

WorldTrans NEWS



Sept/nr. 3/2024/charlotte.stark@met.no

OUTREACH

International System Dynamics Conference (ISDC) Bergen, August:

Billy Schoenberg and the WorldTrans team, "Towards a "fit for purpose", fully coupled, integrated, and interdisciplinary world-Earth model - FRIDA Version 1.0"

Martin B. Grimeland et. al. "Modeling the global macroeconomic system for next generation world-Earth models: The economy of FRIDA v1.1"

Jefferson Rajah et al. "Human behavioural drivers of meat consumption: Using group model building to capture lived realities"

Andreas Nicolaidis Lindqvist et. al. "All models are wrong, some are useful but how do you know?"

Etiënne Rouwette "Lessons from working across facilitated modelling disciplines"

Etiënne Rouwette et al. "Interpersonal relations, emotion and decision making support: conceptualization and a proposal for measurement"

Cecilie Mauritzen, "Modelling climate change in the context of the system that created it". Computational Science seminar at the University of Oslo, 06 September

Chris Smith, "Econometric Model of Climate Change", Cambridge, 16. August

Chris Smith, Beijing Institute of Technology, Online presentation, 27. August

WorldTrans impresses the EU Reviewers



The WorldTrans project recently received very good feedback from the European Union following the review of its 18-month progress report. The EU reviewers expressed their satisfaction and were highly impressed with the accomplishments of the project this far.

Team effort all the way

Project leader Cecilie Mauritzen conveyed her gratitude to the Work Package leaders who presented their progress and expertly answered the reviewers questions.

Mauritzen highlighted the professionalism and coordination displayed by the team, which reinforced her confidence in the importance and quality of their work.

Evolve FRIDA further

In the coming weeks, the WorldTrans team will summarize the feedback and develop an action plan to address any points raised by the EU.

While most of the feedback aligns with the team's ongoing efforts, one key area of focus will be refining further the project's core purposes, particularly in relation to FRIDA, the project's flagship model.

The aim is to ensure that FRIDA version 2.0 (due to be presented in January 2025) is even more well-suited to meet the project's objectives.



RESEARCH HIGHLIGHTS

Progress from BUILDING FRIDA



BILLY



SARAH

Reorganizing FRIDA for better clarity and transparency

Billy presented FRIDA V1.0 to the ISDC meeting in August. For FRIDA V2.0 we have completely reorganized the model to improve clarity and transparency:

Agriculture & Land Use: A major reorganize of animal vs. non-animal products, with updated land use for afforestation.

Economy: Focused on employment, inflation, and the impacts of climate. Circular flow simplified.

Energy: Fossil fuels disaggregated, energy investment now tied to costs with taxes/subsidies integrated.

Climate: Added new emission sources and recalibrated the FaIR model. AR5 WP2 climate impacts table integrated.

Resources & Materials: Concrete modeling is nearly complete, with plans for rare earth metals and fertilizers (leveraging ISDC contacts).

Human Behavior: Major progress on diet shifts, with the integration of norms, values, and economic influences into the Agriculture and Land Use model.

Progress from USING FRIDA



SARAH



ALEX

Stakeholder mapping and educational activities for FRIDA

The lab sessions so far highlight the critical role of integrating systems thinking, critical thinking, ethical reflection, and co-learning to tackle complex sustainability challenges in the development, use, and educational aspects of FRIDA.

The Knowledge-to-Action framework offers a structured approach to guide knowledge transfer from a systems perspective. It recognizes that both knowledge producers and users operate within adaptive, dynamic, and unpredictable systems, making the transition from evidence to action an iterative and complex process. This framework provides a valuable lens through which we can better organize and direct our group efforts.

We are now engaged in four ongoing activities, each with distinct modes of collaboration across the project team:

Synthesis and strategic development

4.1 Evaluating usefulness of IAMs with respect to purpose

Co-learning and experimentation

4.2 Creating processes for interdisciplinary scientific analysis and education

4.3 Creating processes for policymaker engagement and decision support

4.4 Creating processes ("tools for the toolbox") for citizen engagement

RESEARCH HIGHLIGHTS

Work Package 1 has had a major focus on implementing damages caused by climate change. These are often directly linked to GDP, but in FRIDA it is the structures, the crops, the banks etc that experience the damages.

