Response of the equatorial Pacific seasonal cycle to orbital forcing

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Results from coupled atmosphere-ocean GCM simulations show that the seasonal cycle of equatorial Pacific sea surface temperatures can be strongly affected by precession, while changes in obliquity produce only small differences. Idealized simulations were conducted with the Geophysical Fluid Dynamics Laboratory CM2.1 in which the Earth's obliquity and timing of perihelion were changed while all other boundary conditions were prescribed at preindustrial levels. While obliquity forcing produces almost no change in equatorial Pacific seasonality, precession alters the strength of the seasonal cycle through both thermodynamic and dynamic mechanisms. In the western equatorial Pacific, insolation anomalies from precession alter the strength of the monsoonal circulation over the Maritime Continent, inducing anomalous downwelling in the Pacific warm pool. The resulting temperature anomalies travel eastward along the thermocline, surfacing in the eastern equatorial Pacific several months later. This anomalous redistribution of heat, aided by the direct thermodynamic effect of insolation anomalies, produces large changes to the strength and timing of the seasonal cycle in the eastern equatorial Pacific. Because equatorial Pacific sea surface temperatures have local climate impacts as well as non-local impacts though teleconnections, these results may be important to understanding paleoclimate variations both inside and outside of the equatorial Pacific.