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Initialization shock in decadal hindcasts due to errors in wind stress over the tropical Pacific

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Low prediction skill in the tropical Pacific is a common problem in decadal prediction systems, especially for lead years 2–5 which, in many systems, is lower than in uninitialized experiments. On the other hand, the tropical Pacific is of almost worldwide climate relevance through its teleconnections with other tropical and extratropical regions and also of importance for global mean temperature. Understanding the causes of the reduced prediction skill is thus of major interest for decadal climate predictions. We look into the problem of reduced prediction skill by analyzing the Max Planck Institute Earth System Model (MPI-ESM) decadal hindcasts for the fifth phase of the Climate Model Intercomparison Project and performing a sensitivity experiment in which hindcasts are initialized from a model run forced only by surface wind stress. In both systems, sea surface temperature variability in the tropical Pacific is successfully initialized, but most skill is lost at lead years 2–5. Utilizing the sensitivity experiment enables us to pin down the reason for the reduced prediction skill in MPI-ESM to errors in wind stress used for the initialization. A spurious trend in the wind stress forcing displaces the equatorial thermocline in MPI-ESM unrealistically. When the climate model is then switched into its forecast mode, the recovery process triggers artificial El Niño and La Niña events at the surface. Our results demonstrate the importance of realistic wind stress products for the initialization of decadal predictions.