Application of new microwave remote sensing data for determination of snow cover parameters in North Eurasia regions

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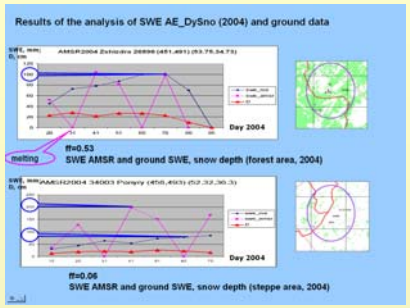
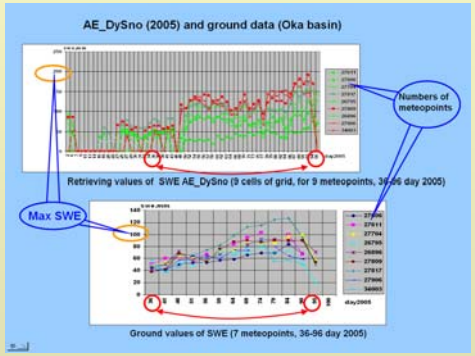
Snowcover of Center European part of Russia

Test areal –basin Oka

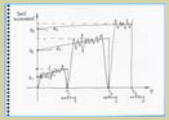


It is traditionally considered, that the greatest divergences of retrieving models and real values of a water equivalent should take place in wood regions because of additional scattering in crones. We have tried to compare retrieved values of SWE with ground data for days when measurements on meteorological stations are made(10,20,31,41,51, etc. day of year). We have found out, that remote value of SWE is overstated in 2 and more times the ground SWE in a steppe zone at the end of winter. Local minimums swe_amsr – thaw weather.



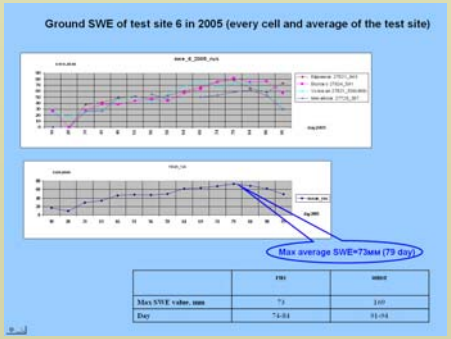
To explain this fact we had to analyze all the days of winter. You see graphs for all days of winter, when there are data AE_DySno (area of Oka basin).
Winter 2005 is not absolutely standard. In January there was a long thawing weather with high temperatures. The snow has almost disappeared. The ice drift was on the rivers (see first slide). The insignificant snow cover remained only in the forests (less than 10 cm) by January, 20. Open areas were without snow. New snowcover has appeared after January, 20. In February, 1 - March,15 snowfalls were regular and the climatic norms of SWE were established (about 85 mm) in March, 5.
Only 2-3 thawing weather (on February, 16-18 or 47-49 day 2005, then 77 day and 85 day) there were in this territory for this time. The snow planks (with significant thickness and density) were formed as a result of a thawing weather. It was resulted to the growth of retrieved values of SWE AMSR . There were no substantial growth of ground values of SWE after a thawing weather. For example, values of AMSR SWE exceed the ground data in 2 and more times after melting 15-18 Feb.

Application of the microwave data for the regional hydrological forecast by help Chang model demands updating retrieved values of SWE after each melting, especially with thaw weather with rain, in particular for territories without forest, where changes of brightness temperatures occurs after a thawing weather due to formation crusts and snow planks. For example, reduction of the retrieved value of SWE after each thawing weather and the subsequent freezing ("parallel shift of a part of the schedules down") will allow to result overestimated values SWE in conformity with ground measurements.
Values of SWE AMSR exceed ground values SWE in 2 times after a thawing weather. This fact is caused not by increasing of SWE but sharp change of snow structure and formation of a rigid snow plank.

