Title: Data Associated with "The Key Role of Cloud-Climate Coupling in Extratropical Sea Surface Temperature Variability"

Abstract: Cloud radiative effects have long been known to play a key role in governing the mean climate. In recent years, it has become clear that they also contribute to climate variability in the tropics. Here we build on recent work and probe the role of cloud radiative effects in extratropical sea surface temperature (SST) variability. The impact of cloud radiative effects on climate variability is explored in 'cloud-locking' simulations run on an Earth System Model. The method involves comparing the output from two climate simulations: one in which clouds are coupled to the atmospheric circulation and another in which clouds are prescribed and thus decoupled from the flow. The results reveal that coupling between cloud radiative effects and the atmospheric circulation leads to widespread increases in the amplitudes of extratropical SST variability from monthly to decadal timescales. Notably, the amplitude of monthly to decadal variability over both the North Atlantic and North Pacific oceans is between ~40-100% larger when clouds are coupled to the circulation. The increases are consistent with the 'reddening' of cloud shortwave radiative effects that arises when clouds interact with the large-scale circulation. The results suggest that a notable fraction of observed Northern Hemisphere sea surface temperature variability - including that associated with North Pacific and North Atlantic decadal variability - is due to cloud-circulation coupling.

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Format of data files – .zip, NetCDF

File Information - File names, directory structure, and brief description of each file or file type, including where in the research process each data file lies (e.g. raw/unanalyzed data, processed/analyzed data, rendered/visualized data). Also indicate the number of data files, including the README file.

Boehm_and_Thompson_CloudLocking_2022_Data.zip contains 12 NetCDF files, with the following file naming convention:

SimulationType_Variable_LandOrOcean.nc

Each data file contains output data from simulations run on the Max Planck Institute Earth System Model.

SimulationType = InteractiveClouds	Simulation output where clouds are fully coupled with the atmospheric circulation
SimulationType = LockedClouds	Simulation output where clouds are decoupled from the atmospheric circulation
Variable = SurfaceLatentHeat	Surface Latent Heat Flux in W/m^2
Variable = SurfaceLongwaveRadiation	Surface Longwave Radiation Flux in W/m^2
Variable = SurfaceSensibleHeat	Surface Sensible Heat Flux in W/m^2

Variable = SurfaceShortwaveRadiation	Surface Shortwave Radiation Flux in W/m^2
Variable = SurfaceTemperature	Sea Surface Temperature in K
Variable = GeopotentialHeight500hPa	Geopotential Height at 500hPa in m
Ocean	Values only over ocean areas

Variable information – Each NetCDF file has the output for a single variable and three dimensions: time, latitude and longitude.

Data source – Simulations were conducted by Dirk Olonscheck at the Max Planck Institute for Meteorology. These simulations are described in detail in Li et al. (2020):

Li, Y., Thompson, D. W. J., & Olonscheck, D. (2020). A Basic Effect of Cloud Radiative Effects on Tropical Sea Surface Temperature Variability. *Journal of Climate*, *33*(10), 4333–4346. https://doi.org/10.1175/JCLI-D-19-0298.1