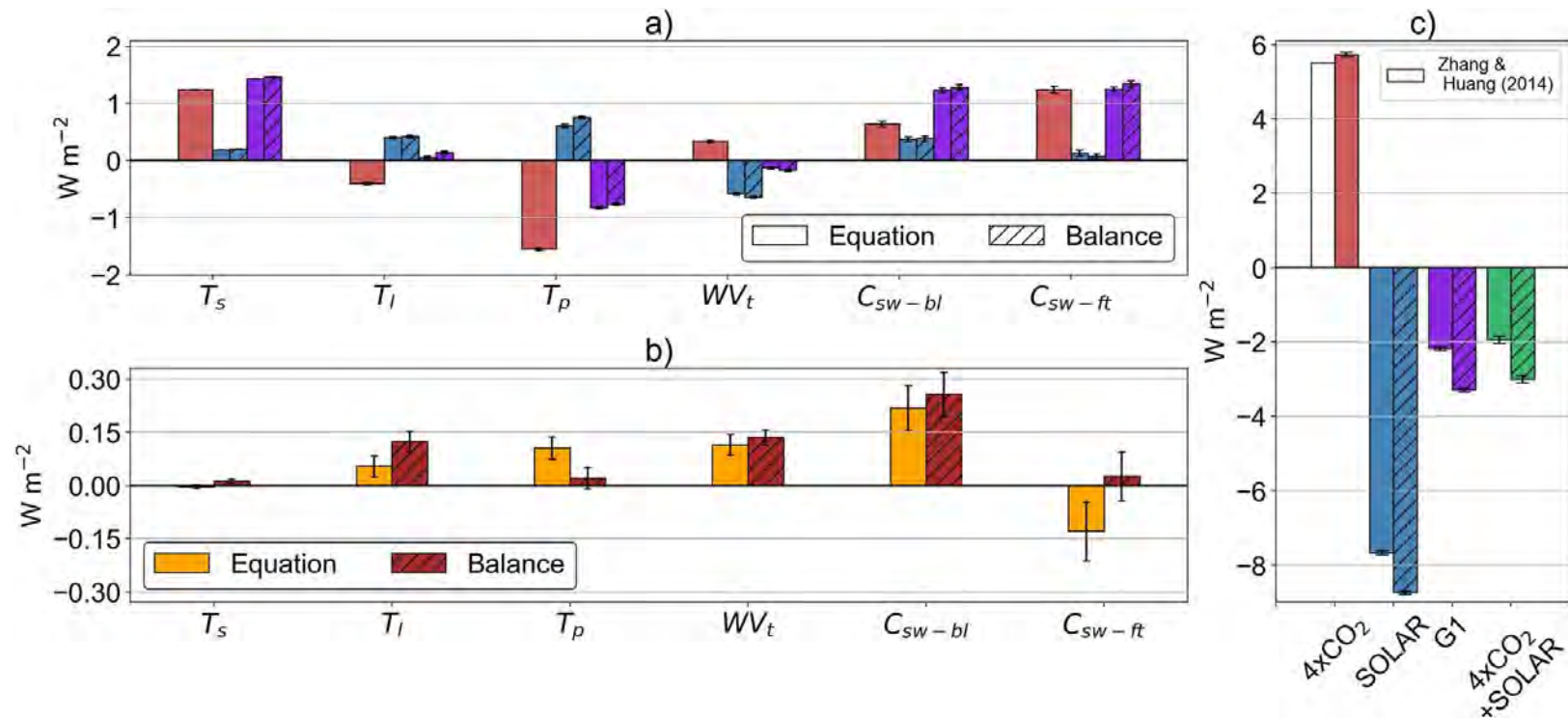
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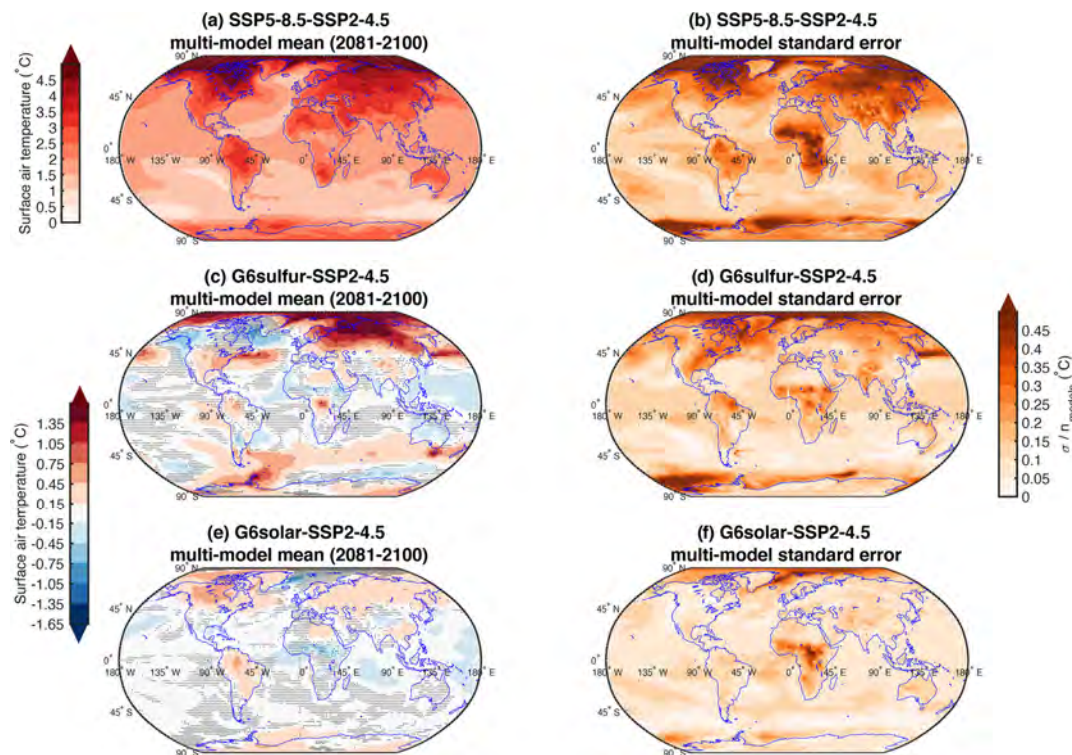
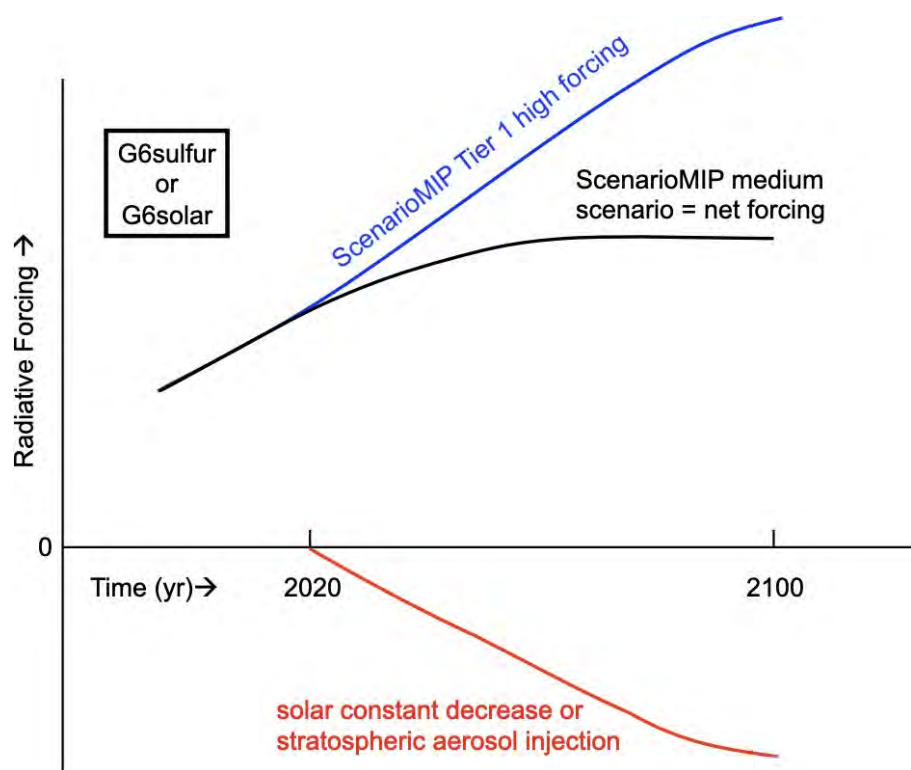
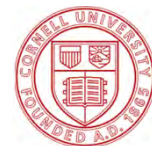
- High signal-to-noise ratio
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- Robust across model version (CMIP5 vs 6)
- Not directly useful for impacts assessment (but maybe for emulators?)

