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Weighing the ocean: How a single mooring in the mid-Pacific can monitor changes in ocean mass.

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Using ocean model data to investigate the physical processes which contribute to regional sea level frequency spectra has led to a curious result: ocean dynamics plays such a small role in interannual tropical ocean bottom pressure variability that it is dominated by non-dynamical effects. Furthermore, the loading and self attraction "fingerprints" associated with mass transfer between ocean and land become practically independent of the position of the land source, when sufficiently far away from land. This means that there is a mid-Pacific region where ocean bottom pressure changes are effectively a measure of the change in the mass of the total ocean (plus the well-determined component of atmospheric mass over the ocean). We give a practical demonstration of this principle by determining the annual cycle of ocean mass from a series of ocean bottom pressure records fortuitously obtained from this region as part of the US National Tsunami Hazard Mitigation Program. We obtain a value within the scatter of values obtained by others using satellite gravity data. We suggest that a small number of moorings could provide an important constraint on the ocean's long-term mass balance, and a valuable complement to satellite gravity measurements which helps to determine the degree one terms which are not directly observable by such a system.