Monitoring the sea surface temperature from IASI for climate application

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ABSTRACT

The sea surface (skin) temperature (SST) is a key parameter in climate science, meteorology and oceanography. Being at the ocean- atmosphere interface, it plays a crucial role in the variability and regulation of climate and its knowledge is essential to understand heat, momentum and gases exchange processes between the ocean and the atmosphere. As such, it is recognized as one of the essential variables for which accurate and global measurements are needed for the understanding, monitoring and forecasting of climate evolution, as well as for numerical weather predictions. Within this framework, satellite remote sensing, by providing daily and global observations over long time series, offers good opportunities. In particular, the excellent calibration and stability of the IASI instrument and the planned long time series of observation provided by the suite of three satellites Metop A, B and C is fully consistent with the quality requirement for climate studies .

We analyze here more than 17 years of the SST time series retrieved from IASI on board the three Metop using a fully physically-based algorithm. We will show that this dataset is characterized by : i) a total independence from in-situ measurements or models. ii) a high accuracy assessed by a systematic comparison with in-situ depth-temperature measurements, with a mean difference lower than 0.05 K and a robust standard deviation of 0.25 K. iii) an excellent stability of the time series, with a trend of the bias compared to in-situ measurements lower than 0.05 K/decade over the 2007-2024 period; iv) a perfect consistency between the three generations of IASI on-board Metop- A, -B, and -C, where monthly comparisons over their overlapping period give a mean SST difference lower than 0.02 K and a standard deviation of 0.3 K. Altogether, these results satisfy the prerequisites required to consider an SST time series as a climate data record (CDR). This opens promising perspectives by demonstrating the possibility to provide an accurate, as well as stable, SST time-series from IASI over the planned 20 years of the Metops-suite, that will be followed by two more decades of the IASI-New Generation missions.

With this dataset fully compliant as CDR, it is possible to monitor the climate evolution and variability by analyzing trends and anomalies of SST. We will present here some examples of the SST regional and global changes observed during the last 17 years and, in particular, we will focus on the increase of heatwave frequencies in European coast.