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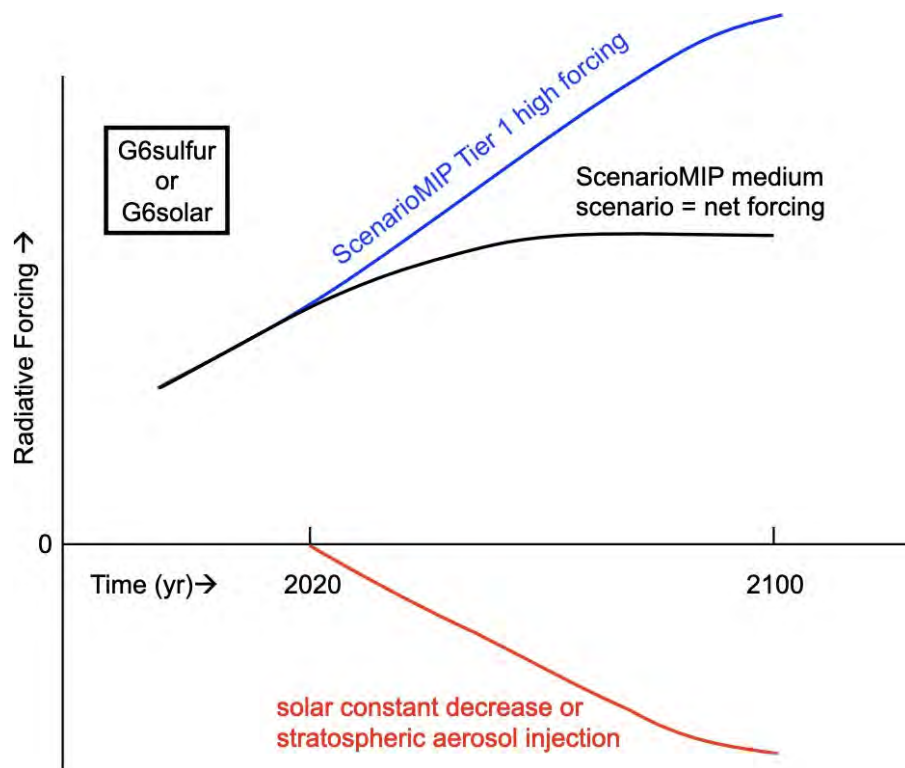


- Example of use: breaking down the radiative adjustments of G1 simulations using the International Satellite Cloud Climatology Project (ISCCP) diagnostics

