

Thirty years of APSIM modelling: Reflections on the journey, past, present and future

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Abstract: It is thirty years since APSIM was first documented in the scientific literature (McCown et al 1995) and its scope and impact has extended far beyond that envisioned in the 1995 paper. Crop and soil models first emerged as tools for agricultural R&D in the 1960's and there was something of a build, use and discard philosophy at that time. A major stimulus for APSIM development in the early 1990's was the desire to create a common platform for soil, crop (and later pasture/animal and forest) scientists to explore the complex interactions between farm management and climate/weather on a sustained, reusable basis. The initial team wanted a capability that they could use for their entire careers and hence a major focus was placed on achieving a model architecture that could evolve alongside highly varied and evolving needs.

The evidence today suggests that this initial aspiration for a flexible capability for modelling diverse agricultural systems was achieved, some might suggest over-achieved. APSIM's keynote papers have been cited many thousands of times and modelling applications appear in the literature for most parts of the world and for most dimensions of agricultural and environmental R&D (see Keating 2024). While APSIM today is very different to APSIM in 1995 (see Holzworth et al. 2018), the motivation behind its continued support and development remains largely unchanged. Key lessons from the past that we argue will remain central to the future, include:

- The value of designing science modules and a platform for module interactions that could be used across a diverse range of application environments, including for applications that had not yet been contemplated.
- The value of keeping a balanced input from science and software teams in the model development process.
- The value of transparency in model functionality via open-access code (to build trust) that is still governed in a disciplined way (to ensure on-going functionality).
- The value of an open-door policy to partnerships that enable individuals, groups and institutions to build additional functionality in their areas of interest and expertise.
- Continuing recognition that these models will be wrong sometimes, either in input specification, module parameterisation or basic model structure. That is to be expected, an opportunity for improvements and only a serious problem if not detected.

APSIM has proved to be a survivor, in part by adapting to changed circumstances over the years. The explosion of interest in machine learning and artificial intelligence is another great stimulus for APSIM to adapt again – more an opportunity than a threat in our view.

REFERENCES

- Holzworth DP, Huth NI, Fainges J, Brown H, Zurcher E, Cichota R, Verrall S, Herrmann NI, Zheng B and Snow V (2018) APSIM Next Generation: Overcoming challenges in modernising a farming systems model. *Environmental Modelling & Software*, Volume 103, pp 43-51, <https://doi.org/10.1016/j.envsoft.2018.02.002>.
- Keating, BA (2024) APSIM's origins and the forces shaping its first 30 years of evolution: A review and reflections. *Agronomy for Sustainable Development* 44 (3), 24
- McCown RL, Hammer GL, Hargreaves JNG, Holzworth D and Huth NI (1995) APSIM - An Agricultural Production System Simulation-Model For Operational-Research, *Mathematics And Computers In Simulation*, Volume 39, Issue 3-4, pp 225-231, [https://doi.org/10.1016/0378-4754\(95\)00063-2](https://doi.org/10.1016/0378-4754(95)00063-2).

Keywords: APSIM, Agricultural Systems, Modelling