

# International Soil Modeling Consortium: Integrating Soil Processes into Earth Process Models

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DOE ESS Cyberinfrastructure Working Group  
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# ISMC background

- A recently formed and growing international group of soil process modelers is focused on improving the soil process description and overall parameterization of earth system models:
  - Global- and regional-scale climate models
  - Ecological models that include ecosystem services, soil carbon, etc.
- Initially, European focus but growing US involvement
- DOE and USGS involvement on Executive Board and Science Advisory Board



# ISMC Mission

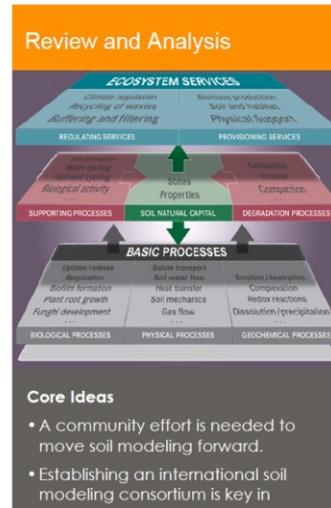
- To integrate and advance soil systems modeling, data gathering, and observational capabilities

## Related objectives:

- To promote integration of soil modelling expertise in neighboring disciplines (climate, land surface, eco, hydro, and other models)
- To perform soil model intercomparison studies at local to global scales
- To consolidate and develop soil and other data platforms for dissemination of soil information and for modeling
- To systematically examine data and model choices on prediction uncertainty for soil and terrestrial processes
- To integrate societal and environmental considerations into soil and ecosystem functioning

# Conception of ISMC

- Soil physics community at SSSA developed and published a white paper\* and companion article, articulating:
  - Our understanding of the issues
  - Solutions for solving them
- Scores of comments received supported the efforts and agreed that change was needed
- Final version was published and companion article published in **CSA News** in October 2011 issue
- SSSA convened a task force to consider structural changes and began implementing them in 2012



## Modeling Soil Processes: Review, Key Challenges, and New Perspectives

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

# Outcomes of the “White Paper”

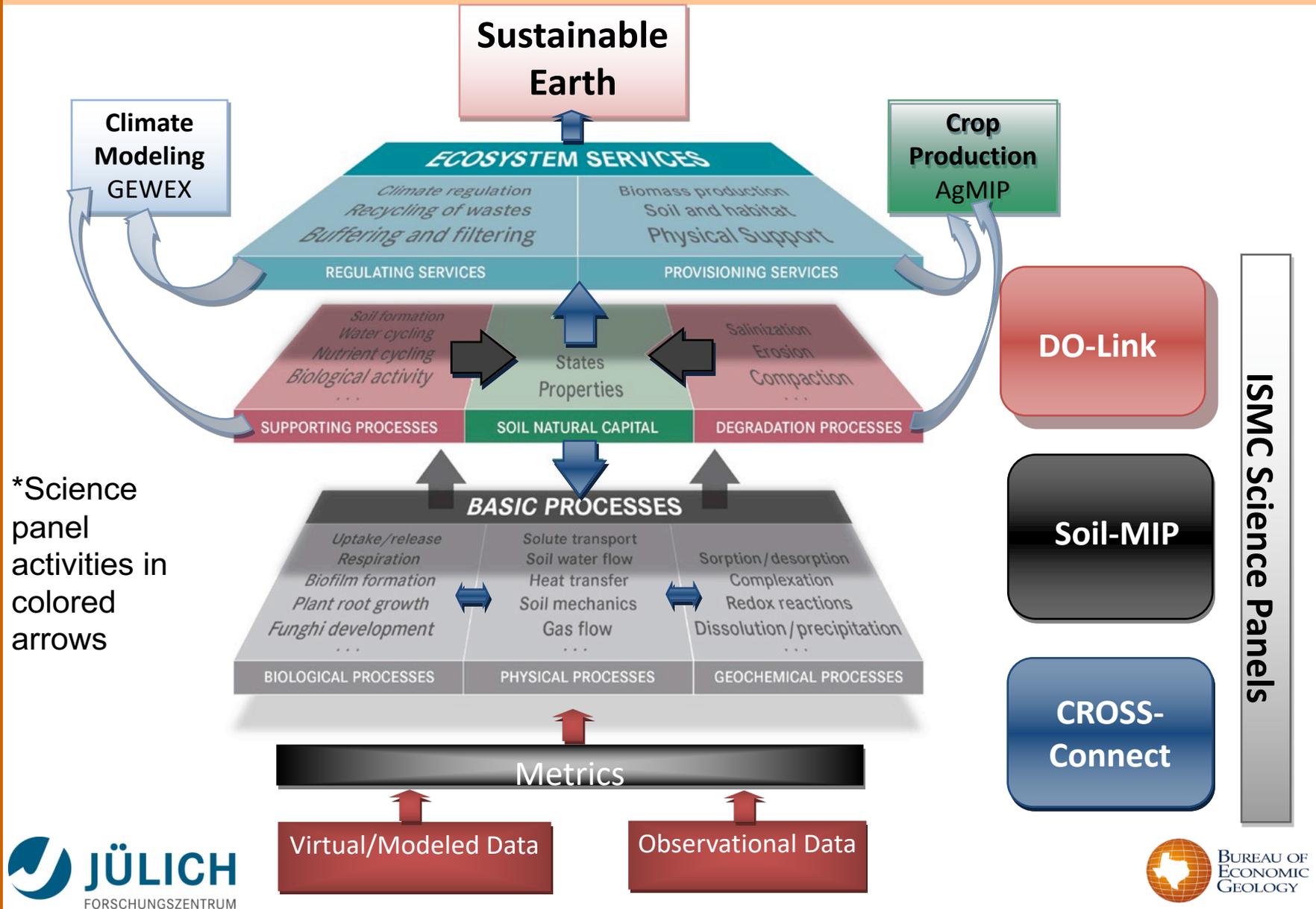
- Soil science and geoscience exist in different educational and research universes – they can benefit and expand by *integrating*
- Examples in research realm where this works:
  - Critical zone observatories
  - NEON activities
- Soils interest group created at GSA to emphasize biospheric processes and to promote bottom-up and top-down connections with SSSA
- More strongly emphasize soil science concepts across different earth science disciplines, especially within climate modeling and ecological communities, stressing broader environmental and societal gains



