



Uveka: a UV exposure monitoring system using autonomous instruments network for Reunion Island citizens

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Reunion Island is a French overseas territory located in the Indian Ocean. This tropical island has about 840,000 inhabitants and is visited every year by more than 400,000 tourists. On average, 340 sunny days occur on this island in a whole year. Beyond these advantageous conditions, exposure of the population to ultraviolet radiation constitutes a public health issue. The number of hospitalisations for skin cancer increased by 50% between 2005 and 2010. Health insurance reimbursements due to ophthalmic anomalies caused by the sun is about two million Euros.

Among the prevention measures recommended by public health policies, access to information on UV radiation is one of the basic needs. Reuniwatt, supported by the Regional Council of La Reunion, is currently developing the project Uveka. Uveka is a solution permitting to provide in real-time and in short-term forecast (several hours), the UV radiation maps of the Reunion Island. Accessible via web interface and smartphone application, Uveka informs the citizens about the UV exposure rate and its risk according to its individual characteristics (skin phototype, past exposure to sun etc.). The present work describes this initiative through the presentation of the UV radiation monitoring system and the data processing chain toward the end-users.

The UV radiation monitoring system of Uveka is a network of low cost UV sensors. Each instrument is equipped with a solar panel and a battery. Moreover, the sensor is able to communicate using the 3G telecommunication network. Then, the instrument can be installed without AC power or access to a wired communication network. This feature eliminates a site selection constraint. Indeed, with more than 200 microclimates and a strong cloud cover spatial variability, building a representative measurement site network in this island with a limited number of instruments is a real challenge. In addition to these UV radiation measurements, the mapping of the surface solar radiation using the meteorological satellite Meteosat-7 data permits to complete the gaps. Kriging the punctual measurements using satellite data as spatial weights enables to obtain a continuous map with a spatially constant quality all over the Reunion Island.

A significant challenge of this monitoring system is to ensure the temporal continuity of the real-time mapping. Indeed, autonomous sensors are programmed with our proprietary protocol leading to a smart management of the battery load and telecommunication costs. Measurements are sent to a server with a protocol minimizing the data amount in order to ensure low telecommunication prices. The server receives the measurements data and integrates them into a NoSql database. The server is able to handle long time series and quality control is routinely made to ensure data consistency as well as instruments float state monitoring.

The database can be requested by our geographical information system server through an application programming interface. This configuration permits an easy development of a web-based or smart phone application using any external information provided by the user (personal phenotype and exposure experience) or its device (e.g. computing refinements according to its location).