Example 2: the G6 experiment

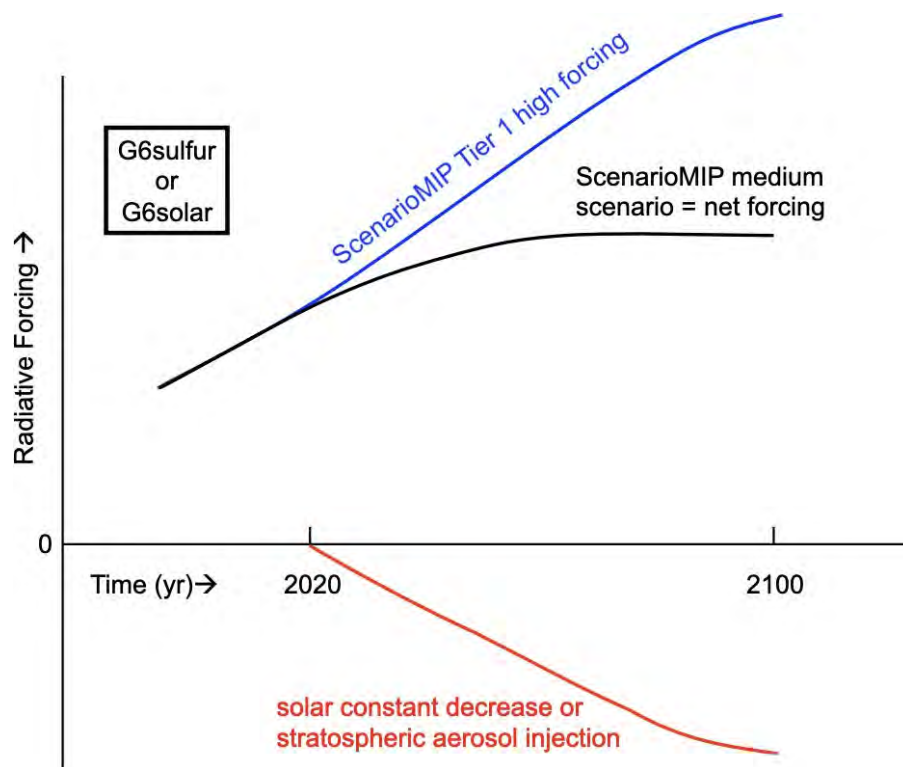


Example 2: the G6 experiment



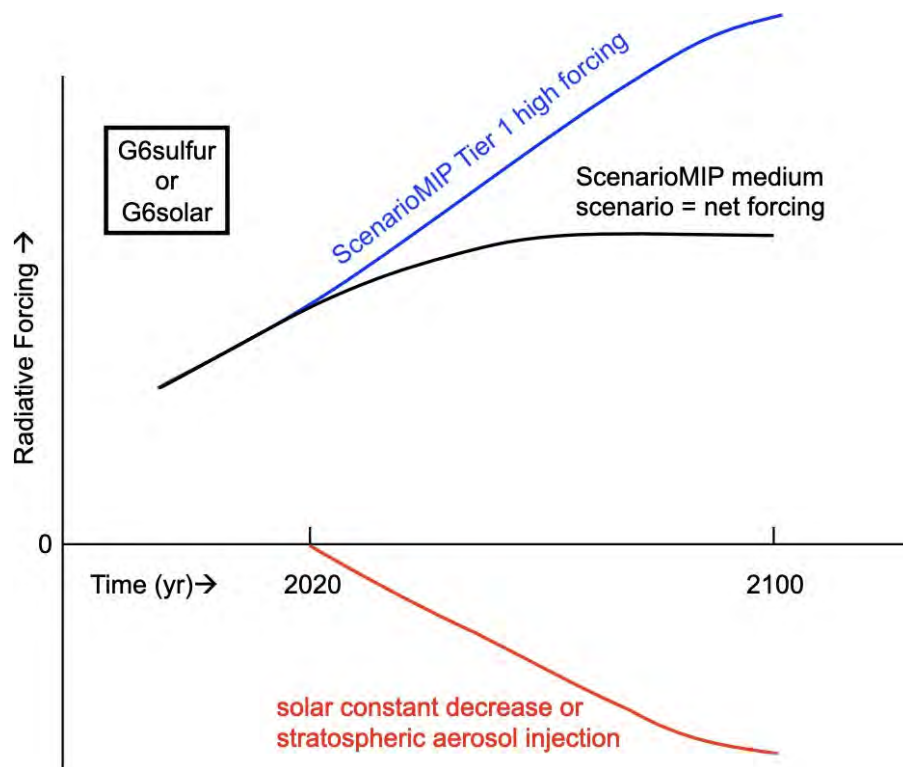
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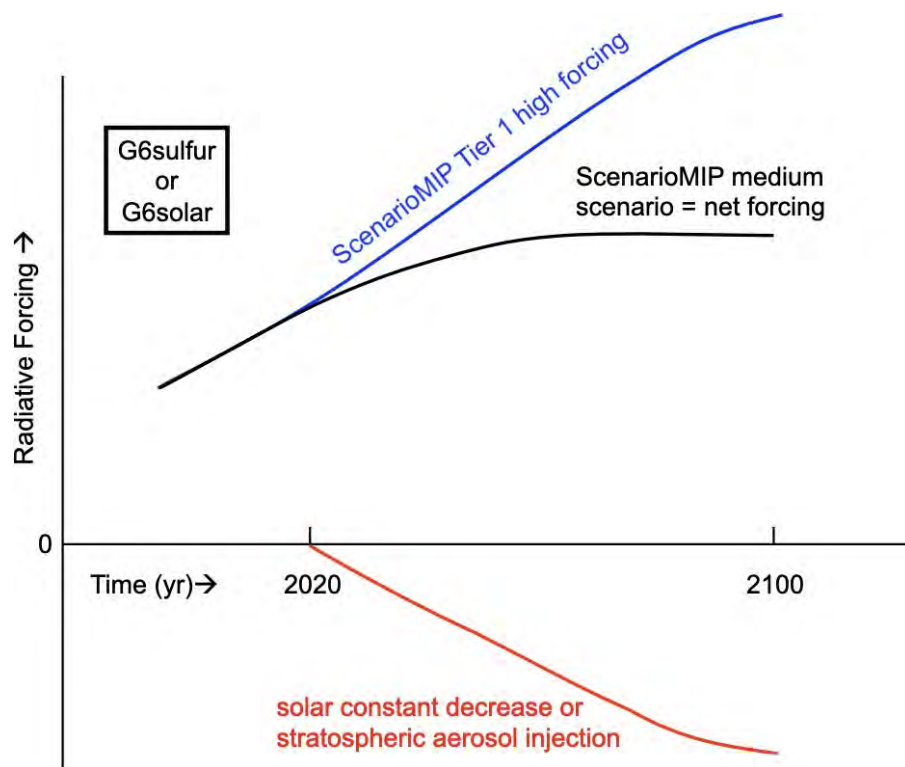
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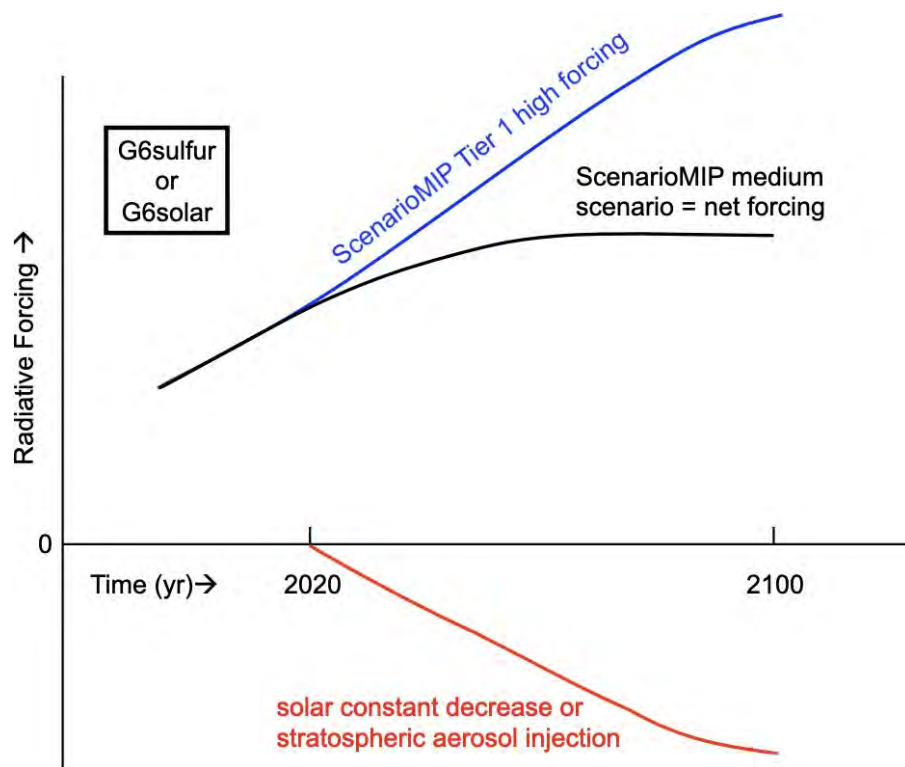
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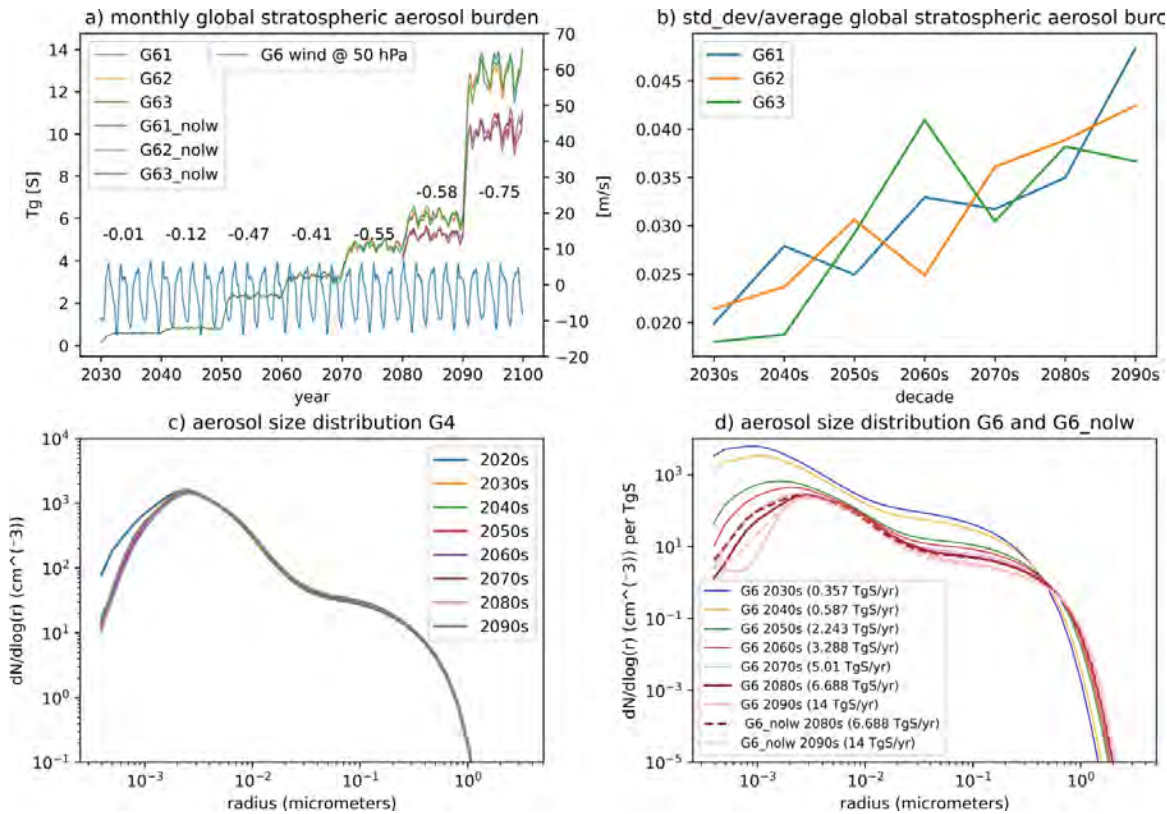
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- SSP5-8.5 :-|

