Geophysical Research Abstracts, Vol. 9, 06660, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-06660

Using AVHRR/NOAA and MODIS/Terra information on land surface characteristics for modeling vertical water and heat fluxes from river basin area

A. E.L.Muzylev (1), B. A.B.Uspensky (2), C. Z.P.Startseva (1), D. E.V.Volkova (2), E. A.V.Kukharsky (2).

(1) Water Problem Institute of Russian Academy of Sciences, Moscow, Russia. (muzylev@aqua.laser.ru Phone: 7-495-1355403. Fax: 7-495-1355415)

(2) Scientific and Research Center of Space Hydrometeorology Planeta. Moscow, Russia. (uspensky@planet.iitp.ru Phone: 7-495-2552137. Fax: 7-495-2004210).

The methodology has been developed and tested for AVHRR/NOAA data processing that provides the retrieval of three types of LST- land surface temperature (namely, land skin temperature T_g, air temperature near foliage T_a, and efficient temperature $T_{s.eff}$), and surface emissivity E, as well as the derivation of three vegetation characteristics, in particular, normalized vegetation index NDVI, vegetation cover fraction B, and leaf area index LAI. The temperature $T_{s.eff}$ is defined as a weighted linear combination of ground (T_g) and foliage-air (T_a) temperatures. The algorithms for AVHRR-based estimation of $T_{s.eff}$, T_g, T_a utilize linear statistical regression similar to well-known split window technique. The specification of E, relating to AVHRR channels 4 and 5, is made using empirical relationships between E and B, E and NDVI together with emissivity models for various surface types. To estimate LAI, empirical relationships have been applied between LAI and NDVI for different land covers. The comparison of satellite estimates T_a, $T_{s.eff}$, T_g with synchronous collocated in-situ measurements during the1998-2005 vegetation seasons gives RMS errors in the range 1.5-2.0, 2.5 -3.5, and 3.5-4.5˚C respectively.

Besides the experimental dataset of remote sensing products has been compiled that includes MODIS/EOS Terra-based estimates of $T_{s.eff}$, NDVI, LAI, E for the region of interest and different dates within the 2003 vegetation season. The verification of $T_{s.eff}$ estimates has been performed via comparison with analogous and collocated

AVHRR-based estimates. The differences between MODIS-based and AVHRR-based $T_{s.eff}$ estimates are found about of RMSE for the latter.

The above satellite-derived products have been used to develop procedures of their assimilation in the model of vertical heat and water transfer in the "soil-vegetation-atmosphere" system (SVAT) for river basin. The model accounting for land surface heterogeneities allows to assess evapotranspiration Ev, vertical soil moisture and temperature profiles, soil surface and vegetation temperatures as well as sensible LE and latent H heat fluxes for any time interval within vegetation season. The river basin landscape patchiness has been represented in the model with soil constants, index LAI, fraction B and other vegetation characteristics. These values have been treated as the model parameters using the finite element schematization of the basin. The Seim River basin with watershed area equal to 7460 km^2 situated in forest-steppe zone of the Central Russia (Kursk region) has been chosen for investigation. The model has been validated using standard hydrometeorological data and satellite-derived estimates of several surface and vegetation characteristics. The capabilities have been investigated to replace the ground-based estimates of LAI, B and T_a by satellite-based ones while computing Ev, LE, H and other components of water and heat balances. Model runs with assimilation of LAI, B and T_a estimates (obtained from ground-based observations or from satellite data) demonstrate that the discrepancies between modeled and satellite derived LSTs for different dates of each vegetation season do not exceed the RMS errors inherent for the LST evaluation. The acceptable accuracy levels of water and heat balance component assessment have been also achieved under all scenarios of LAI, B and T_a specification. These results give evidence for the applicability of satellite derived LAI, B and T_a estimates to calculate the vertical water and heat fluxes especially for the territories where surface observations are sparse.