

On-site at the
b-it*
& via Zoom

*For registration [here](#).

Prof. Dr. Dominik L. Michels

“Climate Resilient Habitats: On Digital Modeling and Simulation Capabilities Capturing Spatial Variations in Local Environments“

April 6, 2023, 13:30 h CEST, Zoom

Abstract

Climate change impacts communities and human habitats worldwide and locally in different ways. A multitude of interdependencies between, for example, geophysical and human-made factors make adaptations to this changing world extraordinarily challenging. Coarse prediction models, for example predicting an increase of temperature and a decrease of rainfall in specific regions, are not sufficient to allow communities to prepare for and adapt to the multifaceted impacts in their local environment. Urban planning, for example, in progressively heat-stricken areas should incorporate building surfaces that reflect radiation, allow cooling wind to flow freely through neighborhoods, and strategically place plants in areas where shade is needed most. In order to address such needs, we aim to develop the required digital modeling and simulation capabilities by combining our expertise in geometric modeling and computational architecture, physics-based modeling and numerical simulation, and visualization. The necessity for these capabilities is similarly evident if we consider rural and farming regions or forests [1]; these complex ecosystems also maintain their own climate [5].

Similarly, detailed geometric models are required as it has recently been established that climate change not only has an impact on plant ecosystems, but that vegetation also contributes to local weather variations, resulting in diverse microclimates in contrast to the overall macroclimate. On a larger scale, urban, rural and farming, and forest areas are interconnected and changes within each area can easily cause effects beyond the direct environment. In this context, modeling and simulation of weather phenomena [2-3] is at the core of our work considering detailed representations of the underlying geometric structures at the level of individual objects such as buildings or trees [4]. Such high-resolution data are of fundamental importance in order to adapt to the associated challenges of a changing environment and to support a climate-resilient community. Furthermore, the data obtained from modeling and simulating these complex environments could serve as synthetic training data, leveraging machine learning capabilities for smart cities and the development of state-of-the-art land use concepts.

[1] Synthetic Silviculture: Multi-scale Modeling of Plant Ecosystems. Watch it [here](#).

[2] Stormscapes: Simulating Cloud Dynamics in the Now. Watch it [here](#).

[3] Weatherscapes: Nowcasting Heat Transfer and Water Continuity. Watch it [here](#).

[4] Fire in Paradise: Mesoscale Simulation of Wildfires. Watch it [here](#).

[5] Ecoclimates: Climate-Response Modeling of Vegetation. Watch it [here](#).

About the speaker

Dominik L. Michels is a Full Professor (W3) of Computer Science holding the professorship of Intelligent Algorithms in Modeling and Simulation (IAMS) at the Technical University of Darmstadt since 2023. He is also a KAUST Associate Professor of Computer Science and Mathematics, and was previously employed at Stanford University.

His research aims for the development of intelligent algorithms targeting principled, accurate and efficient simulations, and their applications in the fields of Visual Computing and Scientific Computing. This is based on solid theoretical foundations resulting from fundamental research comprising algorithmics, artificial intelligence, computer algebra, machine learning, mathematical modeling, and numerical analysis.

In summer 2016, he started to build up the Computational Sciences Group at KAUST after Professor Michels joined the Computer Science faculty at Stanford University in fall 2014 heading the High Fidelity Algorithmics Group within the Max Planck Center for Visual Computing and Communication. Prior to this, he was a postdoctoral fellow in Computing and Mathematical Sciences at Caltech. He studied Computer Science and Physics at University of Bonn and B-IT, from where he received a B.Sc. in Computer Science and Physics in 2011, a M.Sc. (first class honors) in Computer Science in 2013, and a Ph.D. (summa cum laude) in Mathematics and Natural Sciences (Dr.rer.nat.) in early 2014. He was awarded the prize for the best dissertation in 2014 within his subject area. During his academic studies he was visiting several international institutions, among others Harvard University, the Massachusetts Institute of Technology, NASA's Jet Propulsion Laboratory, and the Joint Institute for Nuclear Research within the greater Moscow area.

His studies and research were awarded and supported with various honors, for example by the German Academic Scholarship Foundation, with a Johannes Kepler Foundation Scholarship awarded for excellent achievements in algorithmics and geometry, by the ACM SIGSAM for achievements in computer algebra, and with the academic award of the AFCEA. Professor Michels was awarded an artificial intelligence grant of the German State of North Rhine-Westphalia endowed with 1.25 million euros in 2019.

In the non-academic context, he serves as a research partner in the sections of high-technology and consumer goods partnering with and advising leading multinational companies and research institutions from various sectors, specifically from the high-technology and consumer goods sections. Professor Michels is also involved in various spin-offs. In this context, he received the first Procter & Gamble Faculty Award for his research contributions to the consumer goods industry. He also partnered and published regularly with Adobe, Google AI and Google Brain, respectively.

He is a member of the ACM, the IEEE, and the London Mathematical Society. Professor Michels was selected as a member of the top-class jury for the German AI Award in 2019. In 2023, he was elected as a corresponding member of the Göttingen Academy of Sciences and Humanities. He declined faculty offers from Chalmers University of Technology and the University of Gothenburg in 2019, and from the University of Bonn in 2020. Professor Michels was appointed to the German Council of Advisors on Digital Economy in 2020 by the German government under Peter Altmaier, who served in Chancellor Angela Merkel's cabinet as Federal Minister for Economic Affairs and Energy. After the 2021 German federal election, he served in this capacity under Robert Habeck, the deputy to Chancellor Olaf Scholz, and Federal Minister for Economic Affairs and Climate Action.

About the Lecture Series

The lecture series on Innovation Pathways to Sustainability is organized by the TRA Sustainable Futures. It is a forum for high profile and internationally visible scientists who are active in academia or at the science-policy interface. The lectures address an interdisciplinary audience of experts from natural, social, and engineering sciences as well as representatives from international and implementation-oriented organizations.

The lecture is held at the b-it, but will also be available via Zoom (talk will be recorded and published afterwards).

If you like **to attend in person**, please register [here](#).

Otherwise, the Zoom access is:

<https://uni-bonn.zoom.us/j/93369202266?pwd=MWNqZ3JUSzFidGtGZHJkMGgvR2M0Zz09>

Meeting-ID: 933 6920 2266; Code: 939753