The STSM applicant submits this report for approval to the STSM coordinator

Action number: COST ES 1404
STSM title: "Using ERA-Interim data and SNOWPACK to reconstruct snow load in the mountain regions of Bulgaria"
STSM start and end date: 25/03/2018 to 01/04/2018
**Grantee name: Dimitar Nikolov**

The main goal of the proposed research was to accomplish one larger project for testing the possibility to use snow-cover models for simulation and assessment of the snow load in the mountain regions of Bulgaria. The advantage of this approach is that once validated, it allows assessing snow loads even in locations where no information on the snow cover is available, which is mostly the case in complex mountain terrain.

We thus decided to use the snow-cover model SNOWPACK developed by the WSL Institute for Snow and Avalanche Research SLF (WSL/SLF) and assessed its ability to correctly simulate the height and the bulk density of the snow cover at four meteorological stations in the Bulgarian mountains with altitudes ranging from 1680 up to 2376 m above sea level.

DESCRIPTION OF WORK CARRIED OUT DURING THE STSMS

Our first task was to extent the period from 2008/2009 – 2015/16 to full 10 winter seasons (2007/08-20016/17) and to fill some missing data. This was done before the start of the proposed STSM. In Davos we firstly transformed the format of the data from xls to smet and then started the simulations. After first results we realized that the parameterization of the solar radiation (which is missing in the original input data) with the available cloud cover degree is not the appropriate one and this was corrected. Due to this correction we made the simulations again for the whole period and replaced the previous results. The new results now represents much better the measured snow height as it is shown on the first figures (1 and 2) below.

