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Snow Albedo Effect on Air Temperature Measurements – Task 3.5 of the JRP ENV58 MeteoMet2 Project

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In the framework of JRP ENV58 MeteoMet2, a project aimed at the evaluation of the overall measurement uncertainties for Essential Climate Variables (ECVs), a task is dedicated to the evaluation of the overall measurements uncertainties for the quantities involved in the meteorological observations and climate change evaluations.

The MeteoMet2 project is structured in 3 work packages (WP 3) each covering a different area of observation: air, sea and land. The ECVs consider water vapour in upper-air and surface atmosphere, surface and deep sea temperature, salinity, air temperature, precipitation, albedo, permafrost temperature and soil moisture.

In WP 3 metrological procedures to evaluate intrinsic characteristics of air thermometers and humidity sensors plus radiation shield will be developed. The effect of influence parameters, such as sensors siting, rain and albedo on air temperature measurements, will be analysed. Within WP 3 JRP-participants jointly carrying out numerical and experimental characterizations of automatic weather stations in order to supply to the meteorological community the correction and uncertainties for the effects.

The objective of task 3.5 of WP 3 is to study the influence of the albedo in terms of high sunlight reflection from snow covered soil on near-surface air temperature measurements. The absorbed energy raises the surface temperature, evaporates water, melts and sublimates snow and ice, energizes the turbulent heat exchange between the surface and the lowest layer of the atmosphere. The air temperature increases under those conditions. Air temperature instruments are effected by radiative extra heating when exposed to snow covered surface. Temperature records can be different from air temperature value, due to warming of sensors by conduction and convection, inside the shields. Different instruments show a different magnitude of this effect. The evaluation of this effect, in terms of correction and uncertainty on air temperature measurements, is the scope of this work. Therefore, an evaluation of the difference between the readings of couples of identical sensors, exposed to snow covered surface or to natural soil in the same site, is carried out. The experiment ended in April 2017 and the results show a clear effect on air temperature measurements due to the snow albedo effect. Furthermore, the issues of MeteoMet2 are a report to users on how to include the albedo effect on air temperature measurements in terms of uncertainty and correction and a recommendation to manufacturers on how to possibly reduce the magnitude of the effect.