Model Information of Potential Use to the IPCC Lead Authors and the AR4

BCC-CM1

20 December, 2005

I. Model identity:

A. Institution, sponsoring agency, country

Beijing Climate Center, National Climate Center, China Meteorological Administration, No.46, S.Road, Zhongguancun Str., Beijing 100081, China

B. Model name (and names of component atmospheric, ocean, sea ice, etc. models)

Name of the coupled GCM: BCC-CM1
Name of AGCM: BCC T63
Name of OGCM: IAP T63
Name of sea ice model: thermodynamic
Name of land model: NCC/BATS/Sun snow

C. Vintage (i.e., year that model version was first used in a published application)

2000

D. General published references and web pages

Ding, Yihui, Yunqi Ni, Xuehong Zhang, Weijing Li, Min Dong, Zong-Ci Zhao, Zechun Li, Wenhai Shen eds., 2000, Introduction to the short-term climate prediction model system, China Meteorological Press, Beijing, China, 500pp in Chinese;

Climate System Modeling Division (CSMD), 2005, An introduction to The Fist-generation Operational Climate Model at National Climate Center, Advances in Climate System Modeling, 1, 14pp, in both Chinese and English;

http://ncc.cma.gov.cn/english

E. References that document changes over the last ~5 years (i.e., since the IPCC TAR) in the coupled model or its components. We are specifically looking for references that document changes in some aspect(s) of model performance.

Dong, M. ed., 2001, Introduction to National Climate Center Atmospheric general Circulation Model documentation – basic principles and applications, China Meteorological Press, 152pp, in Chinese

Ding, Yihui, Ying Xu, Zong-Ci Zhao, Yong Luo and Xuejie Gao, 2004, Climate change scenarios over east Asia and China in the future 100 years, Climate Change Newsletter 2003/2004, 2-4, in English;

Climate System Modeling Division (CSMD), 2005, An introduction to The Fist-generation Operational Climate Model at National Climate Center, Advances in Climate System Modeling, 1, 14pp, in both Chinese and English;

F. IPCC model version's global climate sensitivity ($KW^{-1}m^{2}$) to increase in CO_2 and how it was determined (slab ocean expt., transient expt--Gregory method, ±2K Cess expt., etc.)

G. Contacts (name and email addresses), as appropriate, for:
   1. coupled model (Dr. Ying Xu, xuying@cma.gov.cn)
   2. atmosphere (Dr. Ying Xu, xuying@cma.gov.cn)
   3. ocean (Dr. Yongqiang Yu, yyq@lasg.iap.ac.cn)
   4. sea ice (Dr. Ying Xu, xuying@cma.gov.cn)
   5. land surface (Dr. Yong Luo, yluo@cma.gov.cn)
   6. vegetation (Dr. Xuejie Gao, gaox@cma.gov.cn)
   7. other?

II. Besides atmosphere, ocean, sea ice, and prescription of land/vegetated surface, what can be included (interactively) and was it active in the model version that produced output stored in the PCMDI database?

A. atmospheric chemistry? *No.*

B. interactive biogeochemistry? *No.*

C. what aerosols and are indirect effects modeled? *Sulfate aerosols.*

D. dynamic vegetation? *No.*

E. ice-sheets? *No.*

III. List the community based projects (e.g., AMIP, C4MIP, PMIP, PILPS, etc.) that your modeling group has participated in and indicate if your model results from each project should carry over to the current (IPCC) version of your model in the PCMDI database.

Coupled GCM: CMIP2, 20C3M
AGCM: EAMIP

IV. Component model characteristics (of current IPCC model version):

A. Atmosphere *(Dong, M. ed., 2001, Introduction to National Climate Center Atmospheric general Circulation Model documentation – basic principles and applications, China Meteorological Press, 152pp, in Chinese)*

1. resolution:

   T63 (1.875lon x 1.875lat), L16

2. numerical scheme/grid (advective and time-stepping schemes; model top; vertical coordinate and number of layers above 200 hPa and below 850 hPa)

   model top at 25hPa, hybrid P-σ coordinates (E-ta), There are 8 layers above 200hPa and 3 layers below 850hPa. reference-atmospheric scheme, mass-

conservation scheme, improved semi-Lagrange method, Morcrette Scheme and k-distributive parameterization scheme, Gregory mass flux scheme, finite difference method, a semi-implicit time-stepping scheme

3. list of prognostic variables (be sure to include, as appropriate, liquid water, chemical species, ice, etc.). Model output variable names are not needed, just a generic descriptive name (e.g., temperature, northward and eastward wind components, etc.)

