Analysis of experimental data of surface fluxes in experiments FIFE, KUREX, TARTEX and SADE.

Panin G.N. and Nasonov A.E. (Institute of Water Problems, RAS)

Abstract

Modern measurement methods of the surface turbulent fluxes (STF) of heat, moisture and momentum in the near surface atmospheric layer by the eddy correlation method and their calculation, relay on the validity of the similarity theory of Monin-Obukhov, which requests stationarity and horizontal homogeneity. Experimental data taken at specially selected sites allowed to develop this concept.

Recently performed experiments, purposely conducted in non-ideal conditions showed an underestimation of the STF values.

Analysis of field experiments showed, that the statistical error δ is often too small to close the observed gap in the sum of the four fluxes. Moreover, the gap is of a non-statistical nature. Almost independently on the type of field experiment, the sign of the gap shows too small turbulent fluxes.

This gap indicates the existence of a systematic error Δ besides the statistical error δ In order to account for this systematic error the basic formulation of the one-dimensional surface energy balance is given in form:

$$R_n - \lambda E^{HH} - H^{HH} - G = R_n - STF^{HH} - G = \Delta \pm \delta$$

The observed amount of imbalance was connected with the degree of heterogeneity of the landscape around the energy balance station. Results from the field experiments FIFE, KUREX, TARTEX and SADE, point to a relation between the underestimation of the turbulent fluxes and the terrain inhomogeneity. To systematize the correction for this effect a scheme is suggested.

This scheme might prove to be useful for the design of new validation experiments in non-ideal terrain.