Clouds may have more of an impact on El Nino than thought

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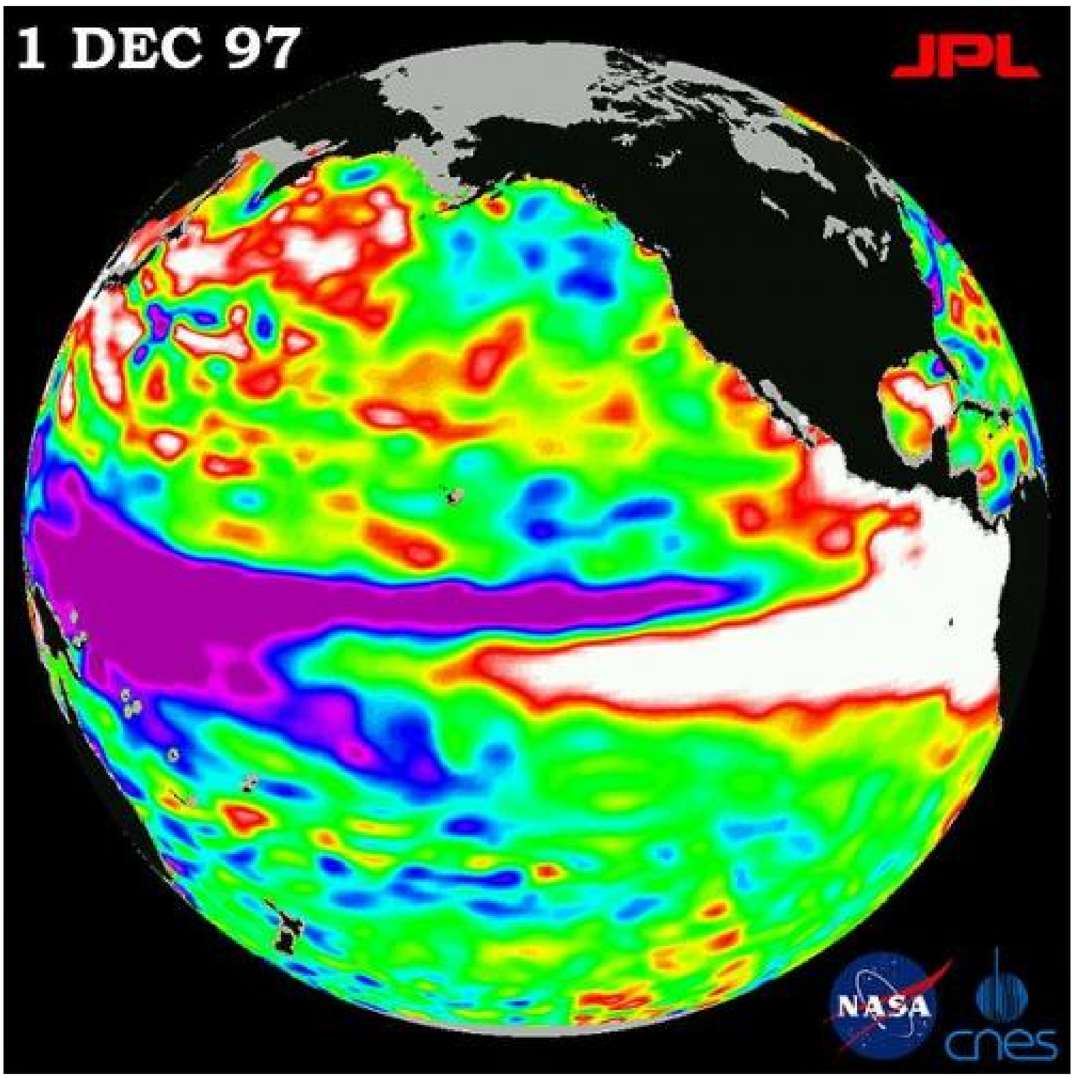

The 1997 El Nino seen by TOPEX/Poseidon. Credit: NASA

(Phys.org)—A small team of researchers from the U.S., Australia and Germany has found evidence that suggests cloud formation may have a much bigger impact on weather patterns associated with El Niño events than has been thought. In their paper published in the journal *Nature Geoscience*, the team describes they differences they found when they input cloud data into computer models that simulated weather patterns associated with El Niño' events and why they now believe that all such models should include such data going forward.

Scientists predicted that El Niño' weather events would be more severe this winter compared to recent events, and thus far, their predictions have proved to be true—temperatures have fluctuated wildly in parts of Europe and the U.S. along with associated rain events, leading to serious flooding. In this new effort, the researchers have found that cloud formation may have more influence on such weather events than has been thought.

The El Niño/Southern Oscillation (ENSO) as it is known formally, causes the most weather variability on a small time scale, and attracts an enormous amount of attention due to associated changes in rain patterns—the western parts of the U.S. and the northern parts of South America, for example, typically see more than normal amounts of rainfall, while parts of Africa experience droughts. As scientists struggle to truly understand global weather patterns associated with ENSO, they debate the degree of impact of oceanic process versus those that occur in the atmosphere. In this new effort, the researchers suggest that the atmosphere may exert much more of an impact on ENSO events than has been thought, due in large part, to cloud formations which can serve as a blanket of sorts, preventing warm air from escaping from lower elevations, which can lead to more rainfall.

To better understand the impact of cloud formations on ENOS weather events, the researchers input cloud data into standard climate models and compared the results with models running under the same conditions without cloud data. They report that they were surprised to find that the cloud formation data caused large changes to atmospheric circulation patterns and accounted for more than half of the strength of ENOS events. They suggest their findings indicate that all future climate models include cloud data so that they can offer a better representation of real events, and thus, give better predictions.

More information: Gaby Rädel et al. Amplification of El Niño by cloud longwave coupling to atmospheric circulation, *Nature Geoscience* (2016). DOI: 10.1038/ngeo2630

Abstract
The El Niño/Southern Oscillation (ENSO) is the dominant mode of inter-annual variability, with major impacts on social and ecological systems through its influence on extreme weather, droughts and floods. The ability to forecast El Niño, as well as anticipate how it may change with warming, requires an understanding of the underlying physical mechanisms that drive it. Among these, the role of atmospheric processes remains poorly understood. Here we present numerical experiments with an Earth system model, with and without coupling of cloud radiative effects to the circulation, suggesting that clouds enhance ENSO variability by a factor of two or more. Clouds induce heating in the mid and upper troposphere associated with enhanced high-level cloudiness over the El Niño region, and low-level clouds cool the lower troposphere in the surrounding regions. Together, these effects enhance the coupling of the atmospheric circulation to El Niño surface temperature anomalies, and thus strengthen the positive Bjerknes feedback mechanism14 between west Pacific zonal wind stress and sea surface temperature gradients. Behaviour consistent with the proposed mechanism is robustly represented in other global climate models and in satellite observations. The mechanism suggests that the response of ENSO amplitude to climate change will in part be determined by a

balance between increasing cloud longwave feedback and a possible reduction in the area covered by upper-level clouds.