

Decadal variations in the tropical Indo-Pacific sea surface height based on a historical OGCM simulation

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We examine long-term sea surface height (SSH) variations in the tropical Indo-Pacific Oceans, using a historical OGCM simulation (1948-2006). It is known that the SSH pattern in the tropical Pacific is not a mirror image on decadal timescales. For example, it is north-south asymmetric during the positive phase (1977-1987), while it is north-south symmetric during the negative phase (1996-2006). EOF analysis of tropical Pacific SSH anomalies indicates four dominant modes: east-west seesaw pattern (1st mode), north-south asymmetric pattern (2nd mode), north-south symmetric pattern (3rd mode) with longer time scales, and north-south symmetric pattern (4th mode) with ENSO timescales. The SSH pattern during the positive phase is largely explained by the combination of the four modes including a north-south asymmetric pattern (2nd mode), while the north-south symmetric 1st and 4th modes are dominant during the negative phase. This answers the question why the tropical Pacific SSH pattern is not a mirror image on decadal timescales. Overall, the tropical Indo-Pacific SSH decadal variability is correlated with the wind stress curl. The 1st and 3rd modes are associated with the tropical Indian Ocean SSH variability through the atmospheric bridge. We also discuss a possible reason for the enhancement of the trade winds over the tropical Pacific after the late 1990s, which leads to the enhanced negative phase hereafter.

Keywords: decadal variability, sea surface height, ocean general circulation model, Indo-Pacific