

# Whither the 100<sup>th</sup> Meridian: The once and future physical geography of America's arid-humid divide

<sup>1</sup>N. Lis, <sup>2</sup>J. Feldman, <sup>2,3</sup>R. Seager, <sup>2,3</sup>Mingfang Ting

<sup>1</sup>*Penn State University*, <sup>2</sup>*Columbia University*, <sup>3</sup>*Lamont Doherty Earth Observatory of Columbia University*

The idea that the 100th Meridian is a dividing line between the arid west and humid east was first advanced by John Wesley Powell in 1890, and the 100th Meridian has remained as an informal division in aridity to the present day. Whether there is a scientifically sound, climatological and hydrological origin of this division is analyzed, and if so, whether climate change will cause the “Hundredth Meridian” to shift in the future. The potential evapotranspiration (PET) is first computed using a suite of three NLDAS-2 land surface models and the Penman-Monteith Equation, and the aridity index (AI), defined as precipitation divided by PET, is used as the aridity metric. There is a sharp gradient in aridity along and just east of the 100th Meridian, verifying Powell's observations. We further determined that this arid-humid boundary is primarily caused by strong spatial gradients in precipitation and humidity, which in turn are caused by the seasonal cycle in wind direction and moisture transport. Using CMIP5 climate model data, the future was projected in 20-year increments from the present through 2100. Models project that the arid-humid boundary will shift eastward by approximately 2 to 3 degrees by the end of the 21st Century, the gradient will weaken, and that the entire continental US will experience at least some degree of aridification. The relative contributions of precipitation, temperature, specific humidity and circulation change to the eastward shift of the “100th meridian” will be discussed.