We have organized a new dev team to focus on climate impacts. This team is busy developing relationships from climate change to climate impacts for sea-level rise, crop productivity, worker productivity, energy demand and heat mortality.

These relationships are derived from a combination of recent literature surveys and climate impact model databases including the Inter-sectoral Impacts Model Intercomparison Project (ISIMIP).

Chris and Jana attended the "[Climate Challenge and Economic Policy: Navigating Uncertainties and Agents' Heterogeneity](#)" conference in Zürich. Chris presented the inclusion of climate change and climate impacts in integrated assessment models, including the aims of WorldTrans and the current status of the FRIDA model.

Progress from NATURAL SYSTEM



CHRIS



JANA

Implementing the damages resulting from climate change in FRIDA

Jeff and Birgit (U Bergen) attended the International System Dynamics Conference. Jeff presented his conceptual model on dietary behavior shifts, how it was derived from participatory modeling activities and how it will be formalized in the FRIDA model.

Sibel taught global system dynamics modeling at the IIASA Summer School on System Analysis.

Regionalization of the population and economy modules of the FeliX model has been completed.

The regionalization work continues on the energy supply and market module, as well as the disaggregation of the sectoral energy demand, in order to connect them to lifestyle-based population segmentation for behavior-driven food and energy demand scenarios.

WP2 meetings resume on 23 September. [Quanliang](#) will then present the regionalization work.

Progress from HUMAN SYSTEM



SIBEL



BIRGIT

Developing FRIDA and FeliX from old habits in the past, to the life we live today and future

WorldTrans Advances Climate Modeling at ISDC 2024

At the International System Dynamics Conference (ISDC) 2024 in Bergen, members of WorldTrans team presented a wide variety of project advancements. First and foremost, FRIDA v0.1 was introduced to the community, by Billy Schoenberg: "Towards a "fit for purpose", fully coupled, integrated, and interdisciplinary world-Earth model - FRIDA Version 1.0".



Billy presenting FRIDA in Bergen. Photo: J. Rajah (UiB)

Summaries of the presentations:
Towards Modelling (Pro-)Environmental Human Behaviour in Integrated Assessment Models from a Systems Approach, by Jefferson K. Rajah et al.

Integrated Assessment Models (IAMs) often rely on techno-economic indicators and lack nuanced representations of human behavior. Our project addresses this by developing a system dynamics model that integrates both theoretical and real-world insights into pro-environmental behavior. This approach combines top-down theoretical frameworks with bottom-up participatory modeling to enhance IAMs. As part of the WorldTrans consortium, this work aims to refine IAMs and improve climate change mitigation strategies through the development of FRIDA, a global-scale, publicly accessible IAM.

Human behavioural drivers of meat consumption: Using group model building to capture lived realities by Jefferson K. Rajah et al.

Existing pro-environmental behavior models often rely on abstract psychological theories that may not fully reflect real-world experiences. To address this, we conducted group model building workshops with graduate students to create a model based on lived realities. Using meat consumption as a case study, we employed causal loop diagramming to capture participants'

feedback and local contexts. This approach enriches theoretical frameworks with practical insights, offering a more nuanced understanding of human behavior and its environmental impacts.

Modeling the global macroeconomic system for next generation world-Earth models: The economy of FRIDA v1.1, by Martin Grimeland et al.

This work introduces a new global macroeconomic model that tracks the flow of money and integrates finance-mediated credit as a key growth driver. Part of the FRIDA v1.0 socio-ecological model, it features a fully endogenous circular flow system for government spending based on taxation and debt. The model accounts for credit and business cycles and their mechanistic interactions with climate change. Although it improves existing models by reflecting economic dynamics and climate impacts, it still requires further development to fully represent the real economy.

All models are wrong, but some are useful. How do you know? By Andreas Lindqvist et al.

How to enhance global IAMs by incorporating novel approaches from various user perspectives. His work contributes to the development of FRIDA, a feedback-rich World-Earth model using system dynamics. Nicolaidis Lindqvist is specifically focused on the water and land-use sectors of this model.

