
Snow analysis for COSMO Consortium – Kick off meeting

Wednesday November 18, 2020, 9h - 13h CET, Zoom meeting

Participants:

Marco Arpagaus, Sascha Bellaire, Jean-Marie Bettems (chair & minutes), Louise Braud, Varun Sharma (MeteoSwiss)
Gernot Geppert, Juergen Helmert, Martin Lange, Christoph Schraff (DWD)
Inna Rozinkina and 3 colleagues (RHM)
Bodo Ahrens (Uni Frankfurt)
Evgenii Churiulin (Uni Kassel)

Agenda:

09h00 - 09h20 Welcome & Introduction [Jean-Marie]
09h20 - 10h10 Status & plan at DWD [Martin, Gernot]
10h10 - 10h50 Status & plan at MCH [Sascha, Louise]
11h20 - 11h50 Status & plan at RHM (to be confirmed) [Inna, ...]
11h50 - 13h00 Discussion [all]

Status and plans at DWD

(http://www.cosmo-model.org/content/tasks/workGroups/wg3b/docs/snow_analysis_2020118_dwd1.pdf ,
http://www.cosmo-model.org/content/tasks/workGroups/wg3b/docs/snow_analysis_2020118_dwd2.pdf)

- Status: snow analysis based on in situ SYNOP observations (snow depth, precipitation & temperature), NOAA global snow depth analysis, NOAA IMS snow mask. Cressman analysis for lateral interpolation. Target variables are snow depth and fresh snow factor. Independent code base.
- Plan: transfer into DACE framework and replace Cressman with 2D Var analysis, targeting a working version till end 2021, then testing and tuning. Additional developments, like use of ensemble information to complement horizontal and vertical correlation functions in the B matrix, or evaluation of LETKF, or use of satellite derived SWE later on.

Status and plans at MCH

(http://www.cosmo-model.org/content/tasks/workGroups/wg3b/docs/snow_analysis_2020118_mch1.pdf ,
http://www.cosmo-model.org/content/tasks/workGroups/wg3b/docs/snow_analysis_2020118_mch2.pdf)

- Background: current effort is to finalise a first operational version of the new multi-layers snow model (SNOWPOLINO) developed in the frame of COSMO PT SAINT; this model is based on the state of the art SNOWPACK model from the SLF (<https://www.slf.ch/en/snow/snowpack/snow-cover-modelling.html>) and will soon be available in COSMO v6.0. Also, a new version of TERRA standalone (TSA) coupled with SNOWPOLINO is being developed, and will be used for tuning and validating the new snow model; it will be possible to force this updated TSA by gridded atmospheric fields or by in-situ observations at selected locations. Following this work, a new COSMO PT will be defined to integrate these developments in the ICON model, and to further refine SNOWPOLINO (e.g. considering snow & vegetation, snow & dust); it is currently estimated that a first CPU version of ICON including SNOWPOLINO could become available before the end of 2021.
- Status and plan: the MCH strategy regarding the snow analysis is to force SNOWPOLINO (TSA) with the atmospheric fields derived from the operational COSMO analysis; in addition, SNOWPACK (or a further developed SNOWPOLINO) will be used at observation sites to translate the measured snow depth into precipitation increments, in order to correct the COSMO precipitation analysis (which is particularly important in complex terrain). One advantage of this approach is to directly provide a multi-layers snow analysis to initialise the model forecast. Current plan is to replace our current snow analysis with this new approach during winter 2020/2021.

Status and plans at RHM

- Status: RHM is using the SNOWE software (http://www.cosmo-model.org/content/model/documentation/newsLetters/newsLetter16/cnl16_04.pdf), derived from the current operational surface analysis of DWD, but using observation driven 1D snow model at observation locations to derive a correct snow density.
- Still, significant shortcomings of snow analysis over Russia caused by (1) low density of in-situ observations, (2) large regions covered by forest, (3) complex topography regions.
- Neural network approach is being evaluated to mitigate some of these problems.

Miscellaneous

- Assimilation of microwave satellite data requires a multi-layers snow model.
- EuroSnow COST action has been submitted and could start in 2021 Q2 if accepted (see below).

Discussion

- Significant differences in the approaches developed at different centres... but we can learn from each others, and do cross-comparisons.
- It is useful to have a coordination meeting twice a year, but defining a new COSMO PP is not meaningful at this stage, also because work at DWD and at MCH is anyhow on-going, and PT SAINT & SAINT 2 already cover part of these developments.
- Do one need multi-layers snow analysis to run SNOWPOLINO? For the COSMO model, INT2LM will be able to transform a snow height information into a multi-layers snow profile... The same receipt could be used in ICON ...
- Full details of an operational implementation of MCH approach have still to be worked out (e.g. frequency of analysis, update of soil temperature and humidity...)
- Open issue at MCH: how to transform the precipitation increments obtained from snow height measurements (in the MCH approach) into a 2D field? ... DACE 3D Var could be used for that purpose...
- Open issue at MCH: how to correct underestimation of snow melt (due e.g. to overestimated albedo or too cold temperature) during melting periods? ... information from DWD new single layer snow analysis or from satellite derived snow mask could be integrated ...
- RHM could contribute to the development of snow over forest (SAINT 2)

Decisions

- No new COSMO PT or PP are proposed at this stage.
- Next coordination meeting in May 2021.
- [Louise] Consider SNOWPOLINO validation at mid-altitude stations (with many on/off snow cover during the winter season).
- [Martin] Evaluate availability of good quality in-situ snow observations in Germany (besides what is available on the GTS) for low land SNOWPOLINO validation.

COST EuroSnow proposal.

It was submitted in October 2020 by 62 proposers from 29 countries and could start in Q2/2021 if accepted.

The main aim of EuroSnow (European Snow Network) is to facilitate and improve assessments of the snow cover and its components from the local, regional to the global scale to support weather, hydrological and climate science, monitoring of natural hazards, decision making and formulation of environmental policy with interdisciplinary cooperation across European snow scientists, observers, modellers and end-users from all fields related to snow.

EuroSnow will comprise five working groups (WG) to address knowledge gaps and needs related to data collection, curation and management (WG1), models, retrieval algorithms and data assimilation (WG2), snow hazards and extreme events (WG3), snow chemistry and microbiology (WG4), and identification of interdisciplinary knowledge gaps and coordination of WG activities (WG5). EuroSnow further aims to coordinate the flow of knowledge and information between observers, modelers, and end-users among the scientific community and the civil society, to assist community sections with snow-related hazards and extreme events, and to train the next generation of scientists, observers and end-users on instruments, methods, protocols and products for snow observations and modelling.
