Geophysical Research Abstracts, Vol. 7, 07952, 2005
SRef-ID: 1607-7962/gra/EGU05-A-07952

Modelling new processes controlling the turbulent heat fluxes over sea in numerical models

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Turbulent heat fluxes over sea (sensible and latent) are generally calculated using different types of bulk formulation including bulk-coefficients. These coefficients 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 the process of *Forced Convection* is controlling the heat transport in the unstable region (Sahlee et al., 2005). The data also shows that Monin-Obukhov similarity theory is not valid and that the stratification is not a controlling parameter for the fluxes. 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.

Theories are developed using data from the measuring sites at Östergarnsholm east of Gotland in the Baltic Sea. The new theories are tested in two numerical models:

The ocean process-oriented model, PROBE-Baltic covering the Baltic Sea (*Omstedt and Axell*, 2003) and forced with gridded meteorological data.

The 3D regional limited-area climate model RCA (*Rummukainen et al.*, 2001) covering the Baltic Sea region.

The new formulations show a significant effect on the model results, especially on the heat fluxes, but also on mean parameters as sea surface temperature air temperature and humidity. The sensible heat fluxes are decreased or increased, depending on the situation, while the latent heat fluxes are mainly decreased. The effect seems to be

greatest during fall, where we have most situations with unstable stratification and high wind-speed.

References

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