Example 2: the G6 experiment



- Comparing a new model (here, SOCOL) with different aerosol microphysics to the old one, understanding aerosol response to changing injection rates,

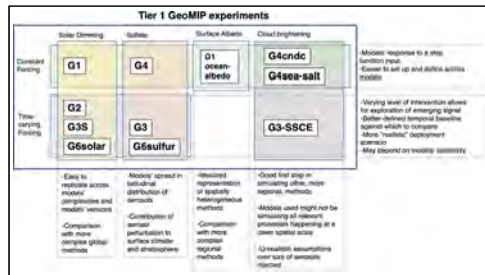


But wait – there’s more!

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Tier 1 experiments are only some of the experiments...

The community runs so many more!



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- Prescribing aerosol distribution in models without interactive chemistry/microphysics (with CCMI for WMO report)
- Isolating the role of stratospheric heating on surface climate and atmospheric dynamics (with QBOi)
- Single forcing locations for MCB experiments?

What's our endgame?



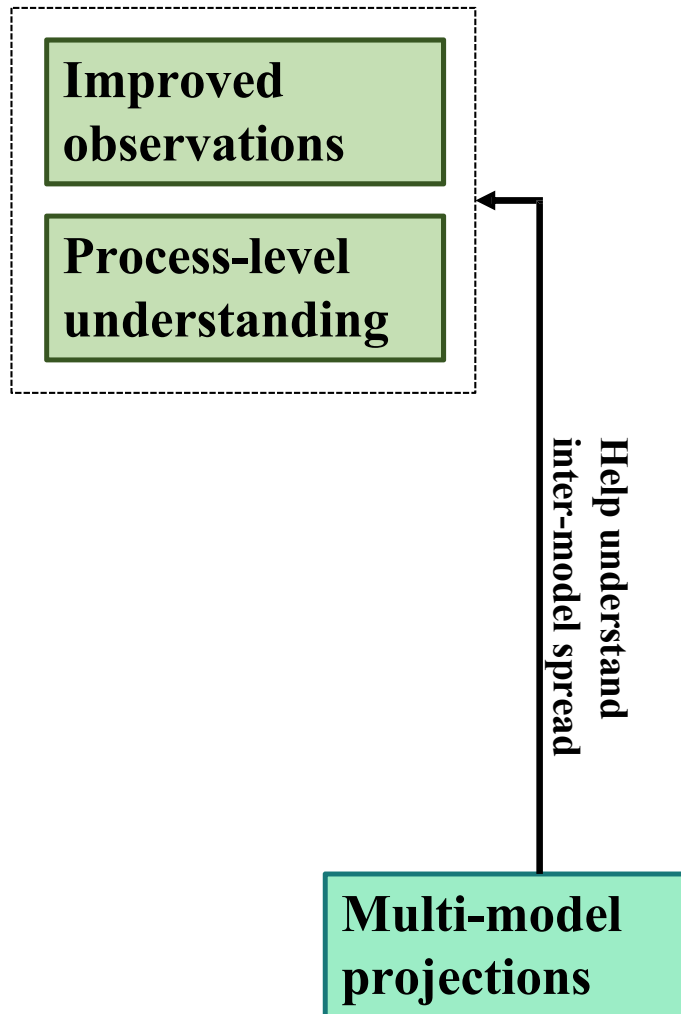
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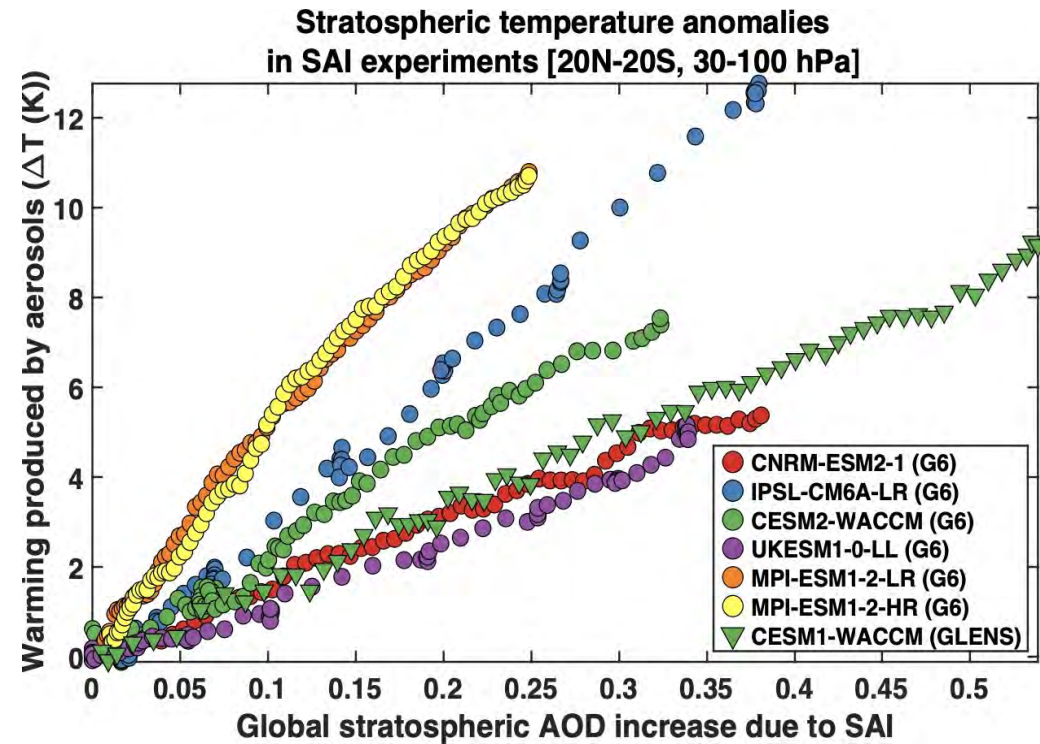
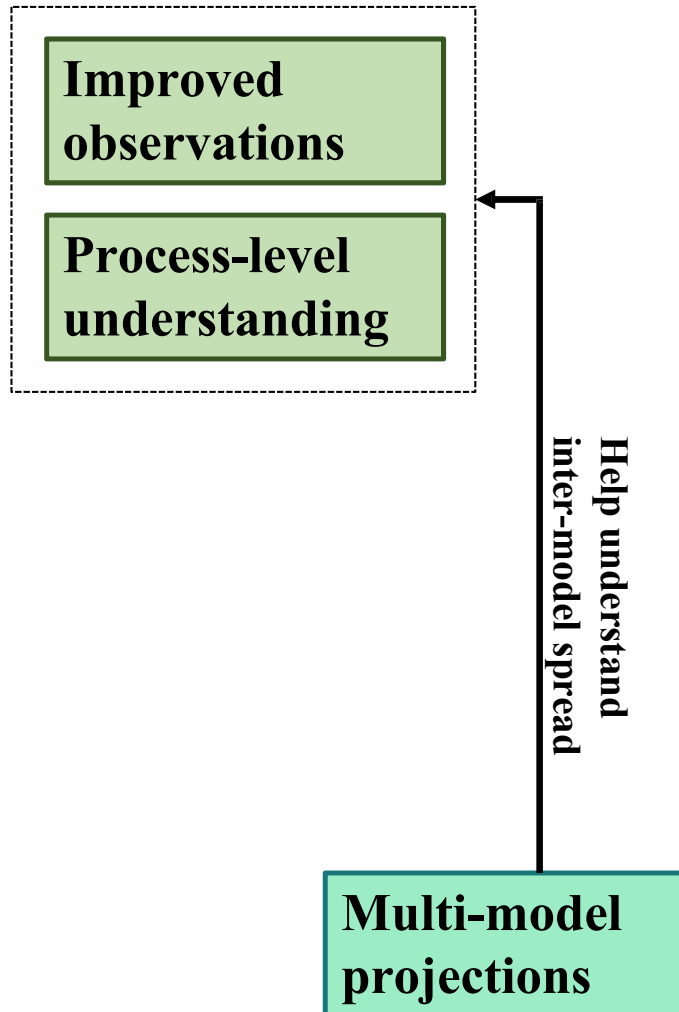
**Multi-model
projections**

