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THE HEAT IS ON: PATENTED RAIN GAUGES TECHNOLOGY FOR COLD CLIMATES

Rain gauge and meteorological sensors in cold climates: Italian technology as a reliable support to measure in extreme environmental conditions

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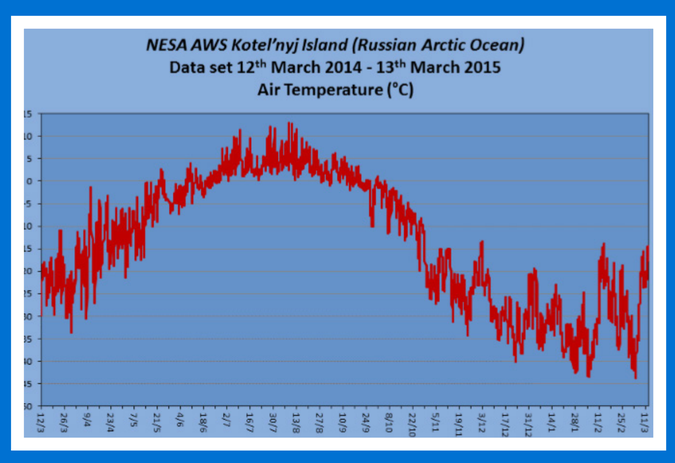
Scientific studies about measurement of snow precipitation demonstrate that the measure of equivalent water quantity acquired by a standard heated tipping bucket rain gauge (even if manufactured according to WMO) can be underestimated up to 30-40% in places where precipitations are mainly solid during the year (CUGERONE et al., 2012). In particular, during a snowfall, relevant problems are caused by strong gusts (turbulent wind transport that reduces the real amount of gathered snow, if proper screens like "Alter" are not used) and by formation of ice on collecting surface of sensor; moreover, specific factors depending on the orography, exposure and heating sensor processes (with possible water evaporation) can increase total uncertainty. Main target for manufacturing Companies is to develop professional instruments suitable for both industrial and scientific uses, according to WMO norms .



Temperatures below -40°C are not rare, and few precipitations occur almost exclusively in solid form, except for brief rainfall during the summer (according to the database, the lower temperature was measured on 5th March 2015: -43.7°C). Annual average is around -13°C.

NESA srl patented its industrial invention nr. 0001385352 titled "Pluviometro riscaldato a basso consumo di energia" ("Heated rain gauge with low power consumption") (Italian office for Patents and Trademark – Ministry of Economic Development, Rome, January, the 1st, 2011). The procedure is described as follow: the heating is activated below a certain temperature threshold but for a limited time interval (typically 10 minutes); if in this interval at least one tilting is measured (indication of precipitation), then the heating continues for another time interval, instead it stops if no signal is recorded. Appropriate electronic circuits have to manage both heating activation and deactivation and the verification of precipitation presence; this technique is suitable for monitoring systems with limited energy availability, and allows to further refine knowledge on solid precipitation mensuration in critical conditions.

WHAT'S NEXT?

The technology and its associated developments make it possible to carry out more accurate weather measurements. The use of sophisticated management and remote control systems, the implementation of patented and sustainable solutions, the application of validation methods and the independent checks of final results allow the collection of datasets that can be used for the most varied post-processing (such as climate analysis, weather prediction models, air pollution dispersion simulations and so on).
The use of precision digital rain gauges with "smart" electronics for efficient heating management (for cold climates) is one of the most interesting challenges for professional instrument manufacturers who need to provide products where the demand for lowering electricity consumption as much as possible (in order to allow the use of devices also in remote areas with low energy availability) and at the same time adapt to the increasingly strong push towards new IoT technologies co-exist.
The ever-increasing need to make available IoT devices with "smart" management, always connected to networks like SigFox, LoRaWAN, IEEE 802.15.4, ZigBee, is a challenge that involves entire sections of the manufacturing industry, and will certainly bring benefits to all supranational organizations, MetOffices and any other institutional user who will be increasingly facilitated with the availability of reliable, up-to-date and remote-collected data that can reduce technical, infrastructure and maintenance costs.

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