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Sea surface temperature: Wavenumber variability from satellite data

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The sea surface temperature (SST) has been observed by satellite instruments since the early 1980's and is one of the longest space-based records of any Earth physical parameter. SST has been an essential data set for weather forecasting, and this operational need has resulted in multiple satellite sensors observing the SST at any given recent time. Measurements from the different satellite sensors need to be calibrated with each other as well as with in-situ data in order to produce a consistent SST record. The microwave (MW) sensors have typically coarser 25-km resolutions than the infra-red (IR) sensors which can resolve down to a 1-km scale. On the other hand, the IR-based measurements are prone to data-voids due to cloud contamination, which does not affect MW sensors nearly as much. Combination of these data sets can be shown to be complementary, contributing to accuracy of a blended SST map ("analysis"). An advantage of the space-based SST analysis is the spatial coverage. It is observed that the physical resolutions of the existing SST analysis products, as measured by the power spectral density (PSD) of their wavenumber contents, tend to fall short of the resolution capability of most IR sensors. It is possible that typical operational weather forecasting models could tolerate such lack of high wavenumber contents. Still, finer SST patterns could potentially affect accuracy of severe-weather prediction performed by high resolution models. Moreover, higher resolution SST analysis could also benefit understanding of marine ecosystems, through improved localization of such potentially relevant features as ocean temperature fronts and mesoscale gyres ("warm/cold-core rings"). We present the wavenumber PSD's of various SST analysis and retrieval products and consider possibilities of utilizing the resolution capability of the SST retrievals for a gridded analysis.