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Air-sea interaction features in the Baltic Sea and at a Pacific trade-wind site - an inter-comparison study

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A systematic comparison of wind profiles and momentum exchange at a trade wind site outside Oahu, Hawaii and corresponding data from the Baltic Sea is presented. The trade wind data are to a very high degree swell dominated, whereas the Baltic Sea data include a more varied assortment of wave conditions, ranging from pure growing sea to swell. Showing the drag coefficient as function of the ten meter wind speed demonstrates striking differences for unstable conditions with swell for the wind speed range 2 ms-1 < U10 < 7 ms-1, the trade-wind site drag values being significantly larger than the corresponding Baltic Sea values. In striking contrast to this disagreement, other features studied are surprisingly similar between the two sites. Thus, exactly as found previously in Baltic Sea studies during unstable conditions and swell, the wind profile in light wind (3 ms-1) shows a wind maximum at around 7 – 8 m above the water, with close to constant wind above. Also, for slightly higher wind speed (4 ms-1 < U10 < 7 ms-1) , the similarity between wind profiles is striking, with strong wind increase below a height of about 7 – 8 m followed by a layer of virtually constant wind above. A consequence of these wind profile features is that Monin-Obukhov similarity is no longer valid. At the trade wind site this was observed to be the case even for as high wind speed as 10 ms-1. The turbulence kinetic energy budget was evaluated for four cases of 5 – 8 half-hour periods at the trade wind site, giving results that agree very well with corresponding figures from the Baltic Sea.