(Tier 1 GeoMIP scenarios)

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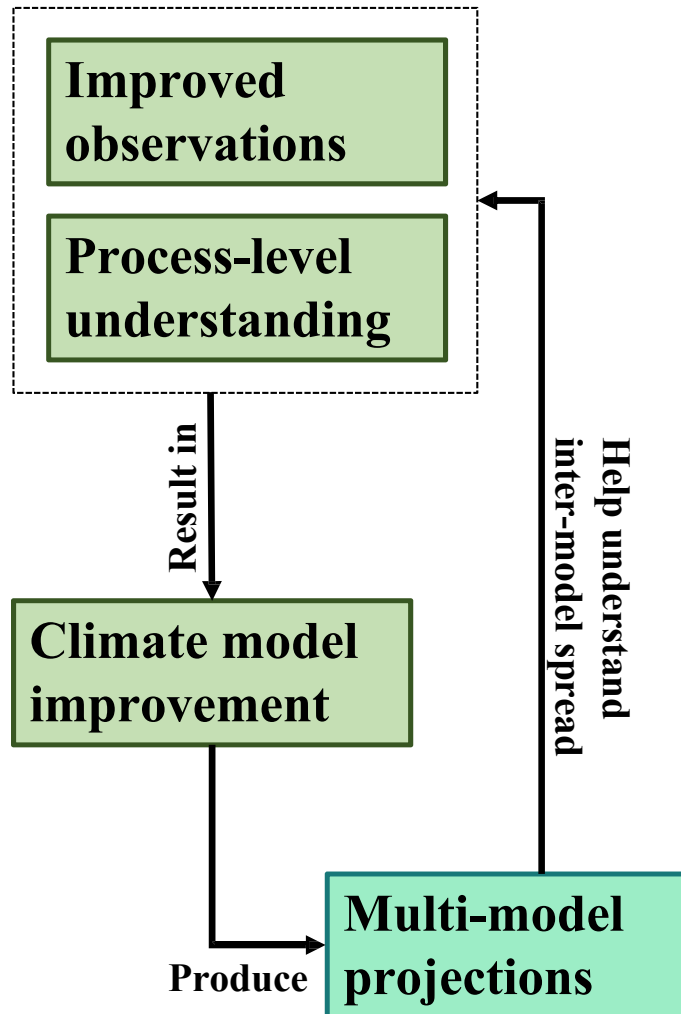
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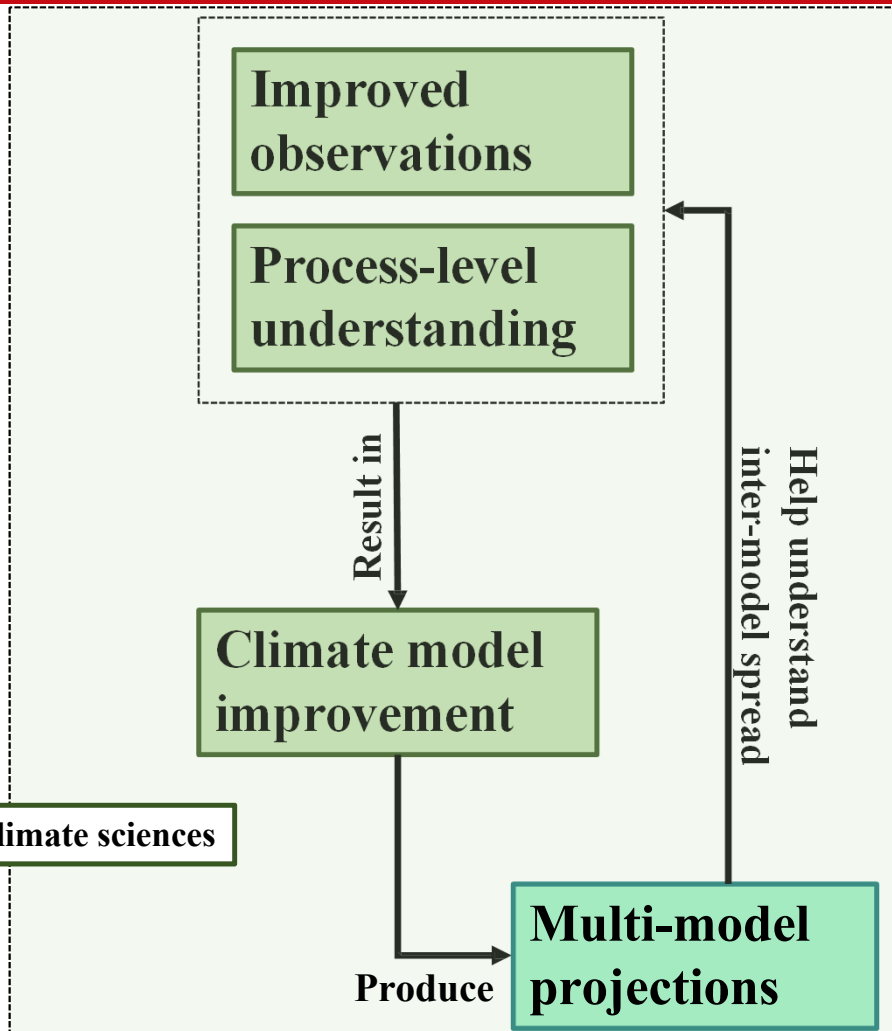
[Tilmes, Vioni et al., 2021 ACP](#)

