

Data Set Name:

Perturbed sea-ice physics parameter simulations

Data Set Location:<ftp://gdo148.ucllnl.org/pub/cvijanovic-et-2017.tgz>**Abstract:**

This data set was used to investigate the atmospheric impacts of sea-ice loss, as described in the study by Cvijanovic et al. (2017). By sampling the uncertainties in selected sea-ice physics parameters, an ensemble of simulations with a seasonally ice-free Arctic (and Antarctic) are obtained. These are compared to a corresponding ensemble of ‘control’ simulations, performed to represent the sea-ice conditions at the end of the 20th century.

Source:

This data was created by LLNL’s Uncertainty Quantification Strategic Initiative Laboratory Directed Research and Development Project under tracking code 10-SI-013; and the Department of Energy Early Career Research Program Award SCW1295. The work was performed under the auspices of the US Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344, and is released under UCRL number LLNL-MI- 893448. For further dataset questions, see Cvijanovic et al. (2017) or contact cvijanovic1 (at) llnl.gov.

Data Set Information:

This is a set of 30 simulations obtained with the Community Climate System Model (CCSM) version 4 (Gent et al. 2011). The model configuration used incorporated the Community Atmosphere Model version 4 (CAM4) (Neale et al. 2013), Community Land Model version 4 (CLM4) (Lawrence et al. 2011) and Los Alamos Sea Ice Model version 4 (Community Ice Code 4—CICE4) (Hunke and Lipscomb 2008) coupled to a mixed layer (slab) ocean. Based on the previous ensemble simulations by Lucas et al. (2013), the sea-ice physics parameters that have the strongest impact on the sea-ice extent have been selected. The selected sea-ice physics parameters and their respective control and perturbed values are summarized in Table 1. These parameter perturbations were separately applied in each hemisphere: “low Arctic ice” (“low Antarctic ice”) simulation sets are obtained by applying the parameter changes in the Northern (Southern) Hemisphere alone. For each set of sea-ice parameter values used (control, set 1 and set 2) we perform 5 additional simulations with altered initial atmospheric conditions. Further details about the data and methods are given in the publication by Cvijanovic et al. (2017)

Table 1: Values of sea-ice physics parameters

| Parameter | control | “low Arctic/Antarctic ice” set 1 | “low Arctic/Antarctic ice” set 2 |
|------------------------------------|---------|----------------------------------|----------------------------------|
| snow grain radius tuning parameter | 1.5 | -0.84 | -1.8 |
| thermal conductivity of snow | 0.3 | 0.1 | 0.1 |
| snow melt maximum radius | 1500 | 1362.7 | 1800 |

Attribute Information and File naming:

Each file is given in its standard netcdf (.nc) format. Variable dimensions are given as (time, lat, lon) and (time, lat, lon, lev) for 2d and 3d variables. Monthly means for years 20 to 40 of model integration are given for the following CAM4 variables: ICEFRAC, TS, PRECT, Z3, U, V, OMEGA, FLNT, CLDHGH, TTROP, PS.

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Set 1 is denoted by suffix 0020, set 2 by 0041, followed by the numbers 01, 02, 03, 04, 05 that refer to the additional ensemble members.

Citation Requests:

When using the data please cite Cvijanovic et al. (2017) and Lucas et al. (2013):

Cvijanovic I, Santer BD, Bonfils C, Lucas DD, Chiang JCH, Zimmerman S (2017) Future loss of Arctic sea-ice cover could substantially decrease rainfall over California. *Nature Communications*.

Lucas DD, Covey CC, Klein R, Tannahill J, Ivanova DP (2013) Quantifying Uncertainties in the Seasonal Cycle of Arctic Sea Ice (American Geophysical Union, Fall Meeting 2013, abstract #GC31B-1044). Available at: <http://adsabs.harvard.edu/abs/2013AGUFMGC31B1044L>.

References:

Gent PR, et al. (2011) The Community Climate System Model Version 4. *J Clim* 24(19):4973–4991.

Neale RB, et al. (2013) The Mean Climate of the Community Atmosphere Model (CAM4) in Forced SST and Fully Coupled Experiments. *J Clim* 26(14):5150–5171.

Lawrence DM, et al. (2011) Parameterization improvements and functional and structural advances in Version 4 of the Community Land Model. *J Adv Model Earth Syst* 3(3). doi:10.1029/2011ms000045.

Hunke EC, Lipscomb WH (2008) *CICE: The Los Alamos sea ice model user's manual, version 4*.

Lucas DD, Covey CC, Klein R, Tannahill J, Ivanova DP (2013) Quantifying Uncertainties in the Seasonal Cycle of Arctic Sea Ice (American Geophysical Union, Fall Meeting 2013, abstract #GC31B-1044). Available at: <http://adsabs.harvard.edu/abs/2013AGUFMGC31B1044L>.