Geophysical Research Abstracts, Vol. 9, 02666, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-02666

Aerodynamic roughness of the sea surface at high winds

V.N. Kudryavtsev (1), **V.K. Makin** (2)

(1) Nansen International Environmental and Remote Sensing Center (NIERSC), Saint-Petersburg, Russia, (2) Royal Netherlands Meteorological Institute (KNMI), De Bilt, The Netherlands (makin@knmi.nl)

The role of the surface roughness in formation of the aerodynamic friction of the ocean surface at high wind speeds is investigated. The study is based on a wind-over-waves coupling theory. In this theory waves provide the surface friction velocity through the form drag, while the energy input from wind to waves depends on the friction velocity and the wind speed. The wind-over-waves coupling model is extended on high wind speeds taken into account the effect of sheltering of the short wind waves by the air flow separation from breaking crests of longer waves. It is suggested that the momentum and energy flux from the wind to short waves, that are trapped into the separation bubble of breaking longer waves, are locally vanished. At short fetch, typical for the laboratory condition, and strong winds steep dominant wind waves break frequently and provide major part of the total form drag through the air flow separation from breaking crests. That almost excludes the effect of the short waves on the sea drag. In this case the dependency of the drag coefficient on the wind speed is much weaker than would be expected from the standard parameterization of the roughness scale through the Charnock relation. At long fetch typical for the field, waves in the spectral peak break rarely and their contribution to the air flow separation is weak. In this case the surface form drag is determined predominantly by the air flow separation from breaking of the equilibrium range waves. As found at high wind speeds up to 60 m/s the model aerodynamic roughness is well consistent with the Charnock relation, i.e. there are no saturation of the sea drag.