**DESCRIPTION OF THE MAIN RESULTS OBTAINED**
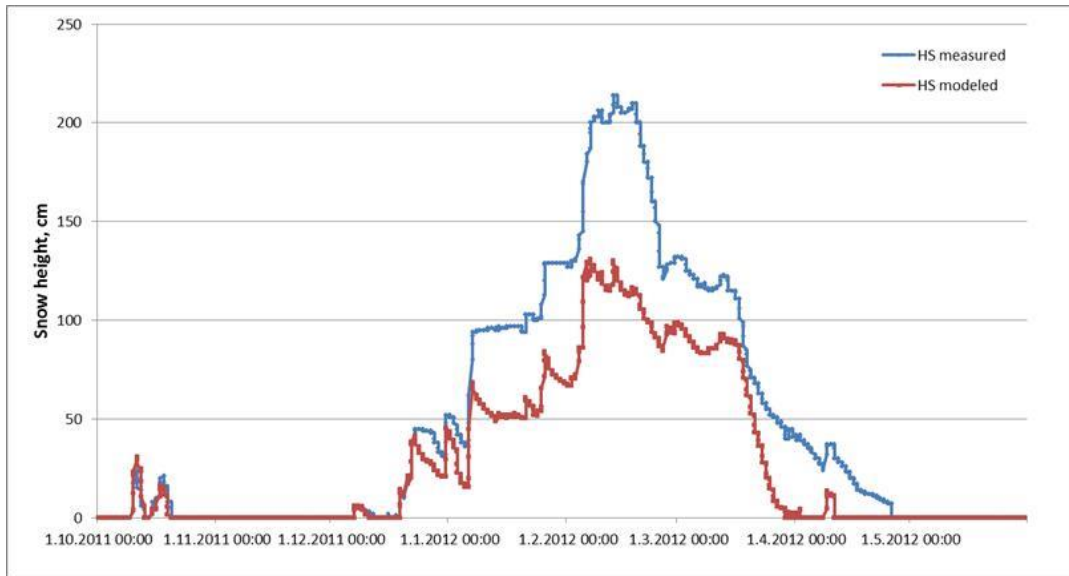
Fig. 1. Simulation of the snow cover for peak Rojen for the winter season 2011/12 with the first parameterization of the solar radiation
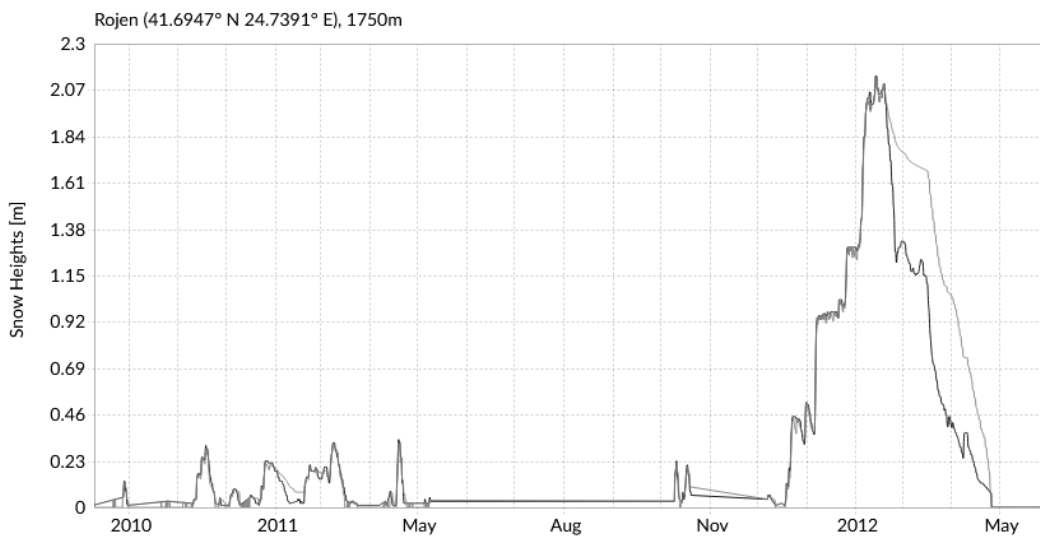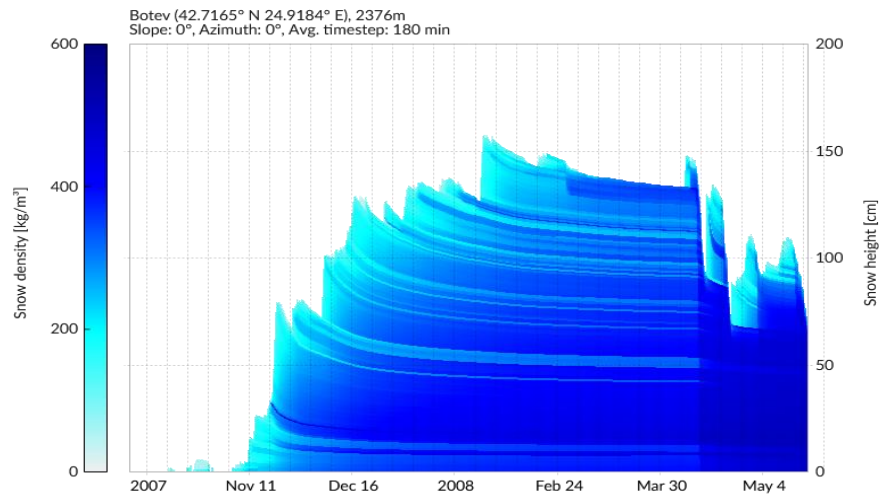

