Geophysical Research Abstracts
Vol. 14, EGU2012-4932, 2012
EGU General Assembly 2012

Distributed land surface modeling with utilization of multi-sensor satellite data: application for the vast agricultural terrain in cold region

E. Muzylev (1), A. Uspensky (2), A. Gelfan (1), Z. Startseva (1), E. Volkova (2), A. Kukharsky (2), P. Romanov (3), and M. Alexandrovich (1)

(1) Water Problems Institute of RAS, Laboratory of Hydrological Cycle, Moscow, Russia (hydrowpi@aqua.laser.ru), (2) State Research Center of Space Hydrometeorology Planeta. Moscow, Russia (uspensky@planet.iitp.ru), (3) City College of City University of New York, New York, NY, USA (Peter.Romanov@noaa.gov)

A technique for satellite-data-based modeling water and heat regimes of a large scale area has been developed and applied for the 227,300 km2 agricultural region in the European Russia. The core component of the technique is the physically based distributed Remote Sensing Based Land Surface Model (RSBLSM) intended for simulating transpiration by vegetation and evaporation from bare soil, vertical transfer of water and heat within soil and vegetation covers during a vegetation season as well as hydrothermal processes in soil and snow covers during a cold season, including snow accumulation and melt, dynamics of soil moisture and temperature during soil freezing and thawing, infiltration into frozen soil. Processes in the "atmosphere-snow-frozen soil" system are critical for cold region agriculture, as they control crop development in early spring before the vegetation season beginning.
For assigning the model parameters as well as for preliminary calibrating and validating the model, available multi-year data sets of soil moisture/temperature profiles, evaporation, snow and soil freezing depth measured at the meteorological stations located within the study region have been utilized. To provide an appropriate parametrization of the model for the areas where ground-based measurements are unavailable, estimates have been utilized for vegetation, meteorological and snow characteristics derived from the multispectral measurements of AVHRR/NOAA (1999-2010), MODIS/EOS Terra & Aqua (2002-2010), AMSR-E/Aqua (2003-2004; 2008-2010), and SEVIRI/Meteosat-9 (2009-2010). The technologies of thematic processing the listed satellite data have been developed and applied to estimate the land surface and snow cover characteristics for the study area. The developed technologies of AVHRR data processing have been adapted to retrieve land surface temperature (LST) and emissivity (E), surface-air temperature at a level of vegetation cover (TA), normalized vegetation index (NDVI), leaf area index (LAI) and vegetation cover fraction (VCF). On the base of special technology, the archive has been also prepared for the study area comprising remote sensing MODIS-derived products (LST, E, NDVI, LAI). The new technique for combining MODIS and AMSR-E snow retrievals and generating continuous (gap-free) maps of snow cover characteristics has been developed and tested. Besides, the original technique has been developed and applied to retrieve estimates of LST and E from the SEVIRI/Meteosat-9 data. Thus, the archive of AVHRR, AMSR-E and MODIS remote sensing products has been complemented by the SEVIRI-derived estimates of ls and for two vegetation seasons.
Opportunities of utilizing land-surface/snow remote sensing products obtained from the different sensors (SEVIRI/Meteosat-9, AVHRR/NOAA, MODIS/EOS Terra & Aqua, AMSR-E/EOS Aqua) in the developed RSBLSM has been studied. Sensitivity of the simulation results to different satellite remote sensing data has been analyzed. The obtained results allowed concluding that utilization of the differently derived satellite-based estimates in the developed model, intensively calibrated and validated against the available ground observations, provides an opportunity for reproducing spatial fields of evapotranspiration, soil moisture and temperature at different soil depths, temperature of soil/vegetation surfaces, snow and other water and heat characteristics for the vast agricultural region.