   Temperature, northward and eastward wind components, surface pressure, specific humidity, ice water, liquid water

4. name, terse descriptions, and references (journal articles, web pages) for all major parameterizations. Include, as appropriate, descriptions of:
   a. clouds

   NEW-ECMWF (Simpson, JAS, 1971, 449-455; Morcrette, JGR, 1991, 96, D5, 9121-9132; Shen et al., 2000; Sang, 2000; Dong and Ping, 2001)

   b. Convection

   Improved Gregory scheme (Gregory and Rowntree, 1990, MWR, July; Ping et al., 2000)

   c. boundary layer

   boundary layer (Sang, 2000), snow (Sun and Jin, 2000)

   d. SW, LW radiation

   NEW/ECMWF1989 (Morcrette, JGR, 1991, 96, D5, 9121-9132; Shen et al., 2000)

   e. Any special handling of wind and temperature at top of model

   The vertical velocity is set to be zero at top of model.

B. Ocean *(Zhang et al., 2000, Introduction to Oceanic General Circulation Model Technic Report, 120pp, in Chinese; Zhang, X.-H., G.Y.Shi, H.Liu, and Y.Q.Yu, 2000, IAP* Global Ocean-Atmosphere-Land System Model, Beijing, Science Press, in English)

1. resolution

   L30, 1.875oX1.875o

2. numerical scheme/grid, including advection scheme, time-stepping scheme, vertical coordinate, free surface or rigid lid, virtual salt flux or freshwater flux

   Uniform longitude-latitude grid without shift poles.
   Leap-frog time integration scheme.

Free surface.
Eta vertical coordinate.
Freshwater flux.

3. list of prognostic variables and tracers

   Sea surface height, temperature, salinity, horizontal velocity

4. name, terse descriptions, and references (journal articles, web pages) for all parameterizations. Include, as appropriate, descriptions of:
   a. eddy parameterization
   GM90 scheme from MOM2 (Gent, P.R., McWilliams, J.C., 1990. Isopycnal mixing in ocean circulation models. Journal of Physical Oceanography, 20, 150-155.)
   b. bottom boundary layer treatment and/or sill overflow treatment
   No
   c. mixed-layer treatment
   PP scheme within 30S-30N (Pacanowski, R.C., Philander, G., 1981. Parametrization of vertical mixing in numerical models of the tropical ocean. Journal of Physical Oceanography 11, 1442-1451.)
   vertical mixing is treated as a constant outside the tropic area.
   d. sunlight penetration
   MOM2's method described by Rosati, A and K., Miyakoda(1988, J. Phys. Oceanogr., 18, 1601-1626.)
   e. tidal mixing
   No
   f. river mouth mixing
   No
   g. mixing isolated seas with the ocean
   No
   h. treatment of North Pole "singularity" (filtering, pole rotation, artificial island?)
   Filtering with a artificial island at the polar.

C. sea ice
   thermodynamic sea ice
1. horizontal resolution, number of layers, number of thickness categories

2. numerical scheme/grid, including advection scheme, time-stepping scheme,
3. list of prognostic variables
4. completeness
5. treatment of salinity in ice
6. brine rejection treatment

7. treatment of the North Pole "singularity" (filtering, pole rotation, artificial island?)

