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# **COSMO Science Plan: soil & surface**

Jean-Marie Bettems / MeteoSwiss

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COSMO GM



# Science Plan

## Soil and surface aspects

- *The **drafts** of WG3b related COSMO Science Plan summary have been distributed to the community in July 2013 :*
  - **SVAT scheme** (Juergen Helmert )
  - Parameterization of **lakes** (Dimitrii Mironov)
  - Parameterization of **sea ice** (Dimitrii Mironov)
  - **External parameters** (Juergen Helmert )

***Opportunity to give your feedback now !!!***



# Science Plan

## SVAT scheme

### Background strategy

- Due to the numerous dependencies between the NWP system and the SVAT model, a **deep understanding** of the capabilities and limitations of the SVAT model is required in the *operational services*.
- TERRA, which was developed at DWD, is running **safely** and **efficiently** since many years **at all scales**.

**TERRA is further chosen as basis for COSMO NWP.**

**Coupling with other SVAT models supports the further development of TERRA, through intercomparison studies.**



# Science Plan

## SVAT scheme

### Main actions planned in a short-term perspective (2015-2017)

- Revision of the **ground heat flux** formulation – consideration of vegetation shading;
- Revision of **plant water uptake** – impact of vegetation properties;
- Implementation of **advanced soil properties data sets**, e.g. Harmonized World Soil Database;
- Model **intercomparison** and **validation** studies (SRNWP data pool) to identify future fields of development activities;
- Identification of processes to be used in **statistical physics** approach.



# Science Plan

## SVAT scheme

### Main actions planned in a long-term perspective (2018-2020)

- Improve the simplified treatment of **infiltration, interception, and run-off** from surface and ground. Due to numerical problems, a revised approach should be considered and extended to possible **stream flow routing**;
- Assimilation of remote sensing soil moisture observations for SVAT model initialisation, or other approaches improving the **initial state of the soil**.



# Science Plan

## SVAT scheme

***Not in the COSMO Science Plan:***  
**new features included in common COSMO / ICON library (2014)**

- Multi-layers **snow model**;
- Representation of sub grid scale **surface heterogeneity** through the tile approach.



# Science Plan

## SVAT scheme

### ***Not in the COSMO Science Plan: developments planed in the CLM community***

- Revised coupling between soil and atmosphere (currently turbulent surface fluxes are computed at different locations in the model);
- 3D soil (multiple horizons, moving water table);
- Urban model;
- Dynamic vegetation;
- C and N cycle.



# Science Plan, feedback

## SVAT scheme



- [SPM] Start a focused action to evaluate TERRA limitations and potentials ?
- [SPM] Can improvement of water budget wait for 2018 ?
- ...





# Science Plan

## Lakes

### Main actions planned in a short-term perspective (2015-2017)

- FLake should be brought into **operational use** by COSMO members;
- Operational results should be **monitored** and the effect of lake parameterization on the overall NWP model performance assessed;

### Main actions planned in a long-term perspective (2018-2020)

- Explicit treatment of **snow over lake ice**;
- Extension of the temperature profile parameterization to include the **abyssal layer** below the seasonal thermocline;
- Collect data on the **optical properties** of the lake water (external parameters);
- FLake should be extended to incorporate the **effect of salinity** (efficient upper-ocean parameterization scheme for seasonal forecasts).



# Science Plan, feedback

## Lakes



- [SPM] Seasonal forecast not a focus of COSMO → is lake salinity needed?
- [SPM] Does operational monitoring belongs to Science Plan?
- ...



# Science Plan

## Sea ice

### Main actions planned in a short-term perspective (2015-2017)

- Sea-ice scheme should be brought into **operation** by COSMO members;
- Operational results should be **monitored**;
- Consider the **fractional ice cover** within a COSMO grid box;

### Main actions planned in a long-term perspective (2018-2020)

- The explicit treatment of **snow over sea ice**.



# Science Plan, feedback

## Sea ice



- [SPM] Does operational monitoring belongs to Science Plan?
- [RHM] **Resources** for working on snow over ice modelization.
- ...



# Science Plan

## External parameters

### Main actions planned in a short-term perspective (2015-2017)

- Consolidate external parameters for the lake model **Flake**;
- Consolidate new *MODIS-based* **background surface albedo**;
- Consolidate **alternative data sets of soil types**  
(*Harmonized World Soil Database*, European Soil Data Base, BGR BUEK);
- Add **vertically dependent soil information** where available  
(e.g. depth of water reservoir or inactive layer and soil texture);
- Provide alternative vegetation characteristics using  
**MODIS-based phenology model**;
- Consolidate **land use data** at higher resolution than GLC2000  
(e.g. *GlobCover*);
- Consolidate **orography at higher resolution** than GLOBE  
(e.g. *ASTER GDEM*).

*Note: cursive data sets are implemented in EXTPAR 2.0*



# Science Plan

## External parameters

### Main actions planned in a long-term perspective (2018-2020)

- Address the **uncertainties** associated with the look-up tables, especially for the SVAT model;
- The determination of the **roughness length** should be revised;
- A new formulation of the surface-layer transfer scheme may require an additional external parameter field for the **displacement height**.



# Science Plan, feedback

## External parameters



- [RHM] Add a consistency check for the soil type **peat**, to support new mire parameterization
- ...