**Fig. 2.** The same as for Fig. 1. but with the new solar parameterization

On the next three figures are presented some examples from the simulation and comparison of the snow heights and the densities for the stations Botev, Cherny and Murgash.
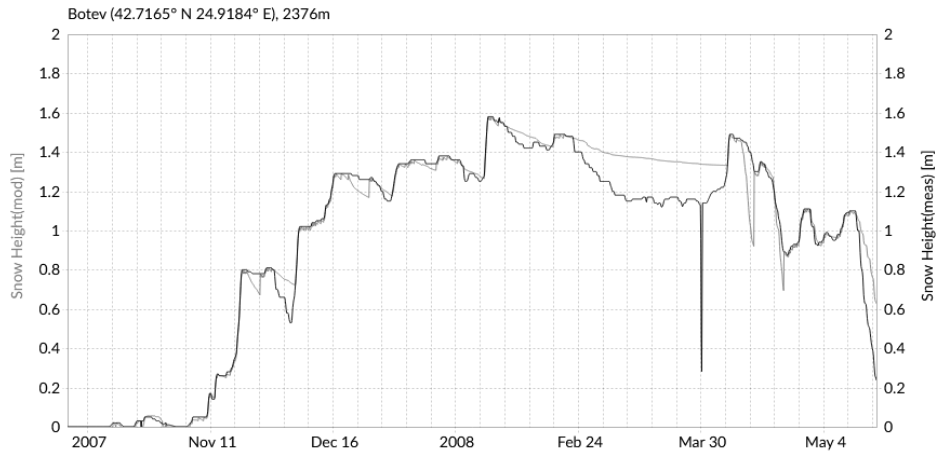
Fig. 3. Results from the simualtions of the snow height for peak Botev, 2007/08

Fig. 4. Results from the simualtions of the snow height for peak Botev, 2007/08
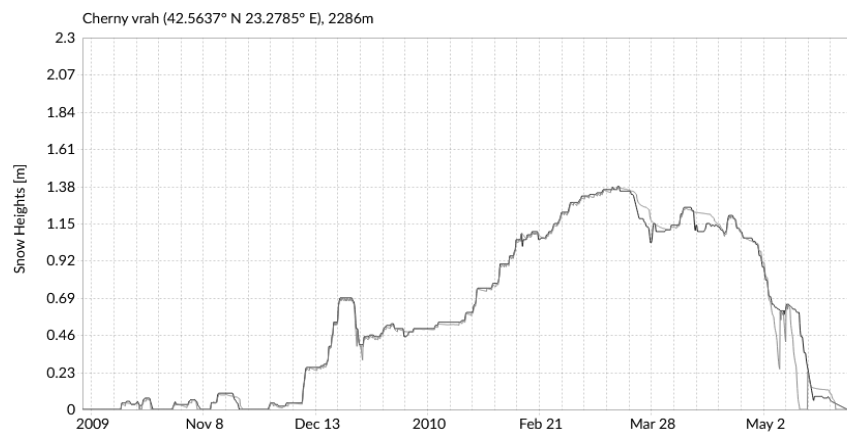
Fig. 5. Results from the simualtions of the snow height for peak Cherny vrah, 2009/10

Fig. 6. Results from the simualtions of the snow height for peak Rojen, 2014/15

First results show very good match of the simulated results with the measurements except for the periods when the measurements settle very fasts and this needs additional investigation.

Our next task was to test the ERA-Interim reanalysis. For this purposes we are using a data set which consists of 5 full years (2007-2012) and 6 additional stations. This analysis is being currently further conducted.

I was able also to learn confidently the use the SNOWPACK model and this will allow me to apply it in different scientific tasks at my institute.

Due to the limit time frame we did not manage to visit the Weissfluhjoch (2 693 m) station but we have discussed the basic snow measurement requirements and we will prepare later in the year a proposal for including two of the Bulgarian mountain stations (Borev vrah and Cherny vrah) in the Global Cryosphere Watch program.

The first results from this STSM were presented at the EGU 2018 Conference in Vienna on the 10 April as a PICO presentation.

The final results are being now summarized and will be submit later in an international scientific journal for publication.

FUTURE COLLABORATIONS (if applicable)

This work will continue with the ERA-Inrerim validation and further ERA-Inrerim driven SNOWPAK simulations of 4 scientific field measurement trips in the Bulgarian mountains in the period 2007-2009. Then the period of these ERA-Inrerim driven SNOWPAK simulations will be extended for achieving long data series of snow loads with different return period. Time frame for these planned activities is 4-5 months.

After that we will search for appropriate common scientific program opportunity in order to prolong this collaboration.