Geoengineering Model Intercomparison Project (GeoMIP) Update

RUTGERS School of Environmental and Biological Sciences

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To join GeoMIP and for more information, visit **http://climate.envsci.rutgers.edu/GeoMIP/**

Abstract. The Geoengineering Model Intercomparison Project (GeoMIP) was kicked off with a workshop at Rutgers University in February 2011. GeoMIP is a "CMIP Coordinated Experiment," part of the Climate Model Intercomparison Project 5 (CMIP5), and is a cooperative project to conduct standardized general circulation model experiments to examine the climate response to artificial stratospheric aerosol clouds that have been proposed to counteract global warming. Twenty-six different climate modeling groups, including 13 CMIP5 and 7 CCMVal participants, have agreed to conduct some or all of the GeoMIP model simulations. There are four GeoMIP experiments of varying complexity where the forcing by anthropogenic greenhouse gases is counteracted by reducing the solar constant or more realistic stratospheric sulfate aerosols. Participants are examining responses of the hydrological cycle, agricultural impacts, diurnal cycle changes, natural vegetation impacts, ozone responses, and many other aspects of the climate response.

As part of the ongoing Climate Model Intercomparison Project 5 (CMIP5; Taylor et al., 2008), new state-of-the-art coupled atmosphere-ocean general circulation models are conducting standard geoengineering runs, building on runs that will already be done for CMIP5. The four GeoMIP experiments (Kravitz et al., 2011) are shown in Figs. 1-4. This is a progress report, which shows the status of runs by CMIP5, CCMVal, and other climate models in the Table below. The next GeoMIP workshop will be at the Hadley Centre, Exeter, UK, March 30-31, 2012.

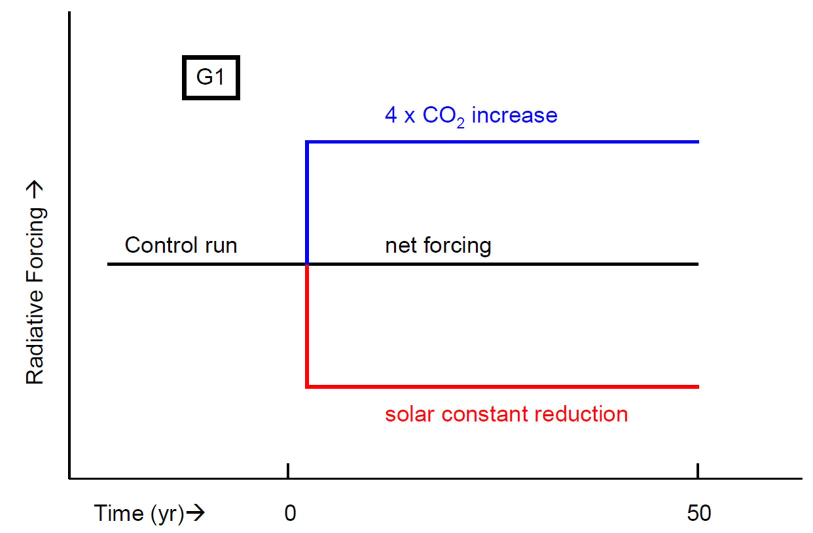

Figure 1. Schematic of experiment **G1**. The experiment is started from a control run. The instantaneous quadrupling of CO_2 concentrations from preindustrial levels is balanced by a reduction in the solar constant until year 50.

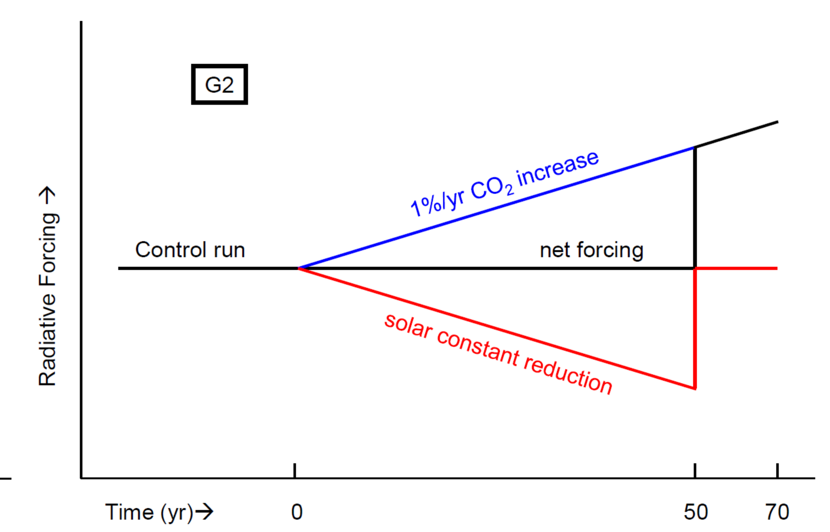

Figure 2. Schematic of experiment **G2**. The experiment is started from a control run. The positive radiative forcing of an increase in CO_2 concentrations of 1% per year is balanced by a decrease in the solar constant until year 50.

