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Characteristics of inertial currents observed in offshore wave records

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It is well known that ambient currents can change the amplitude, direction and frequency of ocean surface waves. Regions with persistent strong currents, such as the Agulhas current off the east coast of South Africa, are known as areas of extreme waves, and wave height modulations of up to 50% observed in the shallow North Sea have been linked to tidal currents. In the open ocean, inertial currents, while intermittent, are typically the most energetic currents with speeds up to 0.5 m/s, and can interact with the surface wave field to create wave modulation, though this has not previously been reported.
We use long records of significant wave heights from buoy observations in the northeast Pacific and show evidence of significant modulation at frequencies that are slightly higher than the local inertial frequency. Quite apart from the relevance to surface waves, this result can provide a consistent and independent measurement, over a wide range of latitudes, of the frequency blue-shift, the strength and intermittency of ocean surface inertial currents.
Near-inertial waves constitute the most energetic portion of the internal wave band and play a significant role in deep ocean mixing. So far, observational data on near-surface inertial currents has tended to come from short records that do not permit the reliable determination of the frequency blue-shift, though this is an important factor affecting the energy flux from the surface into deeper waters. Long records from routine wave height observations are widely available and could help to shed new light globally on the blue-shift and on the characteristics of inertial currents.