

Roughness and the Effects of its Spatial Variability on Coral Reefs
Clifford HEARN*¹

¹ETI Professionals at USGS, St Petersburg, FL

Topographic and bathymetric complexity are key controls on the hydrodynamics of coral reefs. They exist on all spatial scales from microns to kilometers on reefs and within hydrodynamic studies are all treated as part of the spatial spectrum of the generalized concept of 'roughness'. Coral reef hydrodynamics treats roughness in a variety of ways at different spatial scales. Roughness has a major influence on the way that currents flow over reefs and the processes by which energy is transported and dissipated. A fundamental property of roughness is that the average roughness below any specified spatial scale is itself spatially variable on that scale. This means that a hydrodynamic model of a reef will necessarily include spatially varying smaller-scale roughness. This paper considers one feature of this phenomenon which is the change in roughness length, or frictional drag coefficient, encountered between distinct topographic zones of a reef such as the fore-reef, reef-flat and back-reef. The analysis is based on frictional Reynolds numbers for the individual zones of the reef which are combined into a 'reef Reynolds number' which is a measure the relative magnitudes of large scale and small scale roughness. The paper examines the implications of the larger scale variability of roughness on the connectivity between the zones of a reef as provided by the transport of materials and turbulence.