



Super El Niños in a Warming World

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El Niño is a disruption of the ocean-atmosphere system in the Tropical Pacific having important consequences for weather and climate around the globe. The phenomenon originates in the Equatorial Pacific, and it is the strongest interannual climate signal with global teleconnections. El Niño events are typified by strong warming of the order of a few degrees of the eastern and central Equatorial Pacific Ocean with cooling over portions of the subtropics and mid-latitudes and the tropical western Pacific. These SST anomalies drive anomalous diabatic heating in the upper atmosphere thereby perturbing the global atmospheric circulation and generating global teleconnections. Although El Niños considerably vary in strength, typical eastern Equatorial Pacific sea surface temperature anomalies generally do not exceed 3°C. Here we present an ensemble of greenhouse gas integrations (1% increase in CO₂ per year) of the Kiel Climate Model, in which some events exceed SST anomalies of 6°C. Such Super El Niños result in more than twice stronger signal in temperature and precipitation teleconnection patterns that would have dramatic consequences for many countries around the world. The most of simulated Super El Niños happen in the last third of the 21st century and represent a prolonged event that sustain maximal SST anomalies for more than half a year. The change in the zonal wind stress in the Equatorial Pacific Sector is the primary reason for the occurrence of Super El Niños in the greenhouse climate. The simulated U-wind climatology in the warmer climate is characterized by a second minimum that favors longer and more powerful El Niños. The results of our model simulations suggest a higher probability of Super El Niño events in a warmer climate.