The Pliocene Permanent El Nino and Atmospheric Superrotation.

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A mechanism for maintaining a weaker Pliocene equatorial temperature gradient (i.e., a Pliocene "permanent El Nino") is proposed. Evidence from the Super-Parameterized Community Earth System Model shows an enhancement of the Madden Julian oscillation in a warmer climate such as the Pliocene's. This is suggested to excite poleward-propagating atmospheric Rossby waves. These waves can produce an equatorward flux of westerly momentum that weakens the surface easterlies, via a positive feedback between the Rossby waves and equatorial westerlies. The enhanced westerlies may weaken the east-west thermocline slope and SST gradient, leading to a permanent El Nino state. We also show that related mid-latitude wind changes may have lead to the observed Pliocene warming of upwelling sites. The main unresolved current challenge facing this idea is the tendency of superrotation to occur in atmospheric models in the upper atmosphere rather than near the surface where it can impact the ocean; possible limitations of present models that may lead to this difficulty will be discussed.