Geophysical Research Abstracts, Vol. 8, 02299, 2006
SRef-ID: 1607-7962/gra/EGU06-A-02299

A new roughness length for heat and humidity during very near neutral conditions

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To describe the air-sea exchange of sensible and latent heat as well as momentum is crucial in modelling the atmosphere as well as the ocean.

Turbulent heat fluxes over sea (sensible and latent) can be calculated using the roughness lengths for heat and humidity. These parameters show in most investigations a scatter, which is larger than can be explained by uncertainty in measuring techniques and larger than is usually found over land. New results using data from the measuring station Östergarnsholm indicate that during very near neutral conditions, the roughness length for heat and humidity are strongly enhanced (Sahlee et al., 2005; Smedman et al 2005). The new theories gives increasing heat transfer coefficients for small air-sea temperature/humidity differences and high wind-speeds. This is opposite from traditional parameterisations using the Richardson number, which gives larger heat transfer coefficients for large temperature differences and low wind speeds.

To be able to fully understand the effect of these new results and the impact to the atmosphere and ocean they are implemented in different types of models and the results analysed. We use 3D regional limited-area climate model RCA developed for northern Europe to investigate the impact on the atmospheric conditions and a process-oriented ocean model for the Baltic Sea, for the ocean conditions.

The new formulations show a significant effect on the model results. For the atmospheric model the effect of this new regime is dominating the heat fluxes during high wind-speeds. The fluxes can be enhanced by about 100 Wm2 during some situations.