

**ATS/CIRA Colloquium**

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**3 p.m. Thursday, Oct. 14 ATS 101  
Hosted by Charlotte DeMott**

**Extreme tropical variability under greenhouse  
warming**

Whether tropical climate variability will increase in response to greenhouse warming is highly uncertain. This question remains unanswered because externally-forced changes in modes of tropical variability cannot be ascertained using historical records or model predictions. We overcame these issues by studying changes in modes of variability under a range of past external forcings, validating them against proxy-inferred changes in variability during Earth's geological history. For the Indian Ocean, we discovered a mode active during the last glacial period driving much stronger variability than currently observed. This mode – inactive today – could reemerge by mid-century as this ocean develops oceanographic conditions favoring large-scale air-sea interactions. For the Pacific Ocean, simulations of glacial intervals show that a deeper mixed-layer in the central Pacific, disrupts the generation of extreme El Niño, as seen in paleoclimate records. A deeper mixed layer makes ocean currents less sensitive to wind variations during the onset of El Niño – limiting their ability to reach extreme amplitude. The opposite occurs under greenhouse warming, when a shallower mixed layer makes currents highly responsive to wind fluctuations favoring the onset of extreme El Niño. These results reveal a heightened risk of increasing climate extremes throughout a large part of the world if greenhouse gas emissions continue to increase.

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