Finanziato dall'Unione europea NextGenerationEU | Ministero dell'Università e della Ricerca | Italiadomani | National Biodiversity Future Center | ICSC Centro Nazionale di Ricerca in HPC, Big Data and Quantum Computing | Università degli Studi Firenze DST | Max Planck Institute for Biogeochemistry

SHORT LECTURE SERIES

June 4-5, 2026

University of Florence, Department of Earth Sciences DST Unifi

Via G. La Pira 4, Firenze

For PhD Students: 0.7 CFU

Thermodynamics of the Earth System

Dr. Axel Kleidon

Max Planck Institute for Biogeochemistry, Jena (D) ,
Group of Biospheric Theory and Modelling
axel.kleidon@bgc-jena.mpg.de

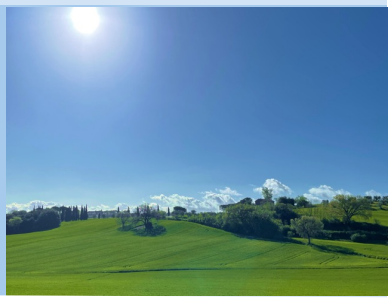
June 4 (14:30-16:30, Room A)

Google Meet link: meet.google.com/sgf-jjhb-azn

- Lecture 1: **The Earth at Work**

How entropy and the second law shape the dynamics of the Earth system

Entropy plays a fundamental role in the Earth system because it sets a fundamental direction for all processes and it constrains how much work can be done using sunlight. This work is needed to maintain the dynamics of the planet: Motion, cycling, the metabolisms associated with life, as well as human societies. I illustrate the utility of this description by showing the insights gained related to climate, life, and global climate change.



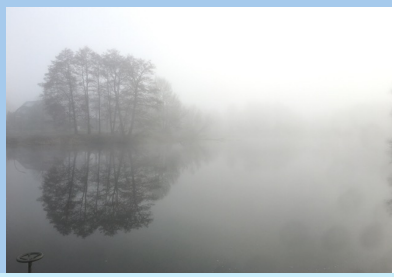
June 5 (11:00-13:00, Room B)

Google Meet link: meet.google.com/mif-afxy-sef

- Lecture 2: **The Work of Water**

How thermodynamics shapes the hydrological cycle and its response to global climate change

The hydrological cycle is maintained far from thermodynamic equilibrium. Sounds complicated? Actually, thermodynamics is central to understand the hydrologic cycle because it sets the basis for how work is performed, which in turn maintains hydrological cycling within the Earth system. Based on this approach I provide relatively simple, intuitive, and physically-based estimates to show that thermodynamic constraints control the magnitudes of evaporation rates as well as precipitation events. The resulting estimates agree very well with observations. This approach then provides a basic perspective of how the hydrological cycle responds to global climate change.



Seminar information: please contact: Dr.ssa Caterina Gozzi – caterina.gozzi@unifi.it