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Fault Fictions: Systematic biases in the conceptualization of fault zone architecture

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Mental models are a human's internal representation of the real world and have an important role in the way a human understands and reasons about uncertainties, explores potential options, and makes decisions. However, they are susceptible to biases. Issues associated with mental models have not yet received much attention in geosciences, yet systematic biases can affect the scientific process of any geological investigation; from the inception of how the problem is viewed, through selection of appropriate hypotheses and data collection/processing methods, to the conceptualisation and communication of results. This presentation draws on findings from cognitive science and system dynamics, with knowledge and experiences of field geology, to consider the limitations and biases presented by mental models in geoscience, and their effect on predictions of the physical properties of faults in particular. We highlight a number of biases specific to geological investigations and propose strategies for debiasing. Doing so will enhance how multiple data sources can be brought together, and minimise controllable geological uncertainty to develop more robust geological models. Critically, we argue that there is a need for standardised procedures that guard against biases, permitting data from multiple studies to be combined and communication of assumptions to be made. While we use faults to illustrate potential biases in mental models and the implications of these biases, our findings can be applied across the geoscience discipline.