and WMO Assessment, 2022

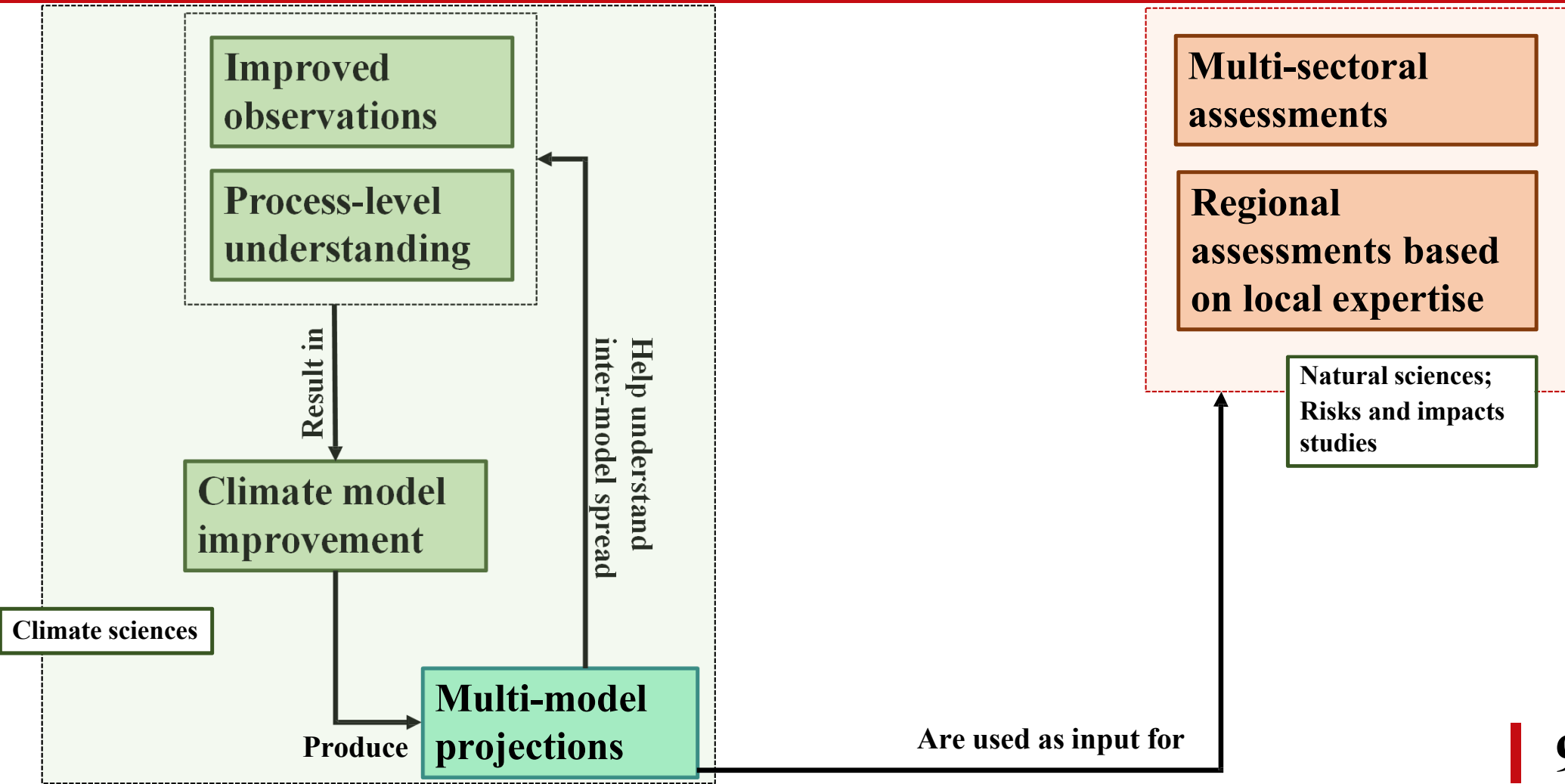
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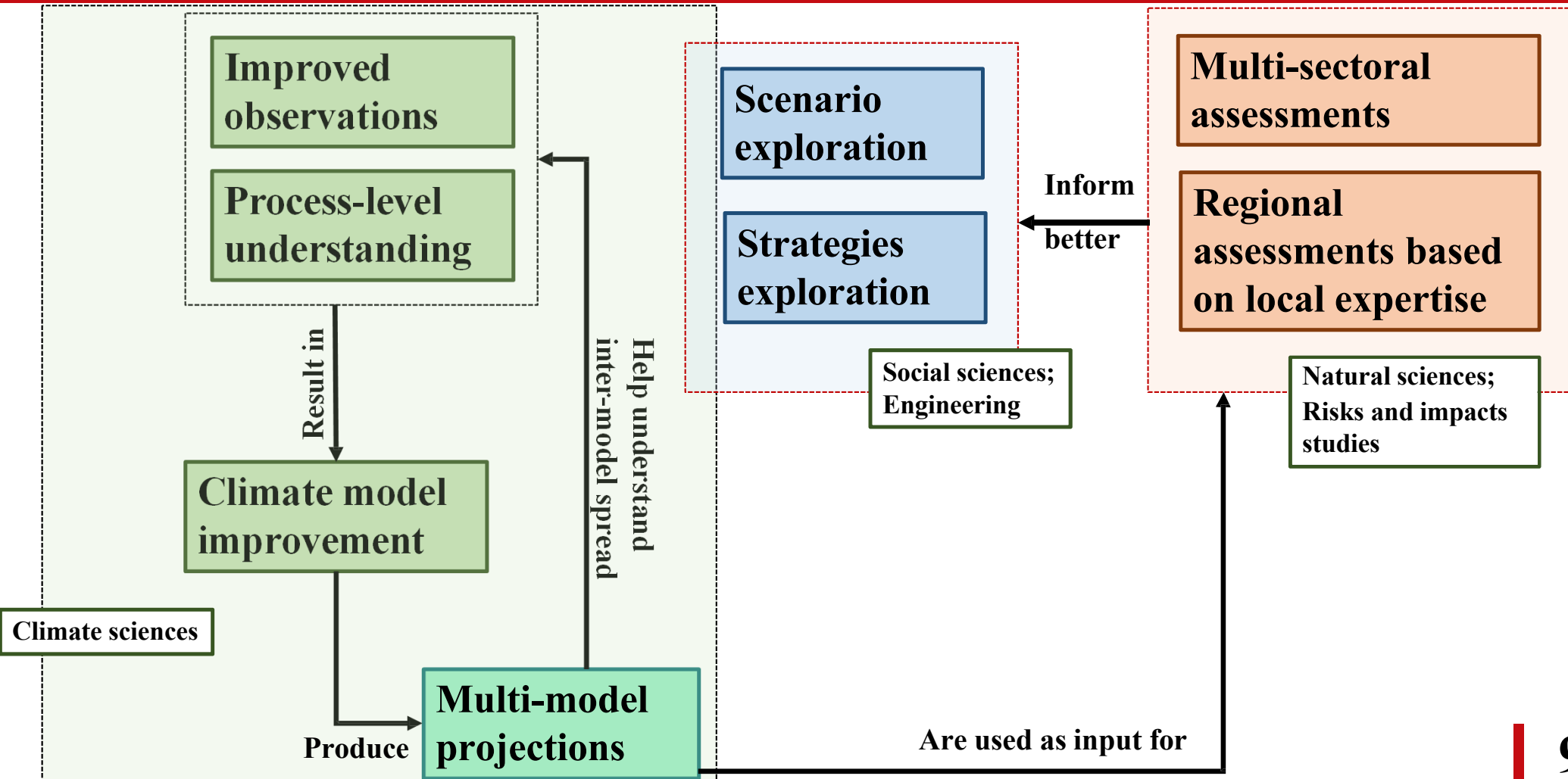