D. land / ice sheets (some of the following may be omitted if information is clearly included in cited references. *(Sun and Jin, 2000; Dong, M. ed., 2001, Introduction to National Climate Center Atmospheric general Circulation Model documentation – basic principles* *and applications, China Meteorological Press, 152pp, in Chinese; CSMD, 2005 in both English and Chinese)*

1. resolution (tiling?), number of layers for heat and water
2. treatment of frozen soil and permafrost
3. treatment of surface runoff and river routing scheme
4. treatment of snow cover on land
5. description of water storage model and drainage
6. surface albedo scheme
7. vegetation treatment (canopy?)
8. list of prognostic variables
9. ice sheet characteristics (How are snow cover, ice melting, ice accumulation, ice dynamics handled? How are the heat and water fluxes handled when the ice sheet is melting?)

E. coupling details *(Zhang et al., 2000, Introduction to Oceanic General Circulation Model Technic Report, 120pp, in Chinese)*

1. frequency of coupling

One day for oceanic model and one hour for atmospheric, land and sea ice models.

2. Are heat and water conserved by coupling scheme?

No.

3. list of variables passed between components:
   a. atmosphere – ocean
   b. atmosphere – land
   c. land – ocean
   d. sea ice – ocean
   e. sea ice – atmosphere

a,b,c,d,e

4. Flux adjustment? (heat?, water?, momentum?, annual?, monthly?).

Heat and momentum adjustment

V. Simulation Details (report separately for each IPCC simulation contributed to database at PCMDI):

A. IPCC "experiment" name
B. Describe method used to obtain initial conditions for each component model
   1. If initialized from a control run, which month/year.
   2. For control runs, describe spin-up procedure.
C. For pre-industrial and present-day control runs, describe radiative forcing agents (e.g., non-anthropogenic aerosols, solar variability) present. Provide references or web pages containing further information as to the distribution and temporal changes in these agents.
D. For perturbation runs, describe radiative forcing agents (e.g., which greenhouse gases, which aerosols, ozone, land surface changes, etc.) present. Provide references or web pages containing further information as to the distribution and temporal changes in these agents.

A. PDcntrl

B. Firstly, the each component model is integrated with the observed climatologically forcing, e.g. 30 model years for atmospheric model, and 3000 model years for OGCM. Secondly, the coupled model was integrated 50 years from the last year of uncoupled model integration, which can be defined as CGCM spin-up. Finially, the initial condition of the experiment "PDcntr " is from the last year of the CGCM spin-up integration in the second step.
*C. No non-antropogenic aerosols included. Solar constant is 1365 W/M*M.*
D. /

A. 20C3M
B. The initial conditions of 20C3M ensemble simulations are from the 1st in March, Jun, Sep, Dec of year 1870 by atmosphere model, respectively.
C./
D. CO_2, N_2O, CH_4, CFC11, CFC12; climatologic mean ozone data from
ftp://sprite.llnl.gov/pub/covey/IPCC_4AR_Forcing/

A. SRESA2
B. The initial conditions of SRESA2 ensemble simulations are from the 1st January of year 1880,it is from control experiments, isn'tt from experiment 20C3M.
C./
D. CO_2, N_2O, CH_4, CFC11, CFC12; climatologic mean ozone; data from
ftp://sprite.llnl.gov/pub/covey/IPCC_4AR_Forcing/

A. SRESB1
B. The initial conditions of SRESB1 ensemble simulations are from the 1st January of year 1880,it is from control experiments, isn'tt from experiment 20C3M.
D. CO_2, N_2O, CH_4, CFC11, CFC12; climatologic mean ozone ; data from
ftp://sprite.llnl.gov/pub/covey/IPCC_4AR_Forcing/

A. 1%to2x
B. The initial conditions of 1%to2x ensemble simulations are from the 1st January of model'year 1980.
C./
D. CO_2 increases by 1% per year from 280ppm. The other forcing is same as PDcntr.

A. 1%to4x
B. The initial conditions of 1%to4x ensemble simulations are from the 1%to2x
C./
D. CO_2 increases by 1% per year from 560ppm. The other forcing is same as PDcntr.

A. AMIP
B. The initial conditions of AMIP ensemble simulations are from the 1st in March, Jun, Sep, Dec of year 1978 by atmosphere model, respectively.
D. CO_2, N_2O, CH_4, CFC11, CFC12; climatologic mean ozone ; data from
ftp://sprite.llnl.gov/pub/covey/IPCC_4AR_Forcing/