

ID: W2033013208

TITLE: Increased frequency of extreme La Niña events under greenhouse warming

AUTHOR: ['Wenju Cai', 'Guojian Wang', 'Agus Santoso', 'Michael J. McPhaden', 'Lixin Wu', 'Fei Jin', 'Axel Timmermann', 'Matthew Collins', 'Gabriel A. Vecchi', 'Matthieu Lengaigne', 'Matthew H. England', 'Dietmar Dommenget', 'K. Takahashi', 'Éric Guilyardi']

ABSTRACT:

Extreme La Niña events occur when cold sea surface temperatures across the central Pacific Ocean create a strong temperature gradient to the Maritime continent in the west. This work projects an increase in frequency of La Niña events due to faster land warming relative to the ocean, and a greater chance of them occurring following extreme El Niño events. The El Niño/Southern Oscillation is Earth's most prominent source of interannual climate variability, alternating irregularly between El Niño and La Niña, and resulting in global disruption of weather patterns, ecosystems, fisheries and agriculture^{1,2,3,4,5}. The 1998–1999 extreme La Niña event that followed the 1997–1998 extreme El Niño event⁶ switched extreme El Niño-induced severe droughts to devastating floods in western Pacific countries, and vice versa in the southwestern United States^{4,7}. During extreme La Niña events, cold sea surface conditions develop in the central Pacific^{8,9}, creating an enhanced temperature gradient from the Maritime continent to the central Pacific. Recent studies have revealed robust changes in El Niño characteristics in response to simulated future greenhouse warming^{10,11,12}, but how La Niña will change remains unclear. Here we present climate modelling evidence, from simulations conducted for the Coupled Model Intercomparison Project phase 5 (ref. 13), for a near doubling in the frequency of future extreme La Niña events, from one in every 23 years to one in every 13 years. This occurs because projected faster mean warming of the Maritime continent than the central Pacific, enhanced upper ocean vertical temperature gradients, and increased frequency of extreme El Niño events are conducive to development of the extreme La Niña events. Approximately 75% of the increase occurs in years following extreme El Niño events, thus projecting more frequent swings between opposite extremes from one year to the next.

SOURCE: Nature climate change

PDF URL: None

CITED BY COUNT: 491

PUBLICATION YEAR: 2015

TYPE: article

CONCEPTS: ['Climatology', 'Environmental science', 'Sea surface temperature', 'Pacific decadal oscillation', 'Climate change', 'Global warming', 'Greenhouse gas', 'Climate model', 'Global temperature', 'Coupled model intercomparison project', 'Extreme weather', 'La Niña', 'Oceanography', 'El Niño Southern Oscillation', 'Atmospheric sciences', 'Geology']