Geophysical Research Abstracts
Vol. 17, EGU2015-13254, 2015
EGU General Assembly 2015

A new approach of the surface temperature measurement for a preventive conservation of the work of arts

Maria Concetta Di Tuccio (1), Sandro De Grandi (2), Arianna Vivarelli (1), Francesca Becherini (1), Luc Pockelé (2), and Adriana Bernardi (1)

(1) National Research Council_institute of atmospheric Science and Climate, Padova,Italy (MC.DiTuccio@isac.cnr.it), (2) R.E.D. s.r.l., Padova, Italy

To conserve the work of arts (paintings, sculptures, etc..) in a preventive mode, a careful monitoring of the environment around these artifacts, as well as of their surface temperature, is necessary. The latter is the only physical variable which can be measured in a non-invasive way, following directly the thermal conditions and variations of the work of arts due to the dynamics of the microclimate.
Considering that the works of art are often untouchable, an automated and accurate remote sensing could be very useful to prevent dangerous processes of deterioration.
For these reasons a new sensor has been developed by a spin-off of the ISAC – CNR. This sensor allows to check in real-time the surface temperature changes of the artifacts both over time and at different predefined points. This automated sensor is a radiometer sensible to wavelengths ranging from 7,5 μm to 13,4 μm. A system rotating over three dimension "pan and tilt" allows to make multiple measures on a grid of points previously defined on the surface of the work of arts. The accuracy, obtained by means of a carefull calibration process, is [U+F0B1] 0,5 °C, more precise than the usual remote sensing (thermal camera and commercial radiometers), characterized by an accuracy value of [U+F0B1] 2°C.
In order to obtain accurate measures of the surface temperature for a real body, the correct emissivity values need to be integrated in the calculation. Hence, an easy to use management software has been developed allowing to set the emissivity value in each point of the grid. For rejoinable points of the surface, the exact emissivity value could be determined comparing the measurements recorded by the new infrared sensor with the ones obtained by a very sensitive sensor (0,02 – 0,03)°C manually placed on the surface for a short time. In case of work of arts placed at great distance from the sersor, the emissivity values must be determined previously. The emissivity depends on a lot of variables and one of them is the surface roughness. Since the artifacts are often charaterized by a high surface roughness, such dependence has been studied in order to obtain accurate temperature measurements. The results obtained indicate an increase of the emissivity with increasing surface roughness.
In conclusion, this study has allowed to develop a reliable, accurate and automatic control system, as well as a low cost sensor that, unlike the thermal camera, can also be used by less experienced operators.
Besides, in order to support the museums managers in the preventive conservation of the artifacts, an alarm system is automatically activated when dangerously large thermal variations on the surface are detected.