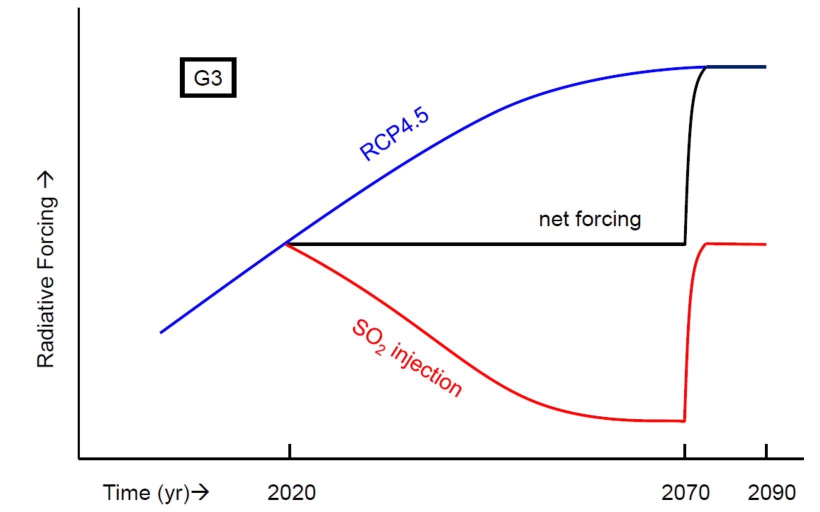

Figure 3. Schematic of experiment **G3**. The experiment approximately balances the positive radiative forcing from the RCP4.5 scenario (Moss et al., 2008) by an injection of SO_2 or sulfate aerosols into the tropical lower stratosphere. **G3 solar** uses solar radiation rather than aerosols.

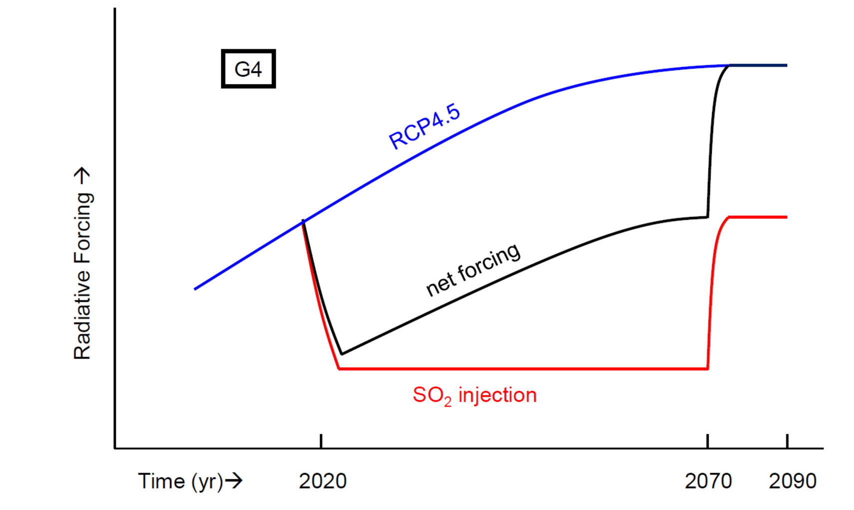

Figure 4. Schematic of experiment **G4**. This experiment is based on the RCP4.5 scenario (Moss et al., 2008), where immediate negative radiative forcing is produced by an injection of SO_2 into the tropical lower stratosphere at a rate of 5 Tg per year.

