



## **Are Earth System model software engineering practices fit for purpose? A case study.**

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We present some analysis and conclusions from a case study of the culture and practices of scientists at the Met Office and Hadley Centre working on the development of software for climate and Earth System models using the MetUM infrastructure. The study examined how scientists think about software correctness, prioritize their requirements in making changes, and develop a shared understanding of the resulting models. We conclude that highly customized techniques driven strongly by scientific research goals have evolved for verification and validation of such models. In a formal software engineering context these represents costly, but invaluable, software integration tests with considerable benefits. The software engineering practices seen also exhibit recognisable features of both agile and open source software development projects - self-organisation of teams consistent with a meritocracy rather than top-down organisation, extensive use of informal communication channels, and software developers who are generally also users and science domain experts. We draw some general conclusions on whether these practices work well, and what new software engineering challenges may lie ahead as Earth System models become ever more complex and petascale computing becomes the norm.