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Winter 2010-2011: a case study of the impact of La Nina on Arctic Vortex

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During the 2010-2011 winter, the Arctic vortex was colder, stronger and more persistent than usual while a La Nina event occurred. With NCEP/NCAR reanalysis data, the effect of La Nina on Northern hemisphere (NH) stratosphere was investigated. Compared with climatology, the polar cap temperature and geopotential height anomalies resulted from La Nina were examined. The wave activities from the troposphere to the stratosphere were much less than climatology, caused by decreased Wave 1 eddies and increased Wave 2 eddies with a weakened Aleutian Low. As a result, the Arctic polar vortex in the stratosphere was much stronger than normal through the entire winter, which was consistent with composite analyses of 12 strongest La Nina years. Notably, recent studies show that ENSO is able to substantially affect stratospheric conditions. We also revisit this issue and focus on the extreme events: 41 strong and 25 weak polar vortexes. It's found that strong/weak polar vortexes mostly occur during La Nina /El Nino winters, but there are also considerable amounts of weaker/stronger or neutral polar vortexes occurring during La Nina/El Nino winters. Other factors such as solar cycle, surface boundary conditions may also influence Arctic polar vortex. The case of 2010-2011 winter therefore gives us an extraordinary good sample to investigate the linkage between SST and the stratosphere.