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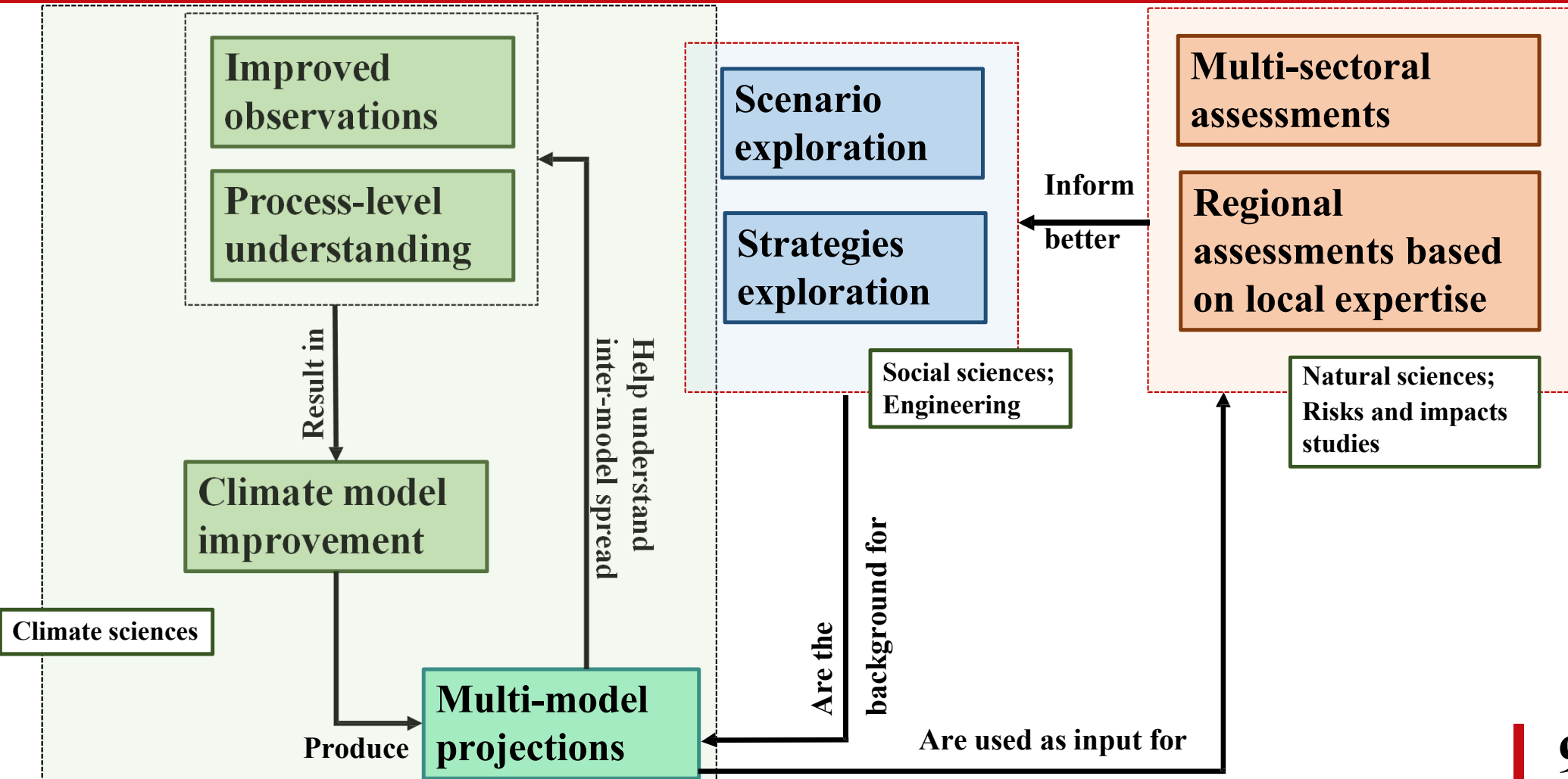
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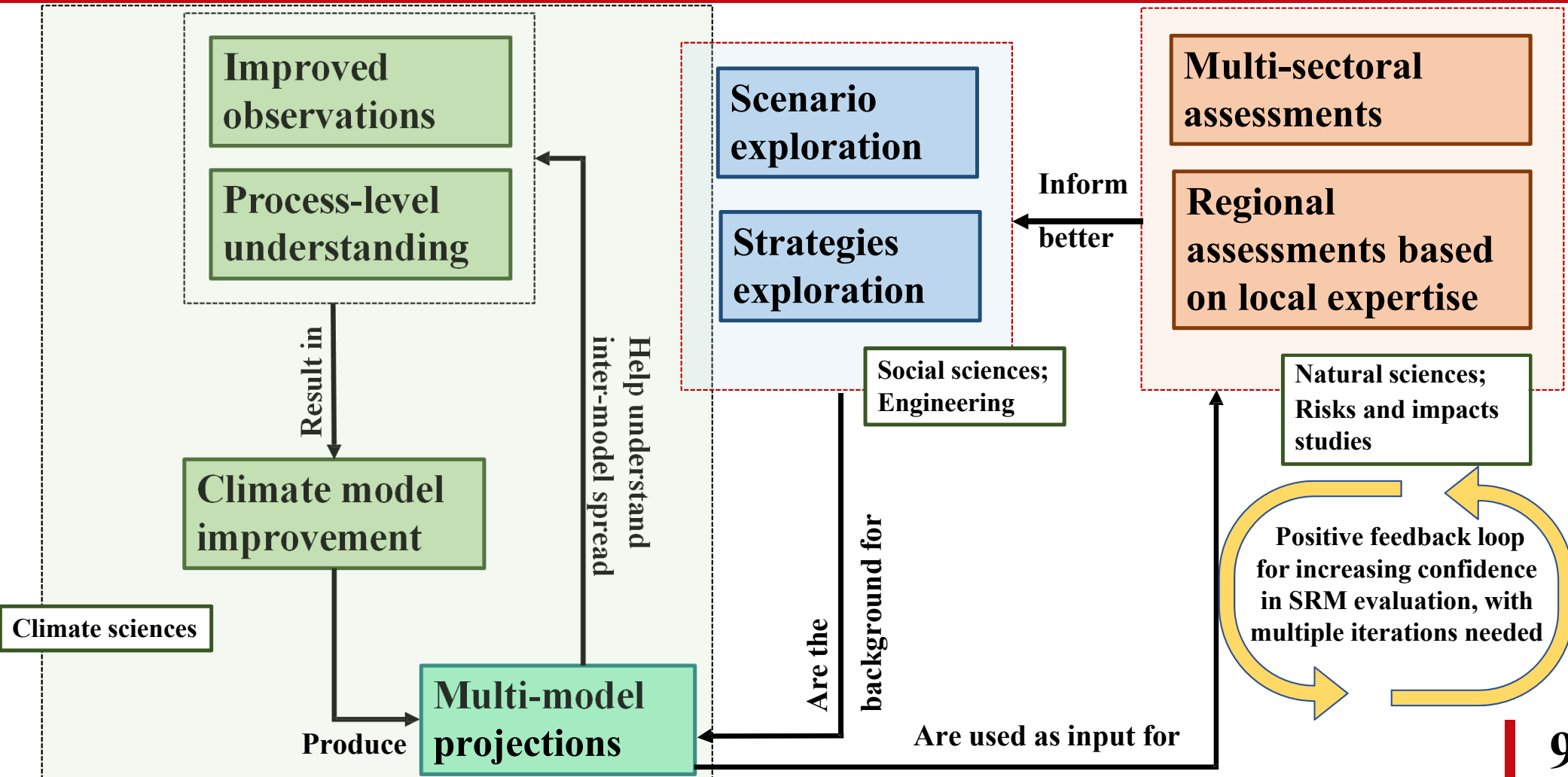