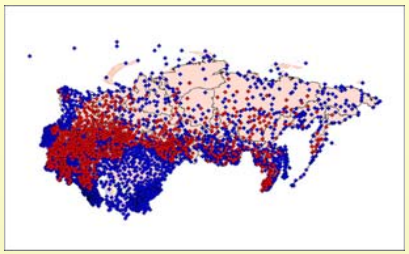


Discrete character of behavior SWE microwave of center of European part (winter with thaw weather)

The traditional means of snow cover observation include the network of meteorological stations, the transect snow data and remote sensing data in the visible and near-infrared bands. The passive microwave remote sensing data are an alternative means of snow cover observation. The existing global algorithms for snow cover depth and water equivalent determination can not get a snow characteristics with an accuracy required for solution of regional hydrological problems. The use of the general algorithm results in high probabilities of errors in snow cover recognition for the European part of Russia, where winters are warm and the snow often happens to be wet.
Start of the American satellite "Aqua" with a new generation of microwave sensor AMSR-E on board allowed to hope for reaching of more exact estimations of SWE in real time.
Research of maps SWE (AE_DailySno, 2003-2005) is implemented for territory of Polar Ural and Center of European part of Russia on the basis of AMSR-E microwave data. Matching of the snow water equivalent maps (AE_DailySno) and SWE, calculated by SSM/I data with ground snow courses data (2003-2005) for this territory is carried out. We see that it is not possible to provide reaching of the stated accuracy (25%) for all territory of Russia within the framework of one universal algorithm.

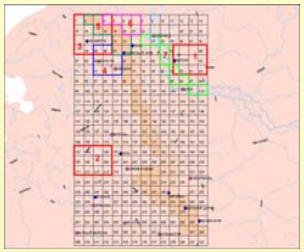


The monotone modification (increasing) of ground values of SWE on meteorological stations of a polygon 6 is shown on this slide. In the end of winter max ground average SWE = 73 mm, max retrieving SWE AE_DySno=169мм.

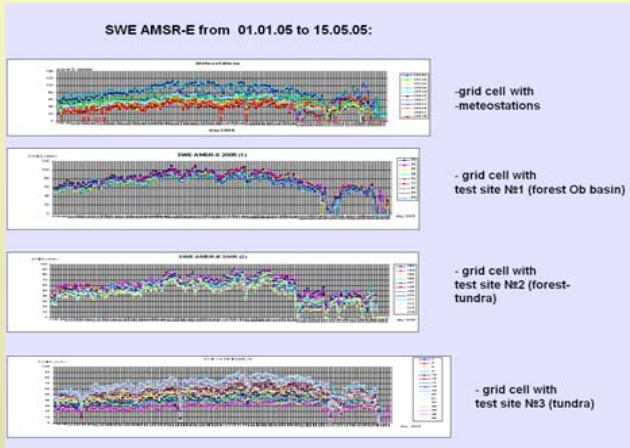


Network of meteorological stations. Now there is a deficit of ground data of snow cover in a polar regions of Russia.

Snowcover of Polar Ural

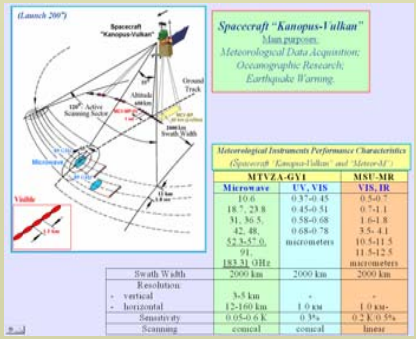


Test areal and test sites



Research of maps SWE (AE_DailySno, 2005) is implemented for territory of Polar Ural

Sub polar Ural – metepoints 23226 and 23220 – tundra. Snow density 0.3-0.35 g cm-3) corresponds to time & space static coefficient 4.8. But retrieving values excess above ground SWE in 2-4 times in beginning of winter and understating in 2-3 times in the end.



Start of the Russian satellite "Canopus-Vulkan" with passive microwave sensor on board is scheduled in 2007