The EUSTACE project: delivering global, daily information on surface air temperature

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Day-to-day variations in surface air temperature affect society in many ways; however, daily surface air temperature measurements are not available everywhere. A global daily analysis cannot be achieved with measurements made in situ alone, so incorporation of satellite retrievals is needed. To achieve this, in the EUSTACE project (2015-June 2018, https://www.eustaceproject.eu) we are developing an understanding of the relationships between traditional (land and marine) surface air temperature measurements and retrievals of surface skin temperature from satellite measurements, i.e. Land Surface Temperature, Ice Surface Temperature, Sea Surface Temperature and Lake Surface Water Temperature.

Here we discuss the science needed to produce a fully-global daily analysis (or ensemble of analyses) of surface air temperature on the centennial scale, integrating different ground-based and satellite-borne data types. Information contained in the satellite retrievals is used to create globally-complete fields in the past, using statistical models of how surface air temperature varies in a connected way from place to place. As the data volumes involved are considerable, such work needs to include development of new "Big Data" analysis methods.

We will present recent progress along this road in the EUSTACE project:
- providing new, consistent, multi-component estimates of uncertainty in surface skin temperature retrievals from satellites;
- identifying inhomogeneities in daily surface air temperature measurement series from weather stations and correcting for these over Europe;
- estimating surface air temperature over all surfaces of Earth from surface skin temperature retrievals;
- using new statistical techniques to provide information on higher spatial and temporal scales than currently available, making optimum use of information in data-rich eras.