Comments on Summary (avtoreferat) of the thesis submitted for the degree of a Candidate of Science in physics and mathematics by Kazakova Ekaterina Vladimirovna "Ezhednevnaya ocenka lokalnyh znachenii i obyektivnyi analiz kharakteristik snezhnogo pokrova v ramkah sistemy chislennogo prognoza pogody COSMO-RU"

In the work of Kazakova Ekaterina Vladimirovna, a new externalized system for objective analysis of the snow cover properties has been developed and coupled to the numerical weather prediction (NWP) system COSMO-RU. The purpose of the system is to improve weather forecast of COSMO-RU by more accurate description of the initial state of snow cover of each forecast run, which are started several times every day. The core of the proposed analysis system is a new multilayer snow cover model (MMSP), developed by the author. The model is applied at the SYNOP station locations in order to convert the observed snow depth to snow density and snow water equivalent (SWE), which are prognostic variables in the NWP model. In addition, these variables calculated at each SYNOP station are interpolated to the COSMO-RU grid by using a method based on Delaunay triangulation. After the intepolation, satellite-based snow extent observations may be applied to correct the analysis where the SWE values are small.

Background SWE for the externalised snow analysis for the fine-resolution regional COSMO-RU is provided by the global coarse-resolution snow analysis from Deutscher Wetterdienst. The analysed values provide a starting point for the next forecast run by COSMO-RU, which applies its own prognostic snow scheme. In this approach, MMSP works independently of the prognostic snow parametrization of the the NWP model. The suggested approach differs from the conventional snow data assimilation in NWP, where both the analysis and forecast are consistently integrated into one framework via data assimilation cycling process.

The methodology has been tested in the environment of COSMO-RU and has been shown to improve the weather forecast, in particular the prediction of screen-level temperature close to the border of snow cover. In addition to the objective analysis, MMSP was applied also for postprocessing of NWP output for the prediction of the thickness of newly fallen snow layer. Evidently, the methods are ready for operational application and for further development in the framework of COSMO-RU system.

The results presented by the author for the defense of the dissertation have been extensively published in peer-reviewed journals and specialized publication series. Summary is well written and allows to understand the main features of the suggested methodology. In particular, the schematic figure (Fig.5) is valuable for the understanding. However, from the description it is not clear how the snow mask from NOAA and MODIS satellites was combined with the SWE field and what is the role of the different components of the snow analysis for the improvement of the weather forecast. In the future, it would be useful to compare the coupled objective snow analysis, suggested here, to the integrated snow data assimilation methods developed for the NWP models elsewhere.

In my opinion, the author of the dissertation has done big and valuable work. According to the Summary, the work meets the Supreme Attestation Comission (VAK) reqierements and without doubt the author deserves the degree of the candidate of physico-mathematical sciences.

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