

The *GEWEX-SoilWat* initiative: first planning workshop

Advancing Integration of Soil and Subsurface Processes in Climate Models

Leipzig June 28-30, 2016

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Report to GEWEX GLASS – October 2016

ETH

Eidgenössische Technische Hochschule Zürich
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Planning workshop *GEWEX-SoilWat: Original plan*

- To provide a scientific basis, scope and integration of *SoilWat initiative* with existing GEWEX structures and activities, we plan a dedicated planning workshop hosted by UFZ in Leipzig-Halle (*June 28-30, 2016*) - the objective is to engage the GEWEX and Soil community members in the planning and in the workshop
- **Discussion areas/potential topics and core group (tentative):**
 1. Integrating (sub-) surface modeling in hydrological and climate models (Conveners: *Dani Or, Harry Vereecken, Eleanor Blyth, Matthias Cuntz, Bill Kustas*)
 2. Model complexity and utility (simple vs complex models) (Conveners: *Martin Best, Gab Abramovitz, Aaron Boone, Jan Vanderborght, Jasper Vrugt, Alex Mcbratney*)
 3. Groundwater-surface-atmosphere interactions (Conveners: *Marc Bierkens, Remko Uijlenhoet, Gerrit de Rooij, Stephan Kollet*)
 4. Human interactions affecting soil-water processes (Conveners: *Taikan Oki, Howard Wheeler, Katja Frieler, Jacob Schewe, Shmuel Assouline, John Crawford, Michael Young*)
 5. Soil observations for hydro-climate research (Conveners: *Jan Hopmans, Sonia Seneviratne, Steffen Zacharias, Hendricks-Franssen Harrie-Jan, Colin Campbell, Todd Caldwell*)
- **Potential outcomes:**
 1. to establish working groups for each of these to further develop the themes above
 2. to provide a scope and a first set of priority topics for the themes
 3. to develop modes of interactions and active collaborations on these topics
 4. to form a liaison group for exchange with related societies and communities – soil, GSA
 5. plan joint projects, white paper, interfacing with other initiatives (listed in the examples)

Planning workshop *GEWEX-SoilWat: Program and participants*

- 25-30 participants - 2 days of presentations and discussions (workshop program below)

28 June 2016 (Tuesday)

13:30 **Welcome and presentation of workshop motivation, objectives, expectations, programme**

Session 1: Integrating soil processes in climate and weather models (*Sonia Seneviratne chair*)

14.00 – 14.20 **Hugo Berbery**

14.20 – 14.40 **Rene Orth**

14.40 – 15.00 **Martine van der Ploeg**

15.00 – 15.30 **Discussion**

Session 2: Model complexity and utility (*Matthias Cuntz - chair*)

16.00 – 16.20 **Bob Walko**

16.20 – 16.40 **Harry Vereecken**

16.40 – 17.00 **Luis Samaniego**

17.00 – 17.30 **Discussion**

17.30 – 19.00 **Plenary session 1 - discussion of research gaps and working group reports**



Planning workshop *GEWEX-SoilWat*: Program and participants

29 June 2016 (Wednesday)

- 08.30–09.00 **Welcome to day 2, expectations and working groups**
09.00–10.30 **Breakup to working groups - formulation of topics and priorities**
11.00–12.00 **Plenary session 2 – setting priorities and topics for GEWEX-SoilWat**
12.00–13.00 **Lunch (KUBUS) – poster viewing**

Session 3: Human interactions affecting surface processes (*Harry Vereecken - chair*)

- 13.00 – 13.20 **Naota Hanasaki**
13.20 – 13.40 **Anne van Loon**
13.40 – 15.00 **Discussion**

Session 4: Groundwater-surface-atmosphere interactions (*Martine van der Ploeg - chair*)

- 15.15 – 15.35 **Stefan Kollet**
15.35 – 15.55 **Harrie-Jan Hendricks-Franssen**
15.55 – 16.15 **Anne Verhoef**
16.15–18.15 **Breakup to working groups – how do we collaborate?**
18.15–19.15 **Plenary session 3 – structures and interfaces for GEWEX-SoilWat**

