SWNG2 models

June 7, 2011

1 General information

- horizontal resolution given as the number of grid points in latitude × number of grid points in longitude.
- vertical resolution given as the number of vertical levels.

GCM	isotopic reference	contacts	non-isotopic reference
GISS modelE	[SLH07]	Gavin Schmidt, Allegra Legrande	[Sca06]
ECHAM4	[HWH98]	Martin Werner	[Mod94]
LMDZ4	[RBVJ10]	Camille Risi, Sandrine Bony	[HMB+06]
GSM	[YKNO08]	Kei Yoshimura	[Kca02]
CAM2	[LFDF07]	Jeun-Eung Lee	[CHB+02]
HadAm	[TVS09]	Julia Tindall	[PGRS00]
HadCM	[TVS09]	Julia Tindall	[PGRS00]
MIROC	[KNS+]	Naoyuki Kurita	[NTNS97]
GENESIS	[MPC+02]	Renaud Matthieu	[TP95]

2 Experimental set-up

- horizontal resolution given as the number of grid points in latitude × number of grid points in longitude.
- vertical resolution given as the number of vertical levels.

GCM	SST forcing	nudging	horizontal resolution	vertical resolution	time period
GISS modelE		free or nudged (u,v) by NCEP	46 × 72	20	1965-2004
ECHAM4		free or nudged (u,v) by NCEP or ECMWF	64× 128	19	1956-2001
LMDZ4	AMIP2	free or nudged (u,v) by ECMWF	72× 96	19	1979-2007
GSM		nudged (u,v,T) by NCEP	73× 144	17	1979-2007
CAM2		free	64× 128	26	1958-2007
HadAM		free	73× 96	17	1958-2003
HadCM	coupled model	free	73× 96	17	1981-2000
MIROC		free	64× 128	20	12-37
GENESIS		free	96× 192	18	1981-1999

- Common period: 1981-1999

3 Representation of the dynamics and physics

GCM	grid point/spectral	advection	convection	land surface model	soil model	snow model
GISS modelE	spectral		Tiedke ([Tie89]) modified by Nordeng ([Nor04])	GISS LSM ([ARC88])	6 layers	3 layers
ECHAM4	spectral			bucket	1 layer	1 layer
LMDZ4	grid point	upstream	Emanuel ([Ema91, EZ99]) modified by Grandpeix	bucket	1 layer	1 layer
GSM	grid point		Relaxed Arakawa-Shubert deep convection scheme ([MS92])	bucket	1 layer	
CAM2	spectral		Zang and McFarlane ([ZM95])	bucket	1 layer	
HadAm	grid point	fourth-order horizontal advection	[GR90] with convective downdrafts	MOSES2 ([CBB+99])	4 layers	
HadCM	grid point	fourth-order horizontal advection	[GR90] with convective downdrafts	MOSES2 ([CBB+99])	4 layers	
MIROC	spectral		Arakawa-Shubert ([AS74])			
GENESIS	spectral			GENESIS	several	

4 Isotopic representation

- The standard isotopic ratio R_D is defined so that $\delta D = (q_{HDO}/q_{H_2O}/R_D - 1) \cdot 1000$ where q_{HDO} and q_{H_2O} are the specific humidity and its isotopic equivalent. We note $R_{SMOW,D} = 155.76 \cdot 10^{-6}$.
- The standard isotopic ratio $R_{^{18}O}$ is defined so that $\delta^{18}O = \left(q_{H_2^{18}O}/q_{H_2O}/R_{^{18}O} - 1\right) \cdot 1000$ where $q_{H_2^{18}O}$ and q_{H_2O} are the specific humidity and its isotopic equivalent. We note $R_{SMOW,^{18}O} = 2005.2 \cdot 10^{-6}$.
- We call ECHAM-like equilibration the representation of isotopic fractionation during rain fall in which 45% of the rain drops reequilibrate in convective clouds and 95% of the rain drops reequilibrate in large-scale clouds.
- h_{eff} is the relative humidity used for calculating the fractionation during rain reevaporation.
- The supersaturation parameter λ is such that superstauration $S = 1 - \lambda \cdot T$.

GCM	R_D	$R_{^{18}O}$	fractionation during rain reevaporation	fractionation during land surface evaporation	diffusivity coefficients	λ
GISS modelE	2*$R_{SMOW,D}$ *19/18	$R_{SMOW,^{18}O}$ *20/18	[Ste75], ECHAM-like equilibration	Yes ([AS06])	[MJ79]	0.004
ECHAM4	$R_{SMOW,D}$	$R_{SMOW,^{18}O}$	first order for precipitation, ECHAM-like equilibration	none	[MJ79]	0.003
LMDZ4	$R_{SMOW,D}$	$R_{SMOW,^{18}O}$	[Ste75]+ second order for vapor; $h_{eff} = 0.9 + 0.1 \cdot h$	none	[MJ79]	0.004
GSM	1	1	[Ste75]	none	[MJ79]	0.003
CAM2	2*$R_{SMOW,D}$ *19/18	$R_{SMOW,^{18}O}$ *20/18	[Ste75], reequilibration function of temperature and precipitation rate and rain drop size distribution ([LF08]), $h_{eff} = min(h + 0.5, 1)$	none	[MJ79]	0.004
HadAM	$R_{SMOW,D}$	$R_{SMOW,^{18}O}$	first order for precipitation, ECHAM-like equilibration, $h_{eff} = 0.75 + 0.25 \cdot h$	none	[CHDC03]	0.005
HadCM	$R_{SMOW,D}$	$R_{SMOW,^{18}O}$	first order for precipitation, ECHAM-like equilibration, $h_{eff} = 0.75 + 0.25 \cdot h$	none	[CHDC03]	0.005
MIROC	1	1	first order for precipitation, ECHAM-like equilibration with 50% reequilibration for convective clouds	none	[MJ79]	0.003
GENESIS	$R_{SMOW,D}$ *19/18?	$R_{SMOW,^{18}O}$ *20/18?	[Ste75], ECHAM-like equilibration, $h_{eff} = a + b \cdot h$	none	[MJ79]	

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