FGOALS_g2 (CMIP5)

Climate Model Report Card

GLISA
A NOAA RISA TEAM

Model Name: Flexible Global Ocean-Atmosphere-Land System Model: Grid-point version 2

Developers: LASG, Institute of Atmospheric Physics, Chinese Academy of Sciences (IAP-LASG), and the Center for Earth System Science (CESS) at Tsinghua University

Data Portal: https://cera-www.dkrz.de, https://esgf-node.llnl.gov

Spatial Resolution: 2.79° x 2.81°

Temporal Resolution: 3 hr, daily, monthly

Historical Run(s): 1850-2005 (monthly), 1950-2005 (daily), 1959-2006 (3 hr)

Future Scenario(s): RCP2.6, RCP4.5, RCP8.5

Future Time Period(s): 2006-2275 (monthly for RCP4.5), 2006-2101 (monthly for RCP8.5), 2025-2100 (3 hr for RCP2.6, RCP8.5), 2025-2200 (3 hr for RCP4.5)

LAKE COMPONENT

Name: Lake model within NCAR's Community Land Model, version 3.0 (CLM3)

Reference: [1]Oleson, K. W., Dai, Y., Bonan, G., Bosilovich, M., Dickinson, R., Dirmeyer, P., ... & Zeng, X. (2004). Technical description of the community land model (CLM). *Tech. Note NCAR/TN-461+STR.*

Description: The lake model is from Zeng et al. (2002), which is based on various one-dimensional models that vertically solve the thermal diffusion equation for 10 layers of water and ice. Each grid cell is assigned a percentage of lake, wetland, glacier, urban, and soil, where lake percentages are from Cogley's (1991) 1.0° x 1.0° perennial freshwater lake data. Snow cover above lakes is greatly simplified and soil beneath lakes is not considered.[1]

Vertical Layers | Depths: 10 layers for a maximum depth of 50m

Vertical Mixing (y/n): Yes

Horizontal Mixing (y/n): No

Lake Ice: The 10 layers can be water or ice, and frozen lake albedos are based on sea ice values from NCAR LSM (Bonan, 1996).[1]

ATMOSPHERE COMPONENT

Name: Grid-point Atmospheric Model of IAP LASG, version 2 (GAMIL2)

Reference: [2]Li, L., Wang, B., Dong, L., Liu, L., Pu, Y., Shen, S., ... & Shi, X. (2014). The grid-point atmospheric model of IAP LASG–version 2: GAMIL2. In *Flexible Global Ocean-Atmosphere-Land System Model* (pp. 9-13). Springer, Berlin, Heidelberg.

Physical Parameterizations: Deep convective scheme (Zhang & McFarlane, 1995; Zhang & Mu, 2005a), convective cloud fraction (Xu & Krueger, 1991; Rasch & Kristjansson, 1998), microphysics schemes (Rasch & Kristjansson, 1998; Morrison & Gettelman, 2008; Shi et al., 2010), advection scheme (Yu, 1994), shallow convective scheme (Hack, 1994), deep and shallow cumulus schemes (Xu et al., 1991)[2,3,4]

Chemistry: Aerosol activation schemes of Abdul-Razzak & Ghan (2000) and Nenes & Seinfield (2003) and forcings by greenhouse gases (including CO_2, CH_4, N_2O), aerosols (including sulphate, black and organic carbon, dust, and sea salt), and ozone[3,4]

LAND COMPONENT

Name: Community Land Model (CLM) version 3

Reference: [1]Oleson, K. W., Dai, Y., Bonan, G., Bosilovich, M., Dickinson, R., Dirmeyer, P., ... & Zeng, X. (2004). Technical description of the community land model (CLM). *Tech. Note NCAR/TN-461+STR.*

 # Land Cover Types: 5 surface types (soil, wetland, urban, lake, glacier) and 15 vegetation plant function types (PFTs), where each grid cell can contain multiple surface types and up to 4 PFTs.[1] Full PFT list in Oleson et al. (2004).

 # Soil Layers: 10 layers (+up to 5 for snow) for a total depth of 3.44m

Soil Moisture: Soil moisture and temperature are governed by the heat and water transfer equations involving vertical transport between layers by means of infiltration, surface and sub-surface runoff, gradient diffusion, gravity, and root extraction through canopy transpiration. Soil water flux is calculated with Darcy's Law.[1]

Runoff: Water that reaches the ground becomes runoff based on how saturatued the upper soil layers are. CLM3 uses a conceptual form of TOPMODEL for runoff parameterization.[1]

Sub-Grid Lakes (y/n): Yes. Grid cells can be assigned a percentage of lake, wetland, glacier, and soil, with lake percentages from Cogley's (1991) 1.0° x 1.0° perennial freshwater lake data.[1]

Carbon Fluxes: This version of CLM does not have carbon cycle or biogeochemical cycles. Terrestrial biogenic volatile organic compound emissions (BVOC) are included in this model, based off of Guenther et al. (1995).[1]

Land Use Change: Land use and land cover changes are not included in this model.[1]

Groundwater: Undocumented

Additional References

[3]Li, L., Lin, P., Yu, Y., Wang, B., Zhou, T., Liu, L., ... & Qiao, F. (2013). The flexible global ocean-atmosphere-land system model, Grid-point Version 2: FGOALS-g2. *Advances in Atmospheric Sciences, 30*(3), 543-560.

[4]Li, L., Wang, B., Dong, L., Liu, L., Shen, S., Hu, N., ... & Yang, G. (2013). Evaluation of grid-point atmospheric model of IAP LASG version 2 (GAMIL2). *Advances in Atmospheric Sciences, 30*(3), 855-867.