# Making sense of uncertainties: Ask the right question

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Climate change solutions rely on data from numerical models, remote sensing, and ground observations. Improvements in modeling (such as convection-permitting models) and measurement technology (such as new remote sensing instruments) lead to an ever growing confidence in our understanding in processes and changes in the climate system. However, all data have---and will remain to have---an associated uncertainty, and it is crucial that these uncertainties are taken into account when designing data-informed climate change solution.

Data producers usually strive to provide reliable uncertainty estimates alongside their products that should help inform decisions that are based on these products. However, data users often struggle to make sense of uncertainty information, because it is usually expressed as the statistical spread in the observations (for example, as random error standard deviation), which does not relate to an intended use of the data. That is, data and their uncertainty are usually expressed as something like "x plus/minus y", which does not answer the really important question: How much can I trust "x", or any use of or decision based upon "x"? As a consequence, uncertainties are often ignored altogether, and model predictions or observational data taken at face value.

In this talk, we demonstrate how looking at deterministic estimates from models or Earth observations alone can be misleading, and that any decisions based on these estimates are unlikely to be the best course of action. We then show how typical data representations like "the state of this variable is "x plus/minus y" can be transformed into more meaningful, actionable information, i.e., statements such as "the data and their uncertainties suggest that we can be "z" \% confident that...". Finally, we discuss how such an approach can help data users make better decisions and design more reliable climate change solutions, thus maximizing the socioeconomic merit of Earth system science data. Adopting such an approach will be a transdisciplinary endeavour that requires close dialogues between data producers and decision makers.