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Automated detection of nonlinear internal waves from seafloor pressure time series

Uwe Stöber (1,2) and James N. Moum (2)

(1) Institut für Umweltphysik, Universität Bremen, Bremen, Germany (ustoeber@uni-bremen.de), (2) College of Oceanic & Atmospheric Sciences, Oregon State University, Corvallis, USA (moum@coas.oregonstate.edu)

Large amplitude, highly nonlinear internal waves (NLIWs) exert large forces and therefore represent a potential danger for offshore structures. At some locations this threat requires operational observations to guarantee the safety of drilling operations. Because NLIWs have a distinct signature in seafloor pressure and since pressure is related to the velocity responsible for large forces, simple and relatively inexpensive measurements of seafloor pressure provide sufficient information to identify potentially dangerous waves. Further cost benefits can be obtained by automated detection. Here, we present a test of an automated detection algorithm that is applied to two seafloor pressure time series from the New Jersey shelf. The algorithm is first applied to the complete time series and then operated in a pseudo-realtime mode with 1 h delay. The results of the detection in pressure are compared to a separate detection in vertical velocity to identify false positives and false negatives. Taking vertical velocity as a reference, the algorithm detects between 19 and 31% of all NLIWs. Strong NLIWs with amplitudes of more than $9\,\mathrm{cm\,s^{-1}}$ are always detected in at least one of the time series. False positives vanish for pressure amplitudes beyond 250 Pa, a modestly energetic wave.