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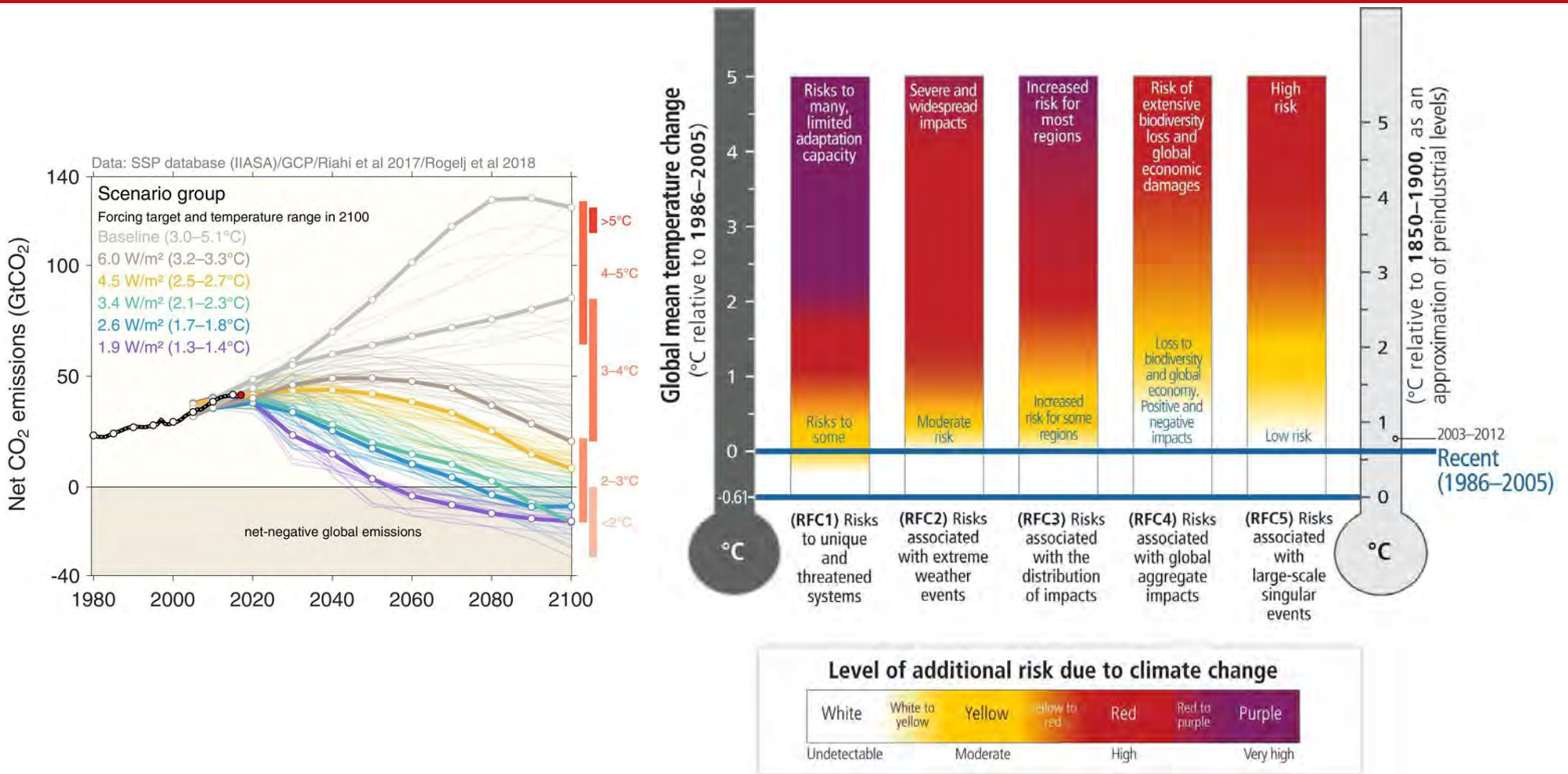


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The road so far



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- 130+ papers published using GeoMIP output; used in IPCC assessments, WMO, named in OSTP, UNEP and EC reports
- A growing community: last meeting in Exeter had over 100 participants – 70+ in person