Lessons from working across facilitated modelling disciplines by Étienne Rouwette

Interpersonal relations, emotion and decision making support: conceptualization and a proposal for measurement by Étienne Rouwette et al.



WorldTrans researchers use gaming to understand barriers to climate change mitigation

Bergen, Norway In a small office in Bergen, researchers Adakudlu Muralidhar and Sarah Mashhadi are using an unconventional method to tackle one of the world's most pressing challenges: climate change. Armed with the board game *Ecopolicy*, the duo is exploring various scenarios and outcomes, which they then feed into the FRIDA system, a dynamic modeling tool designed to assist decisionmakers in crafting effective climate policies.

Muralidhar, with a stack of game-generated numbers in hand, passes them to Mashhadi, who meticulously records them in an Excel sheet.

These numbers represent different scenarios played out in *Ecopolicy*, a game that simulates the complex interconnections between education, sanitation, pollution, production, population, and birth rate. Designed by cybernetics expert Frederic Vester, the game aims to deepen our understanding of global dynamics.

Later, these scenarios will be tested within FRIDA using the Stella software, as part of the WorldTrans project. This initiative seeks to develop a system dynamics model of *Ecopolicy* to better address critical environmental and socio-economic questions.

"It's a very valuable process for us to play out the different scenarios and see what the outcome will be," Mashhadi explains. "We want FRI-

DA to be used by decision-makers to make good decisions for the future. To do that, we researchers must try a lot of different approaches towards a solution."

Muralidhar adds with a smile, "Even though we crash and die at the end – every time."

Despite the lighthearted atmosphere, the researchers are acutely aware of the serious implications of their work.

The game is a harmless tool, but the real-world adaptation to climate change is anything but.

Understanding the intricate balance between different environmental factors is crucial, and the ability to test various outcomes in a simulated environment like FRIDA provides invaluable insights.



"We can't try and fail that many times in real life. That is too expensive"

Board games + researchers = informed policy makers in the future?

"Climate change itself has many roads and is often described as difficult to understand," says Mashhadi.

"But to understand the whole picture, we need to see all parts. Just explaining it is very hard because climate thinking is advanced. We need to find good tools so everyone can get a better understanding of what the earth can handle."

The goal, according to Muralidhar, is not to turn FRIDA into a game but to create a robust tool that can predict the outcomes of different scenarios.

This will help future politicians and researchers make informed decisions without the costly consequences of trial and error in real life.

"We can't try and fail that many times in real life. That is too expensive," Mashhadi concludes.

As they continue to feed data into FRIDA and refine their models, Muralidhar and Mashhadi's work underscores the importance of innovative approaches in the fight against climate change.

By combining gaming with serious science, they hope to provide the world with the tools it needs to navigate an uncertain future.

Photos and text by Charlotte Stark, MET



Brainstorming isn't going to save the world

WorldTrans is about bridging the divide between climate models and engagement. Mitigating climate change requires tough decisions.

- But how do you arrive at a good decision?

Professor Etienne Rouwette has studied engagement in systems thinking for more than two decades. He shares his thoughts about the new book.

"Systems thinking involving decision makers and the public is a practical, well-tested way to do this"

In organisations, it is usually teams that are responsible for big decisions. Decisions by these teams turn out wrong in three out of four cases, research shows.

"The options chosen are not implemented or do not solve the problem"

Wrong approach essentially amounts to a top-down approach.

"Not all people are allowed to participate in the decision. It then turns out that as a result, not all effects have been considered and there is often backlash from those who have not been heard"

"Engaged decision making: From team knowledge to team decisions" and Etienne. Photo: RU

In this book, they draw from research in cognitive and social psychology, decision sciences, and operational research to demonstrate how facilitated model-driven interventions can transform team decision making into a rigorous, transparent, and defensible process.

"Our aim is to provide a practical resource for advanced students and researchers, analysts or consultants, and leaders seeking effective team recommendations." Rouwette Concludes.

Partners



FOLLOW US:



www.worldtrans-horizon.eu



This project has received funding from the European Union's Horizon 2.5 under grant agreement No 101081661. Legal Disclaimer: The contents of this document are the sole responsibility of the authors and do not reflect the opinion of the European Commission. The European Commission is not responsible for any use that may be made of the information contained in this document.