

Parameterization of bulk transfer coefficients and flux calculation over a lake surface

Aiko Miyano^{1*}, Michiaki Sugita¹

¹Grad. Schl. Life & Env. Sci., U. Tsukuba

The bulk formulation is the most useful method to determine fluxes over water surfaces. To estimate fluxes accurately by this method, the proper value of bulk transfer coefficient is essential. Although many studies have been done over sea surfaces, the behavior of the coefficients over a lake surface is not well known. Therefore, the turbulence and profile data have been collected and the coefficients for momentum, sensible heat and latent heat were calculated at the center of Lake Kasumigaura. In this study, how the coefficients differ from oceans and what parameters are affecting them were discussed. As a result, all the bulk transfer coefficients showed strong relations with wind speed U . The dependency was different from sea surface for $U < 4$ m/s, where the values decreased rapidly, but similar for higher wind speeds; stayed constant for $4 < U < 10$ and slowly increased for $U > 10$. Sensible and latent bulk coefficients were also related to temperature. From the sensitivity analysis on each bulk transfer coefficient, it was found out that both momentum and scalar coefficients were more affected by their roughness lengths than atmospheric stability. Momentum roughness length here was determined from three types of water surfaces, that is, smooth, capillary wave-dominated and gravity wave-dominated surfaces. The scalar roughness length, on the other hand, has a good relationship with roughness Reynolds number and can be calculated by the parameter. Bulk transfer coefficients derived from the estimated roughness lengths are very close to the real values, except for those under weak wind conditions.

Keywords: water surface flux, bulk formulation, roughness length