

Causes and Consequences of the 2020-23 Triple Dip La Niña

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The tropical Pacific witnessed three successive years of unusually cold sea surface temperatures, with peak anomalies in late 2020, 2021 and 2022. These conditions represent the first "triple dip" La Niña of the 21st century with major climatic impacts felt around the world. Three year La Niña events are rare but not unprecedented; similar events occurred in 1998-2001 and in 1973-76. A leading hypothesis for multi-year La Niñas is that they occur on the rebound from preceding strong El Niños which, through recharge oscillator dynamics, drain the equatorial band of upper ocean heat content leaving a large heat deficit that takes multiple years to recover. The 2020-23 La Niña did not conform to this scenario--antecedent conditions in the tropical Pacific in 2019 were characterized by a borderline El Niño that did not lead to a large upper ocean heat content discharge. What caused the La Niña is thus a topic of considerable interest. In this presentation, we hypothesize that tropical inter-basin interactions were instrumental in initiating and prolonging the event. In particular, we suggest that the event was triggered by a record Indian Ocean Dipole in late 2019, then boosted in 2020 and 2021 by unusually warm conditions in the tropical Atlantic. Whether climate change may have played a role in these developments will be discussed. We will also discuss the transition from cold La Niña to warm El Niño conditions in 2023, and how that affected global temperature extremes.