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Uncertainty modelling for satellite-based sea surface temperatures

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This contribution addresses progress in uncertainty modelling for satellite-based sea surface temperatures in two projects. The first project is ESA's Climate Change Initiative for Sea Surface Temperature (SST CCI) in which a model has been developed for context-specific uncertainty estimates to be attached to each measured SST. The model has three components : (independent) random, structured random (locally correlated) and systematic. At the level of full resolution pixels, the random component is associated with noise in the satellite observations, the structured random component arises from SST retrieval errors and the systematic is an overall calibration uncertainty. These uncertainties propagate differently into gridded, averaged data. Moreover, and additional random effect is added to the uncertainty for gridded, averaged data to account for incomplete sampling of the time-space domain of the grid (representativity). A tool has been prototyped to propagate these uncertainties to large-scale average SSTs, account properly for correlation structures, which is somewhat effective, but requires more development.

In a second project, FIDUCEO (Fidelity and Uncertainty in Climate data records from Earth Observation), an even more fundamental approach is being attempted, by building models of uncertainty at the radiance level, i.e, at the level of the records from which SST is retrieved. It turns out that such data also contain structure random errors, as well as noise and systematic effects. These all propagate into errors in the SST retrieval in turn, and the error distributions turn out not to be Gaussian. FIDUCEO will also involve experimentation with ensemble methods for characterising uncertainty at both radiance and SST level, as a means of representing complex correlations when transforming data to different spatio-temporal scales for diverse climate applications.

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- **Quantification and estimation of uncertainty**