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Simulation cascade of NWP and land surface model for drought monitoring

O. Kravchenko, N. Kussul

Space Research Institute of NASU-NSAU, Ukraine (inform@ikd.kiev.ua / Fax: +38 044-5264124)

To detect drought condition, estimate drought extent and assess damage such as crop yield losses it is necessary to consider several key parameters of coupled soil-canopy system such as soil temperature and moisture profiles, vegetation water content and pigments concentrations. Modern remote sensing techniques can provide estimates of some of these variables with sufficient spatial and temporal resolution. For instance numerous vegetation indexes, estimates of land surface temperature, vegetation water content based on AVHRR, MODIS, MERIS, ASAR data. However soil moisture estimates and especially soil temperature and moisture profiles remain challenging for current remote sensing. To overcome these deficiencies modern Land Surface Models (LSM) with proper data assimilation procedures can be used.

We present a simulation cascade for drought monitoring. The cascade consists of modern Numerical Weather Prediction (NWP) model and Land Surface Model. We use regional Weather Research&Forecasting (WRF) NWP model and Noah Land Surface Model. The results of WRF simulations are used to provide meteorological forcing data for Noah model. Currently we routinely run these models in Space Research Institute with horizontal spatial resolution 10 km and provide operational forecasts every 6 hours [1]. Forecasts are delivered to user via dedicated Web-service (http://dos.ikd.kiev.ua/?option=com_wrf).

The performance of the models was examined on exceptional drought in Southern Ukraine in 2007. We've conducted several long-term continuous run experiments for April-August 2007 with different parametrization options. Models were configured

over Ukraine territory with 10 km spatial resolution. To ensure stability of the models we use analysis nudging, which is simple but efficient four-dimensional data assimilation scheme available in WRF modeling system. Model's results was validated against SYNOP observations and MODIS based Land Surface Temperatures estimates. Comparison showed that WRF model is capable to reproduce well several key atmospheric parameters such surface air temperature. Noah model shows good performance over western Ukraine while performing worse over eastern regions. The variance in skill of Noah model can be explained by the time shifts between MODIS observations and model output.

Nowadays Ukrainian Earth Observation system GEO-UA is under development as a national segment of GEOSS. The simulation cascade is used for drought monitoring within the system.

[1] Kussul N., Shelestov A., Skakun S., Kravchenko O.: Data Assimilation Technique For Flood Monitoring and Prediction, International Journal "Information Theories and Applications", 2008, Volume 15 (in press)