

COSMO Priority Task SNOWE

WG3b

Period 09.2014-02.2016 (0,5 FTE)

TL Inna Rozinkina (Russia)

Goal

To create the system of initialization of Snow Water Equivalent (SWE) fields based on the coupling of first-guess of COSMO fields with the results of continuous calculations of SWE values for full snow period with use of the information of standard (SYNOP) meteorological measurements

Motivation

The atmospheric modeling need snow Water Equivalent (SWE) and Snow Density (SD) fields as initial fields. The determination of SWE is important first for accurate calculation of land surface T, T2m and as a consequence – of the set of weather conditions, due on the stability of bottom atmospheric levels. The errors of SWE in end of snow period can lead to great errors of T2m because this values determine the boundary of snow covered cells and the possibility of appearance of fractional cover (thawed patches). During the snow melting period the band with sensitive for SWE initial values forecasts (first of T2m) can reach up to 200 km. The errors of T2m in this area can achieve to 10-12 degrees! (Kazakova E., Rozinkina I., COSMO Newsletter, 2011).

In the actual technologies of COSMO forming of initial fields nested into GME DAS the errors of SWE for end of snow period can achieve up 100-200%. This fact can made the forecasts of T2m near snow boundary not realistic. The problem is that SWE is not measured operatively and is not included in the international exchange of operational meteorological data. (This values are held only on restricted number of specialized stations during snow courses which are done once in 5-10 days and often mostly in second half of snow period). Such an information is local and doesn't come into international data exchange through meteorological broadcasts, so it couldn't be used as base data source in operational data assimilation systems. The SWE values can be received through empirical relationships which allow converting snow depth or with use the functions of snow aging. The both method have the discrepancies connected, as a rule, with parametrical setting of snow density. The use of snow parameterization of land surface during the DAS cycles provide the accumulate errors of precipitation and of heat fluxes during long period of continuous land-surface modeling in systems cyclic DAS systems

The measurements of snow depth on the synoptic stations consists the main source of information about snow cover for the global DAS for initialization of fields for COSMO regional calculations. Satellite data with high spatial and/or temporal resolution could be used for more reliable snow boundary determination. In same time the algorithms of atmospheric model need the initial values of SWE.

The problem is that determine SWE of accumulated snow cover based the operational measurement data. The proposed approach with continuous 1-d modeling of the SWE for each measurement station with use as input the SYNOP operational data showed the positive results and the significantly lower error in initial SWE fields from current COSMO-GME technologies. This error was also less that with use the more easy means with implementation of Snow Density as regional empirical constants.

The new PT Propose to realize the technologic system of forming of initial fields of SWE by coupling of first guess fields from DAS GME-COSMO modeling system as with calculated accumulated valued of SWE in Synop stations

Period: 09.2014 - 08.2015

Requered FTE: 0.5

Description of actions:

1. Realization of 1d-algorithm SWECALC for calculation of accumulated snow WE based on regular network measurements: results of preliminary tests will be provided (0,05 FTE)
2. Tests for different climatic and landscape conditions and tuning of 1-D algorithm SWECALC will be done. Software of 1-d algorithm SWECALC and estimates of reliability for different periods will be prepared (0,05 FTE)
3. Technology for coupling of calculation of WE 1-D calculation with FG from GME-COSMO technology (0,1 FTE)
4. Numeric experiments with COSMO model for understanding the sensitivity of T2m forecasts for changes in initial SWE values (0,1 FTE)
5. Tests and tuning of system. (0,1 FTE)
6. Proposed new software for be include into operational COSMO technologies and its description (0,1 FTE)

Participants:

Ekaterina Kazakova 0.40

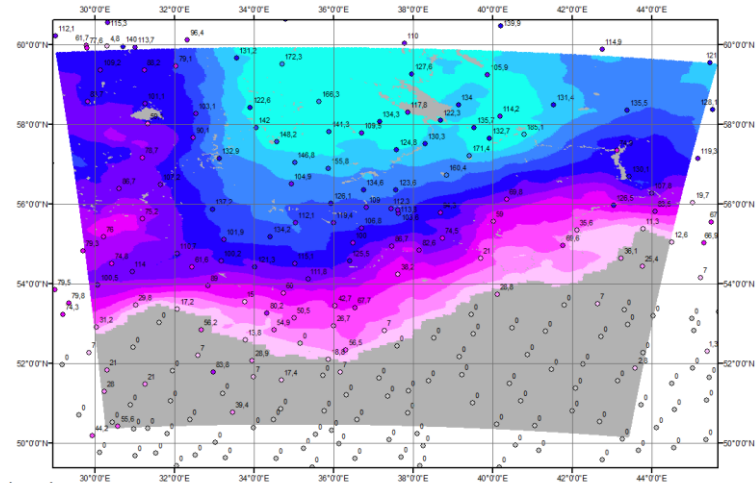
Michael Chumakov 0.05

Inna Rozinkina 0,05

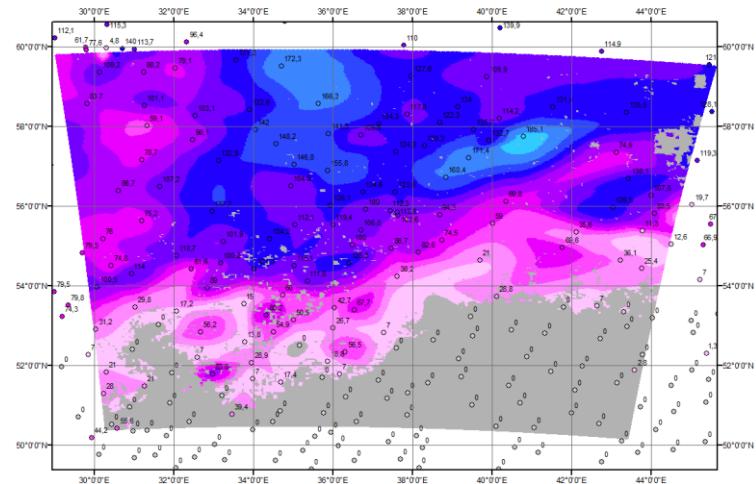
Appendix 1

List of Subtasks

		<i>Start</i>	<i>Time of deliverables</i>	<i>Activities</i>	<i>Deliverables</i>
1	Kazakova E. 0,06 Chumakov M. 0,03 Rozinkina I. 0,01	09/2014	10/2014	Realization of 1d-algorithm SWEALC for calculation of accumulated snow WE based on regular network measurements Analysis of the tests for different climatic area and tuning of 1-d SWEALC.	Results of tests with use of 1d measurement of hydrological stations in different climatic area (appr. from 65° till 45° Lat) The software of 1-d algorithm SWEALC The estimates of reliability for periods of snow accumulation and melting for snow periods 2012/2013 and 2013/2014
2	Kazakova E. 0,08 Chumakov M. 0,02	11/2014	04/2015	The coupling of SWEALC and FG from initial COSMO data The COSMO runs with coupled scheme of assimilation of Snow WE on the real-time for the whole snow period	The preliminary variant of technology of initialization of fields of WE amounts for based on the correction of initial data (FG) of WE of COSMO technology
3	Kazakova E. 0,07 Rozinkina I. 0,03	05/2015	07/2015	Analysis of results of experimental runs.	The results of runs proposals for tuning, proposals for improvement Paper in COSMO-Letters
4	Kazakova E. 0,09 Rozinkina I. 0,01	07/2015	08/2015	Preparing of new software for be include into operational COSMO technologies and its description	Software for initialization of SWE based the SWEALC algorithms, Coordination with snow OA schemes development into DAS Presentation on the COSMO GM