30 June 2016 (Thursday)

- 09.00 – 10.00 **Working group – *Soil observations and interfacing with model* (presentation)**
10.00 – 10.30 **Working group – *Structures and mechanisms for informing climate/soil communities***
11.00 – 12.30 **Core group – how to translate ideas to action, populating WG and activities**
12.30 – 14.00 **Lunch, workshop summary and outlook – adjourn**

Planning workshop *GEWEX-SoilWat: Issues discussed*

Key issues discussed:

- how soil processes (infiltration, evaporation, soil properties, etc.) are represented in land-surface models;
- the role of plants in climate models;
- how to bridge scales between traditional soil models and scales relevant to climate modeling;
- how to effectively incorporate groundwater models;
- strategies for incorporating information from highly resolved global soil maps
- how to move forward with integration of the communities

Planning workshop *GEWEX-SoilWat: Main outcomes*

Main outcomes (action items):

- A survey of how basic soil processes are represented in climate models with emphasis on revisiting pedotrasfer functions used to convert soil information to parameters for hydro-climate modeling (*H. Vereecken and A. Verhoef* – leads)
 - To summarize functional descriptions to estimate hydraulic & thermal properties in LSMs
 - To provide an overview of PTFs used for calculation of hydraulic and thermal properties (17 global climate models used in LS3MIP); revisiting ROSETTA database and collaborating with SoilGrids to inject information and machine learning to improve PTFs and parameters
 - To quantify uncertainty in water and energy fluxes and states generated by PTF and/or type of hydraulic/thermal function, including information aggregation or upscaling
 - To run selected 1D simulations using state of the art soil hydrologic models to assess PTFs

Providing free access to soil data across borders

SoilGrids project | [Download data](#) | [Data license and terms of use](#)



cycle background maps geolocate open layer menu
 open SoilInfo (works only when location is selected)

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ROSETTA Model

The program, exmples, and manual can be downloaded from the [software download area](#).

Year: 1999
Version: 1.0
(requires 32-bit Windows)

Related Topics

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Planning workshop *GEWEX-SoilWat*: Main outcomes

Main outcomes (action items):

- Assessing the utility of resolved soil maps via sensitivity analysis (*SoilParameterMIP*) to evaluate several climate models using old and new soil maps and parameters (*L. Gudmundsson and M. Cuntz and ISMC [D. Or and H. Vereecken]* - leads)
 - Using LS3MIP as a comparison base and running a subset of global models using: (i) a uniform soil world; (ii) the new global SoilGrids database as is; and (iii) SoilGrids with new PTFs (no changes to soil and surface process representation)
 - Comparing model outputs – fluxes, runoff, soil moisture (averaging and metrics are still being considered)
 - A first draft from Lukas and Mathias is forthcoming in a week
- A survey of groundwater database and strategies for incorporating groundwater in climate models (*S. Kollet, A. van Loon and P. van Oevelen* – leads)

Planning workshop *GEWEX-SoilWat*: *Outcomes*

Other outcomes:

- A perspective paper to articulate the needs, objectives, and future directions of *GEWEX-SoilWat* initiative (*D. Or, S. Seneviratne, P. van Oevelen, and G. de Rooij*)
- The workshop was successful in galvanizing interactions between the two communities and highlighted the commitment and interest in finding ways to cooperate for improving soil and subsurface in climate models
- A follow up second *GEWEX-SoilWat* workshop in 2017 to report progress and discuss processes not addressed in the 1st workshop (*soil and plant processes, human interactions*)