# ISMC Structure

- ISMC office
  - Scientific office manager, funding by Jülich for two years
- Chair/Co-Chair and Executive Board
- Scientific Advisory Board
  - Core group providing scientific leadership, established by Executive Board
- Science panels:
  - Linking models to data and observations (DO-Link)
  - Model development and model intercomparison panel (Soil-MIP)
  - Cross-cutting topics and interfacing with science and society (CROSS-Connect)

# ISMC Work Flow Chart\*



# Executive Board

## ■ Chairs

- Harry Vereecken - Forschungszentrum Jülich
- Michael Young - The University of Texas at Austin

## ■ Members

- Ana Tarquis - University Madrid
- Anne Verhoef - University Reading
- Scott Painter - Climate Change Science Institute, ORNL
- Umakant Mishra - Argonne National Laboratory
- Jirka Simunek - University of California Riverside
- Jan Vanderborght - Jülich Forschungszentrum
- Ute Wollschläger - UfZ Leipzig
- Teamrat Ghezzehei - UCMerced University
- Dani Or - ETH Zürich
- Martine van der Ploeg - Wageningen UR

# Science Advisory Board

- Nancy Cavallaro - USDA
- Sonia I. Seneviratne - ETH Zurich
- Luca Montanarella - European Commission
- Jennifer Harden - USGS
- Susan Hubbard - LBNL
- David Lesmes - US DOE
- Diana Wall - Colorado State University

# ISMC Coordinator

## **International cooperation and project management: earth sciences, modelling, ecosystem services**

- Organizing and coordinating activities between partners
- Ensuring accessibility of experimental and modelling data
- Heading the ISMC office
- Herding the cats!



Kris Van Looy

# Science Panel Goals - DO-Link

- Create global soil data meta-repository, openly available for soil system research.
- Facilitate the linkage between data and models to optimize how measurement results are integrated into soil models.

This will be achieved by:

- Analyzing and summarizing data requirements of various disciplines developing and applying soil models;
- Analyzing the need and feasibility for standardizing and harmonizing data required for soil modeling;
- Investigating how data/observation requirements change with spatial and temporal scale/resolution;
- Assessing the link between modelling objectives and data availability and quality.

# Science Panel Goals - Soil-MIP

- Create model intercomparisons that focus on soil services but which follow similar overall objectives as other model intercomparison studies like CMIP, AgMIP, GeoMIP...
- Foster the further development of soil models that can predict soil functions and their changes (i) due to soil use and land management and (ii) due to external impacts of climate change and pollution.
- Develop holistic models that represent the key functions of the soil system and the links between them.
- Integrate soil processes into terrestrial system models that describe the feedbacks between processes in the soil and the other terrestrial compartments

# Science Panel Goals - CROSS-Connect

- Establish the conceptual bases needed to exchange information with other disciplines: climate research, hydrology, biology, plant physiology, agriculture, socio-economic sciences.
- Create multi-disciplinary working teams to establish common vocabulary for integrated datasets and modelling.
- Develop an exchange platform with other international panels like AgMip/MACSUR, GEWEX SoilWat, Crop modelling communities.
- Dialog with other communities (also socio-economics) and establish the outreach of the ISMC initiatives.

# Inaugural Meeting - Austin, TX 2016

- 120 registrants from 15 countries on 5 continents
- Plenaries, orals and posters
- Planning group breakouts



## Outcomes:

- Established structure
- 1-3 year planning timelines
- Science and warehousing plans

# How can we collaborate?

- We are seeking partners from US labs to balance academics in the US and Europe.
- What is the best way to make this partnership happen?
- From the US agency perspectives, what is need most from stakeholders outside of the Federal government?
- What areas of soil science are of greatest interest and where/how can ISMC participate?



Thank You!

ISMC website:

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