

Software challenges for the Agricultural Model Intercomparison Project

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1 Introduction

The Agricultural Model Intercomparison Project (AgMIP⁴) is a distributed climate-scenario simulation exercise for historical model intercomparison and future climate change conditions with participation of multiple crop and world agricultural trade modeling groups around the world. The goals of AgMIP are to improve substantially the characterization of risk of hunger and world food security due to climate change and to enhance adaptation capacity in both developing and developed countries.

Within the AgMIP network, more than a hundred scientists across the globe are challenged to intercompare a variety of agricultural models that have been developed in the past decades to simulate crop production in different areas. To achieve its goals, AgMIP network is challenged on many fronts and is in need for advanced IT support. Agricultural models not only apply different modelling paradigms (i.e scientific intercomparison), but also they are implemented with different programming languages, and rely on different data structures (software and requirements intercomparison). In this respect, supporting the communication and organization of the community, while providing an efficient data, software and visualization infrastructure for the intercomparison models remains a great challenge.

This talk will summarize some of the use cases collected, and will preview tools and application scenarios specified by the IT team of the AgMIP network for supporting crop modelling intercomparison, in its last two meetings in Long Beach, California, USA (Oct 2010), and in Amsterdam, The Netherlands (Apr 2011).

2 The AgMIP Information Technologies Team Protocols

AgMIP IT team goal is to facilitate the compilation, archiving, and exchange of data and software for the AgMIP research community and stakeholders. More specifically, its objectives are to:

- a) Develop an IT infrastructure that allows easy and secure access to shared data, models and results of researchers in the AgMIP consortium, with both a short and long term perspective;

⁴ The AGMIP website: <http://www.agmip.org>

- b) Facilitate primarily the use of data by models and exchange of model results and secondly, the linking of models relevant for the AgMIP project to allow for reproducible and repeatable applications;
- c) Explore the potential of state-of-the-art Information & Communications Technologies, relevant to improve modeling with a long-term perspective, including web-based model executions, digital libraries and Service Oriented Architectures
- d) Organize the online dissemination of AgMIP data and outputs.

IT team will investigate how to efficiently archive and make accessible related data (either reference input data for benchmarking, or simulation results). Specifying a common data structure and overcome data interoperability issues remains the core challenge. Semantic search tools developed on top of rich metadata profiles for digital archives could provide solutions for efficient discovery. The envisioned system will be developed as a distributed federation of databases or as a centralized data service over the cloud. The decision on this aspect is related not only on performance of the alternative solutions but also on the learning curve for training agricultural scientist to adopt it.

A second critical success factor is the availability of a separate interactive stakeholder interface to explore and investigate project outputs by a wider audience (i.e policymakers and food security analysts). Modern Web technologies for interactive data visualization and access, is another IT asset that needs to be exploited for supporting easy access, reuse and transparency of the project results and the underlying process.

The IT Team will work with the Climate, Crop Modeling and Economic Modeling Teams to perform a requirements analysis of the IT infrastructure, and document expectations and intended functionality through use cases. An inventory of existing data and methods will be assessed for their applicability to long term storage and retrieval of AgMIP data and software.

Software engineering good practices for organizing tickets, reporting bugs and sharing code is an extremely important asset for the success of the AgMIP project. Organizing a team of researchers across the Globe, documenting their contributions and tracking project progress can be done systematically by adopting standard software engineering tools, with the appropriate training. Needless to point out that for agricultural scientists are not accustomed to the software engineering culture of sharing data or code, and such transition consists a real paradigm shift.

In addition, software testing methodologies and profiling tools can be used for the intercomparison of the software qualities of the agricultural models under study. Given the diversity of software designs, implementation languages and licenses, this exercise can conclude to concrete guidelines for reusing crop models.

The AgMIP IT team is challenged by the complexity of the agricultural modelling domain and needs to identify and prepare its developments for the long terms needs of the project and beyond.