Super El Niño: A product of three-ocean interactions

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El Niño, the largest climate phenomenon on Earth, profoundly influences global climate, weather, ecosystems, and human societies. Super (or extreme) El Niño, in particular, has a significant impact on climate and extreme weather events, but its formation mechanism remains unknown. This presentation utilizes observations, climate model outputs, and coupled model experiments to demonstrate that interactions among the tropical Pacific, Indian, and Atlantic Oceans contribute to the development of super El Niño. The early onset of El Niño imparts sufficient strength in the summer and fall to trigger the Atlantic Niña and Indian Ocean dipole. Subsequently, the Atlantic Niña and Indian Ocean dipole alternately generate additional westerly wind anomalies over the equatorial western-central Pacific, reinforcing El Niño through the Bjerknes feedback and leading to the emergence of super El Niño. This novel mechanism is termed the Indo-Atlantic booster. The findings emphasize super El Niño as a product of three interactions, suggesting that incorporating both the Indian and Atlantic Oceans and their teleconnections with the Pacific will significantly enhance predictions of super El Niño and climate.