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Maintaining the integrity of a complex model

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Maintaining the integrity of a complex model

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Abstract: Developing and testing complex models is difficult and time consuming so it is vital that once a model has reached an acceptable level it remains that way for the life of the model. This is particularly critical for models that undergo continuous maintenance and improvement. All too often, extensive effort is invested into model development and testing only to see the model performance drift over time, due to science and software enhancement. In addition, it is important that the performance of a model be visible to users and developers. The APSIM Initiative have developed a methodology to ensure this happens. This involves the use of tools such as version control, continuous integration, calculation of a broad range of model performance statistics, and web dashboards. Just as importantly, a process has been developed that links these tools to create a testing regime that all developers of APSIM must follow. It includes peer review of source code and science, performance metrics for all models freely available on the web and guiding principles to help developers commit new changes to models as painlessly as possible. This talk discusses how the APSIM Initiative measure and maintain the performance of models.

Maize

Predicted/Observed	n	RMSE	NSE	RSR
FloweringDAS	90 (90)	7.69488 (7.69488)	-0.329 (-0.329)	1.146 (1.146)
LAImax	74 (74)	0.66808 (0.66808)	0.753 (0.753)***	0.493 (0.493)***
Maize.AboveGround.N	6 (6)	2.52677 (2.52677)	0.894 (0.894)***	0.297 (0.297)***
Maize.AboveGround.Wt	88 (88)	213.955 (213.955)	0.867 (0.867)***	0.363 (0.363)***
Maize.Grain.N	6 (6)	0.92138 (0.92138)	0.97 (0.97)***	0.157 (0.157)***
Maize.Grain.Number	84 (84)	540.557 (540.557)	0.8 (0.8)***	0.444 (0.444)***
Maize.Grain.Size	84 (84)	0.07047 (0.07047)	-0.559 (-0.559)	1.241 (1.241)
Maize.Grain.Wt	103 (103)	165.677 (165.677)	0.767 (0.767)***	0.48 (0.48)***
Maize.Husk.Wt	6 (6)	29.6651 (29.6651)	0.408 (0.408)	0.702 (0.702)
Maize.Leaf.Live.N	6 (6)	0.37288 (0.37288)	0.906 (0.906)***	0.28 (0.28)***
Maize.Leaf.Live.Wt	6 (6)	18.5669 (18.5669)	0.94 (0.94)***	0.223 (0.223)***
Maize.Rachis.Wt	6 (6)	37.0856 (37.0856)	0.602 (0.602)*	0.576 (0.576)**
Maize.Stem.N	6 (6)	0.87528 (0.87528)	-0.082 (-0.082)	0.949 (0.949)
Maize.Stem.Wt	6 (6)	49.5876 (49.5876)	0.928 (0.928)***	0.245 (0.245)***
Maize.Structure.FinalLeafNumber	21 (21)	0.79080 (0.79080)	0.296 (0.296)	0.819 (0.819)
MaturityDAS	90 (90)	8.88507 (8.88507)	0.695 (0.695)**	0.549 (0.549)**

Performance Rating	RSR	NSE	
***	Very Good	0.00 ≤ RSR ≤ 0.50	0.75 < NSE ≤ 1.00
**	Good	0.50 < RSR ≤ 0.60	0.65 < NSE ≤ 0.75
*	Satisfactory	0.60 < RSR ≤ 0.70	0.50 < NSE ≤ 0.65
	Unsatisfactory	RSR > 0.70	NSE ≤ 0.50

Figure 1: An excerpt from <https://apsim.csiro.au/APSIM.PerformanceTests> showing the performance of the maize model.

Keywords: APSIM; Model performance; Model testing; Software Engineering Process