



NITheCS

National Institute for
Theoretical and Computational Sciences

COLLOQUIUM

DATE: Monday, 9 March 2026 | 16h00–17h00 SAST

- VENUES:**
- **Stellenbosch University:** Room 1041, Mathematical Sciences/ Industrial Psyc Bldg
 - **University of the Witwatersrand:** Room P215, 2nd Floor, Physics Building
 - **North-West University:** Seminar Room K310, Physics Building G5
 - **Online**

--- A recording of the talk will be published on the NITheCS YouTube channel afterwards ---

Integrating Earth System and Socio-Economic Modelling for South Africa

Talks presented by two participants from the recent NITheCS South African Earth System Model Initiative Workshop:

Why does South Africa need coupled Earth System and Integrated Assessment Models?

Prof Pedro Monteiro (School for Climate Studies, Stellenbosch University)

ABSTRACT:

Over the past decade, South Africa has developed strong capabilities in atmospheric, ocean and land system sciences. However, these efforts remain fragmented across domains and institutions, limiting progress in understanding coupled carbon–climate–human feedbacks shaping 21st-century risks. Meanwhile, the global community is advancing toward high-resolution Earth System Models (ESMs), generating large data volumes and requiring new analytical, engineering and AI-enabled modelling skills – areas where local capacity remains limited. In South Africa, geophysical constraints such as water scarcity, climate variability and land degradation actively shape development pathways. Addressing this requires moving beyond one-way impact assessments and least-cost optimisation models toward coupled Earth System and regional Integrated Assessment Models (rIAMs) that capture feedbacks between climate and socio-economic systems.

This talk outlines a proposal for a coordinated South African ESM–rIAM platform to strengthen national capability, support Carbon Dioxide Removal research, and build African partnerships for policy-relevant science.



Prof Pedro Monteiro is based at the School for Climate Studies at Stellenbosch University, where he leads the emerging research area of ocean Carbon Dioxide Removal, a key global and regional science and governance challenge toward and beyond net-zero emissions. His work focuses on understanding how regional and global natural carbon sinks, ecosystems, and carbon–climate feedbacks influence the effectiveness of negative emissions and inform sound policy development in the 21st century.

Coupling Earth System and Socio-Economic Models for South Africa: Opportunities for NITheCS

Prof Martin de Wit (School for Public Leadership, Stellenbosch University)

ABSTRACT:

South Africa faces escalating climate risks, including interior temperature rises exceeding 4°C by late century, that cannot be adequately addressed by existing disconnected modelling frameworks. This presentation makes the case for a coupled Earth System Model–Integrated Assessment Model (ESM–IAM) platform for South Africa, hosted within the NITheCS network. Current South African models rely on one-way data exchange, stylised economics, single representative agents, and weak biophysical realism — limitations that produce resilience-deficient planning pathways.

We outline a progression from asynchronous (Type A) toward fully coupled (Type D) modelling, grounded in System Dynamics, Agent-Based Models, thermodynamic constraints, and open-source infrastructure. A hub-and-spokes platform — integrating water, energy, land, oceans, ecosystems, economy and equity — is proposed as a shared national resource. A 10-year research programme identifies quick wins (0–3 years) and ambitious goals (4–10 years), with NITheCS positioned as coordinator of modelling capacity, student training, and international collaboration.



Prof Martin de Wit is Professor of Environmental Governance at Stellenbosch University, where he teaches Environmental Economics. He coordinates the School of Public Leadership's MPhil (Environmental Management) programme and supervises PhD students in the PhD (PDM) programme, focusing on environmental governance, management, and policy.

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