						# of ensemble members (* in progress)					
Model (CMIP5 or CCMVal participant)	**Contact**	**Atmospheric Model Resolution**	**Atmospheric Model Top**	**Oceanic Model Resolution**	**Stratospheric Aerosols**	**Ozone**	**G1**	**G2**	**G3**	**G3 solar**	**G4**
MPI-ESM (ECHAM6)	Hauke Schmidt, Ulrike Niemeier	T63L47	0.01 mb	GR15 L40	Prescribed AOD and surface area	Prescribed	1	1	3		
IPSLCM5A	Michael Schulz, Diana Bou Karam, Olivier Boucher	2.5° lat x 3.75° lon L39	0.1 mb (80 km)	2° lat X 2° lon	Prescribed AOD	Calculated	1	1	*		
GISS ModelE2	Ben Kravitz	2° lat X 2.5° lon L40	0.1 mb (80 km)	1° lat X 1.25° lon L32	Generated from SO_2 injection (Koch scheme)	Calculated	*	*	*		*
NorESM1-M	Jón Egill Kristjánsson, Kari Alterskjær	1.9° lat x 2.5° lon	42 km	~0.5° lat x ~1° lon, 1.125 degrees along the equator	Prescribed	Prescribed	1	1			
CESM-CAM5	Phil Rasch, Jin-Ho Yoon	1.9° lat x 2.5° lon L30	3.5 mb	gx1v6 (dispaced pole)	Prescribed	Prescribed	1	1	*		
CESM-CAM4 (G1, G2, G3 solar)	Simone Tilmes, Jean-Francois Lamarque	0.9° lat x 1.25° lon	42 km	~1° lat x ~1° lon	Prescribed	Prescribed	3	3		3	
CESM-CAM4 Chem (G3 solar, G3, G4)	Simone Tilmes, Jean-Francois Lamarque	1.9° lat x 2.5° lon	42 km	~1° lat x ~1° lon	Generated from SO_2 injection (bulk aerosol scheme)	Calculated				*	
CESM-WACCM4	Michael Mills	1.9° lat x 2.5° lon	5.9603E-6 hPa (~145 km)	~1° lat x ~1° lon	Prescribed from SAGE, prognostic PSC growth	Calculated					
MIROC-ESM	Michio Kawamiya, Shingo Watanabe	2.8° x 2.8° (T42)	~85 km (80 levels)	0.56° ~1.4° lat x ~1.4° lon (44 levels)	Prescribed AOD	Prescribed	1	1			1
MIROC-ESM-CHEM	Michio Kawamiya, Shingo Watanabe	2.8° x 2.8° (T42)	~85 km (80 levels)	0.56° ~1.4° lat x ~1.4° lon (44 levels)	Prescribed AOD --> sulfate SAD	Calculated					4
HadGEM2-ES	Andy Jones	1.25° lat x 1.875° lon	39.3 km	30°N-S: 1/3°, 30°-90°N/S: 1°x1°	Generated from SO_2 injection	Prescribed	1	3	3		3
CanESM2	Jason Cole, Charles Curry	~ 2.81° x 2.81° (T63)	~1 hPa (35 layers)	0.94° lat x 1.4° lon	Prescribed	Prescribed	3	3			3
CMCC-CMS	Chiara Cagnazzo	~1.8° x 1.8° (T63)	0.01 hPa (95 levels)	average 2° lat X 2° lon (31 levels)	Prescribed SO_2 or AOD	Prescribed					
UMUKCA (future HadGEM3-ES)	Peter Braesicke, Luke Abraham	2.5° lat x 3.75° lon (N48) L60	~84 km (60 levels)	~2° L31	Prescribed	Calculated	*	*			
CCSRNIES / MIROC3.2	Hideharu Akiyoshi	T42	0.012 mb		Prescribed	Calculated					1
EMAC2 (DLR)	Martin Dameris, Patrick Jöckel, Veronika Eyring	T42L90MA	0.01 mb		Prescribed	Calculated					
LMDzrepro	Slimane Bekki/Marchand	2.5° lat x 3.75° lon)	0.07 mb		Prescribed	Calculated					
SOCOL	Eugene Rozanov	T30	0.01 mb		Prescribed	Calculated					
ULAQ	Pitari	R6 / 11.5° lat x 22.5° lon)	0.04 mb		Prescribed	Calculated					
UMSLIMCAT	Martin Chipperfield	2.5° lat x 3.75° lon	0.01 mb		Prescribed	Calculated					
EMAC (ECHAM5/MESSy)	Mark Lawrence	ca. 2.8° X 2.8° (T42)	~80 km (1 Pa), 90 levels		Generated from SO_2 injection	Calculated					
HadCM3	Peter Irvine	2.5° lat X 3.75° lon L19	5 mb (28 km)	1.25° lat X 1.875° Lon L20	Prescribed SO_2 or AOD	Fixed	1	1			
HadCM3 [27-member perturbed physics ensemble]	Peter Irvine	2.5° lat X 3.75° lon L19	5 mb (28 km)	1.25° lat X 1.875° Lon L20	Prescribed SO_2 or AOD	Fixed	*	*			
IAPRASCM	Alexander Chernokulsky	4.5° lat X 6° lon L8	80 km	4.5° lat X 6° lon L3	Prescribed lifetime	Prescribed					
GCCESM	John Moore	2.8° x 2.8° (T42)	42 km	200 lat x 360 lon, 30°-90°N/S: 1°x1°	Prescribed	Prescribed					
CSIRO Mk3L	Andrew Lenton	5.6° x 3.2° (R21)	36 km (18 levels)	1.6° lat x 2.8° lon (21 levels)	Perscribed	Prescribed					

References

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Acknowledgments

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