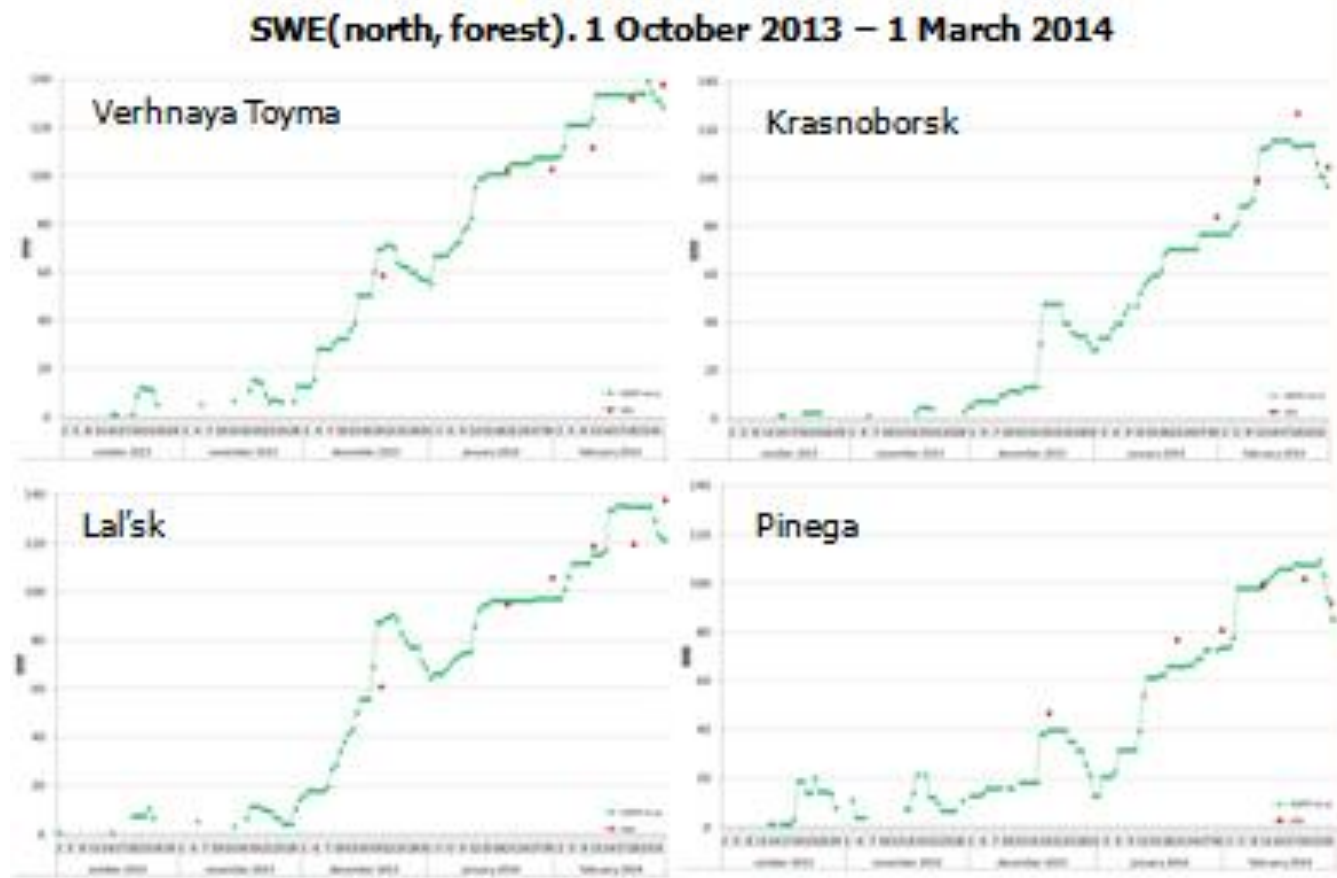
Legend
 0 1-20 41-60 80-100 121-140 160-180 250 350 500 700 900 1100 1300 1500
 21-40 52-80 100-120 141-160 182-200 300 400 600 800 1000 1200 1400



Legend
 0 1-20 41-60 80-100 121-140 160-180 250 350 500 700 900 1100 1300 1500
 21-40 52-80 100-120 141-160 182-200 300 400 600 800 1000 1200 1400

Upper: the SWE Fields as start field of operational COSMO runs (control experiment)

Bottom^ the field of SWE from SNOWE-calculations



The simulations of SWE (lines) with comparison of hydrological measurements

T2m from COSMO-Ru : operational version and experiment with changed SWE initial fields for the points near the snow boundary

Station	10 Apr 2013, 12 UTC (day)			11 Apr 2013, 00 UTC (night)		
	Obs	Ctrl	Ex	Obs	Ctrl	Ex
Efremov	8,0	4,3	6,6	-0,4	-0,5	-0,6
Volovo	6,9	0,6	5,8	-1,1	-3,6	-1,7
Verhovie	7,0	1,2	6,0	0,8	-1,2	-0,2
Temnikov	7,2	6,2	5,6	0,2	0,7	-3,0
Unacha	7,1	6,6	5,4	1,0	0,4	0,7
Fateg	8,1	5,6	6,7	-1,5	-3,0	0,3