From Climate Model Outputs to Reproducible Insights: Building a Connector for Simvue with Agentic AI

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Earth-system and climate-modelling workflows generate **large datasets** including configuration files, runtime diagnostics, solver metrics and scientific outputs. **MITgcm**[1], a numerical model which simulates fluid flows in the atmosphere and ocean, can produce **hundreds of files per simulation.** This makes it difficult to monitor progress, keep results organised and extract key findings for analysis.

Introducing Simvue

Simvue[2] is a platform which enables **real-time tracking and monitoring** of simulations and data processing tasks. It allows users to:

- **Get real-time updates** on simulations as they are run
- **View results interactively** in the web UI
- **Filter, compare and share** runs with colleagues.
- **Abort failed simulations early,** saving time and cost

Data is stored in a standardised, AI-ready format, allowing for the development of surrogate Machine Learning models from within the web UI, which can approximate results from new simulations in a fraction of the time.



The Simvue UI comparing 10 MITgcm Barotropic Ocean Gyre[2] simulations with varying wind stress. Data was extracted automatically during simulation using an agent-developed connector.



Applying Agentic AI

A **Simvue connector** extracts diagnostics and outputs from a simulation and uploads them in a consistent format. Development typically takes weeks and requires a domain expert plus a Simvue developer.

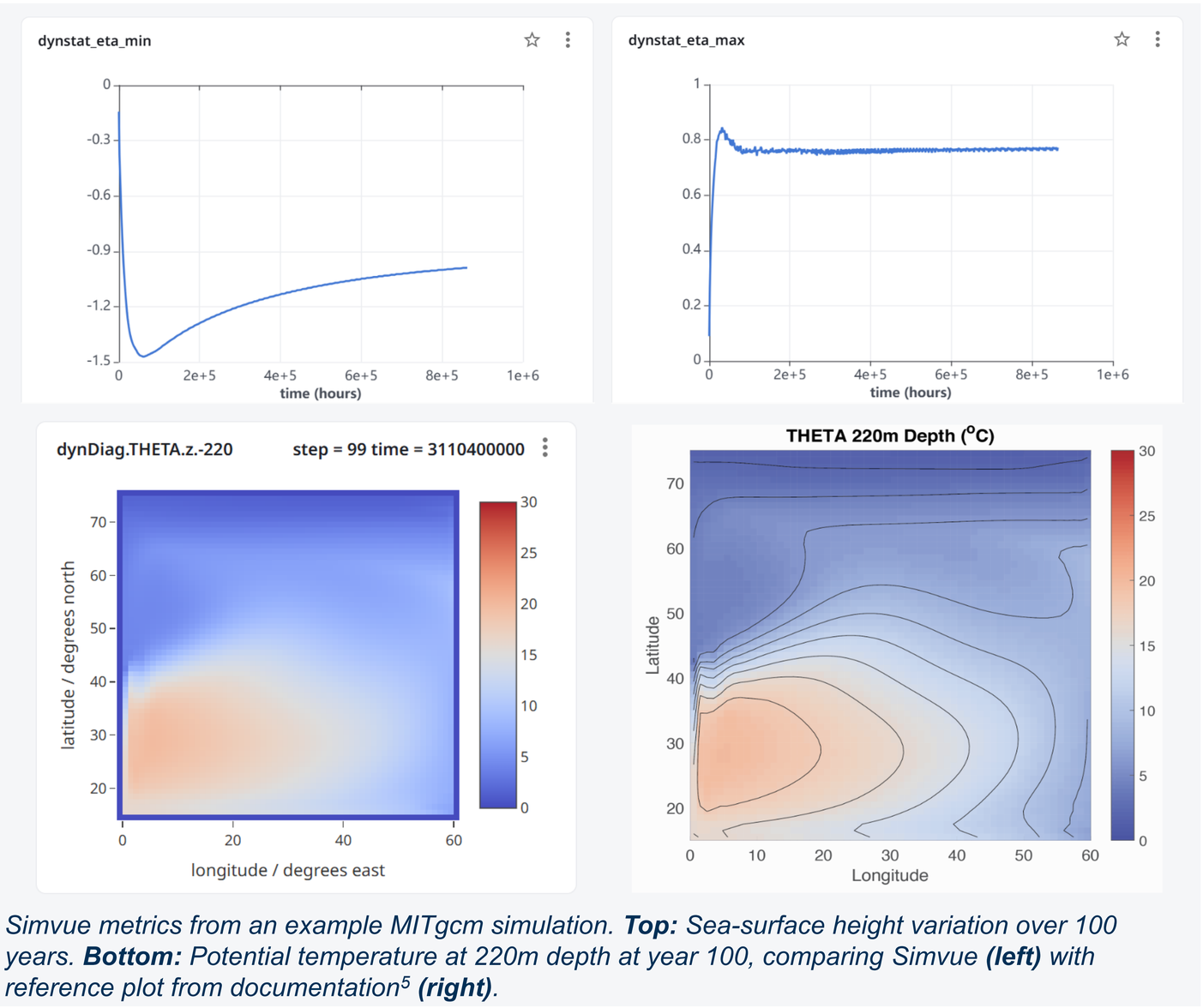
An **AI coding agent** can shorten this work using the model's source code, documentation and example runs. A template repository[4] sets coding standards, while a staged workflow guides development. A **human reviewer** checks progress and provides feedback at each step.

Developing the MITgcm Connector

The MITgcm connector was developed using **ChatGPT 6.1 Sol** and without a domain expert, in a fraction of the time it would take a developer, and costing approximately $20 in tokens. It supports:

- The upload of (user selected) **input and output files** as artifacts
- Extraction of **metadata** from input and configuration files
- **Real-time monitoring** of log files and console messages
- 1D time-based metrics of **diagnostics** (CFL tracers, vorticity…)
- 2D metrics showing **surface profiles** evolution over time (Eta…)
- Extraction and upload of **slices from 3D volumes** (THETA…)

This demonstrates how Agentic AI can be utilised to easily connect Simvue with any climate software, to enable more efficient, reproducible simulation workflows.



*Simvue metrics from an example MITgcm simulation. **Top:** Sea-surface height variation over 100 years. **Bottom:** Potential temperature at 220m depth at year 100, comparing Simvue **(left)** with reference plot from documentation[5] **(right)**.*

[1]: A. Adcroft et al. (2026) MITgcm (Mid 2026 release) [Computer software]. https://github.com/MITgcm/MITgcm
[2]: Lahiff, A. et al. (2026). Simvue (Version 2.6.2) [Computer software]. https://github.com/simvue-io/python-api
[3]: Simvue Connector Template [Computer software]. https://github.com/simvue-io/connectors-template
[4]: Barotropic Ocean Gyre. https://github.com/MITgcm/MITgcm/tree/master/verification/tutorial_barotropic_gyre
[5]: Baroclinic Ocean Gyre. https://mitgcm.readthedocs.io/latest/examples/baroclinic_gyre/baroclinic_gyre.html

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