Potential *GEWEX-SoilWat* synergism - examples

- **Integration of *Critical Zone Observatories* (CZO) and similar eco-hydrological observatories within GEWEX** (eLTER-H2020 - European Long-Term Ecosystem Research Infrastructure; TERENO; ICOS; CUAHSI) – design; sensors; monitoring protocols; data repository [in coordination with GHP]
- **Formation of a global lysimeter network** – to inventory, standardize, and expand coverage of lysimeter observations; links with CZO's (lead – FZ Julich and Wageningen) [in coordination with GHP]
- **Integration of the *International Soil Modelling Consortium*** – coherence and better links between climate and soil modelers with respect to models, data sets for model testing, etc. (lead – FZ Julich) [in coordination with GLASS]
- **Development of linkages with the *Global Soil Map* initiative** [all panels]
- **Simple and low-cost soil moisture monitoring networks** (e.g., TxSON) for highly resolved soil moisture information [GHP and GDAP]
- **Integrating human interactions affecting soil-water processes** [GLASS, others]
- **Incorporation of near surface and small-scale soil processes** (evaporation physics; plants-soil interactions; biogeochemical processes) [GLASS]



Motivation for community-based ISMC

- Modelling soil processes is fragmented and dispersed
- Exchange between different soil disciplines is lacking
- An improved “position“ and visibility of soil research and modelling in the Earth Sciences Community is needed. We need to reach out to other modelling communities in the field of terrestrial systems, climate systems, ecology, ...
- The scientific community lacks easy-to-access and available standardized and high quality data and protocols for calibration and validation
- A better exchange of ideas, expertise and need for development of joint activities through cross-cutting topical areas
- → **ISMC as a community effort**

Objectives of the ISMC

- Address scientific gaps and promote soil science research
- Develop a platform for soil model inter comparisons
- Identify interactions with other relevant platforms
- Establish data platforms for model development and validation
- Enhance the integration of soil modelling expertise in neighbouring disciplines (climate, land surface, ecological, crop, contaminant models)
- Develop cross-topical areas as hubs for innovation and exchange of ideas, models, data and expertise

Past and present ISMC activities

- Abstract „On the need to establish an international soil modelling consortium“ with 48 authors (SSSA, Complex soil systems and AGU, all 2014)
- Informal meetings (EGU 2014 and 2015, SSSA & AGU 2014)
- Organised sessions at conferences (EGU 2015)
- Website and white paper
- Proposed IUSS working group
- Inaugural conference in Austin, Texas, March 2016



EGU-Meeting 2014

Modeling Soil Processes: Key challenges and new perspectives

Vereecken H., Schnepf A., Hopmans J.W., Javaux M., Or D., Roose T., Vanderborght J., Young M., Amelung W., Aitkenhead M., Allison S.D., Assouline S., Baveye P., Berli M., Brüggemann N., Finke P., Flury M., Gaiser T., Govers G., Ghezzehei T., Hallett P., Hendricks Franssen H.J., Heppell, J., Horn, R., Huisman J.A., Jacques D., Jonard F., Kollet, S., Lafolie F., Lamorski K., Leitner, D., McBratney A., Minasny B., Montzka C., Nowak W., Pachepsky Y., Padarian J., Romano N., Roth K., Rothfuss Y., Rowe E.C., Schwen A., Šimůnek J., Van Dam J., van der Zee S.E.A.T.M., Vogel H.J., Vrugt J.A., Wöhling T., Young I.M.

ISMC website: <https://soil-modeling.org/>

International Soil Modeling Consortium — ISMC

https://soil-modeling.org

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160 registrations on February, 2016

NEWS

ISMC session suggested for EGU 2015
Jul 08, 2014

ISMC session at AGU meeting now open for abstract submission
Jun 26, 2014

Complex Soil Systems Conference - Abstract accepted
Jun 25, 2014

Vacancy at FZJ, Agrosphere Institute
Jun 16, 2014

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INTERNATIONAL SOIL MODELING CONSORTIUM

Soil is one of the most critical life-supporting compartments of the Biosphere. Soil provides numerous ecosystem services such as a habitat for biodiversity, water and nutrients, as well as producing food, feed, fiber and energy. To feed the rapidly growing world population in 2050, agricultural food production must be doubled using the same land resources footprint. At the same time, soil resources are threatened due to improper management and climate change. Soil is not only essential for establishing a sustainable bio-economy, but also plays a key role also in a broad range of societal challenges including

1. climate change mitigation and adaptation
2. land use change
3. water resource protection
4. biotechnology for human health
5. biodiversity and ecological sustainability
6. combating desertification

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