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EUSTUSTACE – New global daily temperature dataset for all surfaces of earth since 1850

Gerard van der Schrier and the EUSTACE project team
Royal Netherlands Meteorological Institute, Observations and Data Technology, De Bilt, Netherlands (schrier@knmi.nl)

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 (2015-2019, https://www.eustaceproject.org) we have developed 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. This includes developing new "Big Data" analysis methods as the data volumes involved are considerable. We will present the methods used and the final results of the EUSTACE project, i.e. 1) identifying inhomogeneities in daily surface air temperature measurement series from weather stations and correcting for these over Europe; 2) estimating surface air temperature over all surfaces of Earth from surface skin temperature retrievals; 3) 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.

An overview of produced datasets concludes the presentation.