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Waves and wave-driven flow on a coral reef[1]

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It has been long appreciated that surface wave breaking is a primary mechanism for driving flows over coral reefs and so influences a wide variety of reef ecological processes. In this talk I will discuss measurements of waves and wave-driven flows made on the north shore of Moorea, FP. Despite the steep slope and large wave steepness, integral properties of the waves we observe match linear longwave theory to a remarkable extent, although their vertical structure does seem to differ from what is expected from theory. Our observations also show that the net transport over the reef is carried by both Stokes drift and a mean Eulerian flow, although the portioning changes as the waves shoal, break and dissipate. The balance between mean setup due to breaking, which also matches simple theory, and friction inshore of the surfzone/reef crest sets the overall flow rate. While simple theories match the observations quite well, their predictive value is somewhat reduced by the fact that they include 3 parameters that must be found empirically because they involve the basic geometry of the reef and the complex nature of frictional resistance associated with reef roughness.

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