NCAR | CLIMATE & GLOBAL DYNAMICS

CGD Seminar Series

Interhemispheric Synchronization of Climate

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Date: Tuesday, 14 September 2021

Time: 11am – 12pm

For Zoom information, please contact Tracy Baker tbaker@ucar.edu

For live stream information, visit the CGD Seminar Webpage

ABSTRACT

Clearly, the geographies of the Earth's north and south hemispheres are very different. The northern hemisphere has about 80% of the Earth's total land mass, whereas the southern hemisphere is principally oceanic. These geographic differences produce vast differences in the distribution and annual cycle of surface temperature, the location and intensity of jet streams and storm tracks. As documented by the International Satellite Cloud Climatology Project (ISCCP), different cloud populations inhabit the two hemispheres. However, overriding these differences, there are some surprising similarities. For example, the annually averaged hemispheric top-of-the-atmosphere (TOA) radiation balance is almost identical (Stephens et al. 2015, 2016). Further, despite large differences in where precipitation falls over land or ocean from one hemisphere to the other, the overall annually averaged hemispheric rainfall (total volume or rain rate) is almost identical within the error of the measurements. Here we attempt to understand why there is an apparent symmetry or synchronization between the hemispheres.

This talk explores the hypothesis that there is an overriding global physical constraint that enforces interhemispheric synchronicity. Haynes and McIntyre's (1987, 1990) "impermeability theorem" provides for such a physical constraint, which argues for the conservation potential vorticity substance between isentropic surfaces even in the presence of diabatic heating dissipative forces. This theorem was used by Ortega et al. (2018) to explain the physical and systematic interaction of equatorial and extratropical processes through constrained divergent and Rossby dynamics. We speculate on the other implications of impermeability, including the interannual oscillation between precipitation over land and the ocean, and the apparent interhemispheric synchronization of ice