Geophysical Research Abstracts
Vol. 16, EGU2014-4751, 2014
EGU General Assembly 2014

Intraseasonal versus interannual measures of land-atmosphere coupling strength in a global climate model: GLACE-1 versus GLACE-CMIP5 experiments in ACCESS

Ruth Lorenz (1), Andy Pitman (1), Annette Hirsch (1), Jhan Srbinovsky (2), and Sonia Seneviratne (3)

(1) ARC Center of Excellence for Climate System Science and Climate Change Research Centre, University of New South Wales, Sydney, Australia, (2) Centre for Australian Weather and Climate Research, CSIRO Marine and Atmospheric Research, Aspendale, Australia, (3) Institute for Atmospheric and Climate Science, ETH Zurich, Zurich, Switzerland

Land-atmosphere coupling measures how strongly atmospheric processes are influenced by the anomalies in the land surface state, for example soil moisture. Koster et al. (2006) presented a model intercomparison study–the Global Land-Atmosphere Coupling Experiment (GLACE-1)-where this coupling strength was quantified for boreal summer and global "hot spots" were identified. This study focused on one boreal summer season and intraseasonal timescale. Seneviratne et al. (2006) investigated land-climate coupling in climate change conditions, using a very similar measure to estimate coupling strength but focused on temperature in Europe on the interannual timescale. Seneviratne et al. (2006) also defined additional soil moisture-temperature coupling parameters which can be calculated from any multiyear model run without additional experiments.

We use the Australian Community and Earth System Simulator (ACCESS1.3b) to conduct the GLACE-CMIP5 experiment. This experiment uses prescribed soil moisture experiments over the CMIP5 period to investigate effects of changes in soil moisture content and soil moisture-climate coupling for future climate projections (Seneviratne et al., 2013). It focuses on two experiments: one where soil moisture is prescribed by the climatology from 1971-2000 from the control simulation with interactive soil moisture; and one where soil moisture is prescribed by the transient climatology (running means over 30-year periods).

In addition, we run the GLACE-1 experiment (Koster et al., 2006) with ACCESS1.3b. We run four ensembles of three-monthly model runs, two ensembles for one summer season per hemisphere. For both hemispheres we calculate one ensemble where soil moisture is calculated interactively and one where soil moisture is prescribed every timestep. Hence, we decouple the land from the atmosphere in the latter model runs. We compare the different coupling measures and investigate ACCESS's coupling strength.

We find similar regions of strong coupling for precipitation and temperature in ACCESS compared to the original GLACE-1 experiments. In addition, we find regions of strong coupling for austral summer in tropical regions. This signal is particularly strong for daily maximum temperatures.

Koster, R. D., et al. (2006). GLACE: The Global Land–Atmosphere Coupling Experiment. Part I: Overview. J. Hydromet., 7(4), 590–610. doi:10.1175/JHM510.1

Seneviratne, S. I., et al. (2006). Land-atmosphere coupling and climate change in Europe. Nature, 443(7108), 205–209. doi:10.1038/nature05095

Seneviratne, S. I., et al. (2013). Impact of soil moisture-climate feedbacks on CMIP5 projections: First results from the GLACE-CMIP5 experiment. GRL, 40(19), 5212–5217. doi:10.1002/grl.50956