Preliminary results of UV measurements in the high-altitude station Formigal-Sarrios (Pyrenees)

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INTRODUCTION

AEMET (Spanish Meteorological Agency) has operated a nationwide Erythemal UV broadband network since the mid-1990s, watching UV radiation both at mid latitudes and the Subtropical Region of the Northern Hemisphere (the Canary Islands).

Radiometers are biennially calibrated following the WMO procedure, both laboratory characterisation (relative spectral and angular responses) and absolute calibration (outdoor comparison), in order to ensure traceability to the WCCUV-UV reference spectroradiometer QASUME.

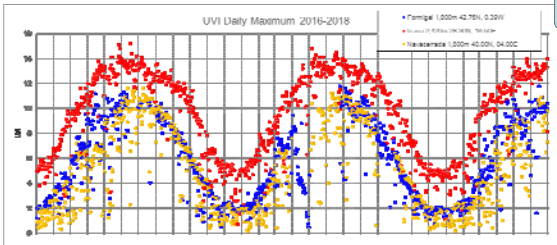
The UV Network operated by AEMET

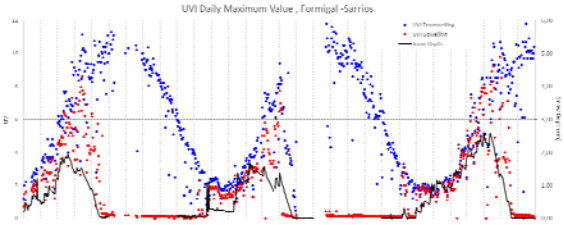
Since 2016, a new high-altitude radiometric station has been deployed at the skiing resort of Formigal-Sarrios (42.76N, 0.39W; 1,800m a.s.l.) in the Pyrenees, comprising one GHI broadband radiometer and two UVER broadband radiometers, upward and downward-looking, following the infrastructure deployed within the SPICE Proyect.

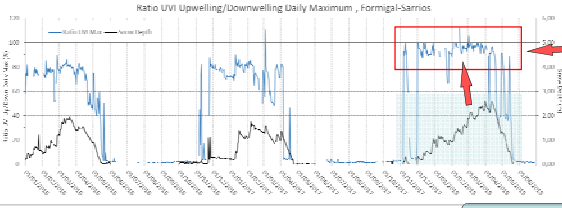
The Formigal-Sarrios staton

In this sense, some results comparing ratio upwelling to downwelling of both UVI daily max. values and daily UVER dosis are shown below. Likewise, some cases of study during the 207-2018 extended winter season are presented.

2016-2018 UVI DAILY MAX. VALUES



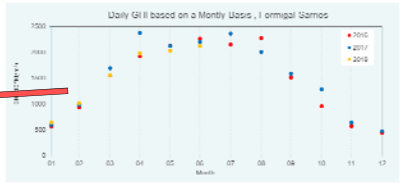




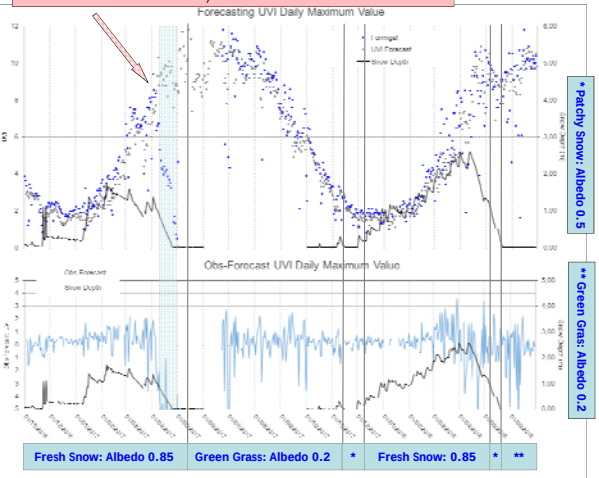
The UVI daily maximum values for Formigal-Sarrios is shown on the left charts comparing with those of the other two high-altitudes sites operated by AEMET: Navacerrada (2º latitude further south) and the well known Izaña Observatory, at the Canary Islands.

The high albedo values recorded during winter-early spring season at Formigal-Sarrios linked with the snow depth figures recorded are displayed on the left charts.

To be noted the higher albedo values during 2017-2018 winter season.



An out of tune surface albedo led an clearly overestimated UVI forecast (see snow depth graph and the corresponding snow cover albedo on the blue label below)



The UVI forecasting system is based on the libRadtran software package under clear sky conditions.

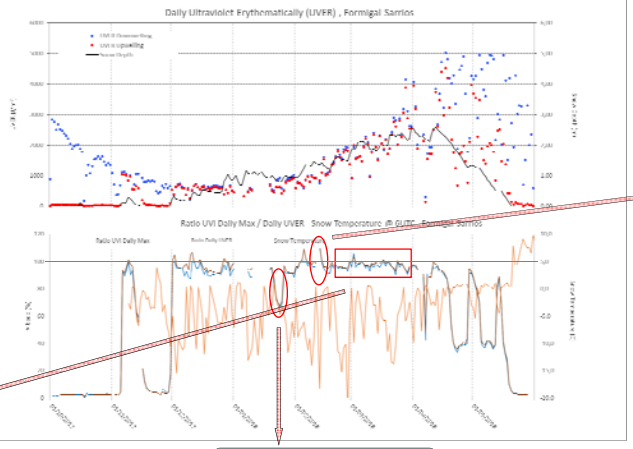
Note that isolated extreme negative BIAS values are due to the under clear sky conditions in the Libradtran software

Total ozone input comes from the IFS ECMWF model interpolated to the station. The max UVI is calculated at the true solar local noon. Surface albedo is manually tuned depending on the snow cover.

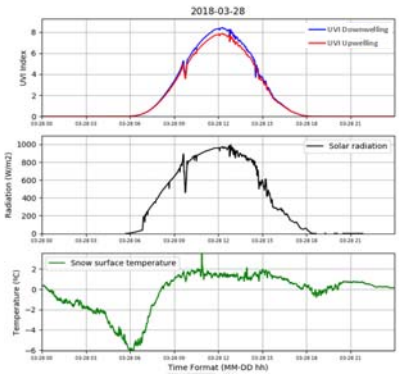
2017-2018 EXTENDED WINTER SEASON CASES OF STUDY

Daily UVER dosis, ratios for UVI max daily values and daily UVER dosis are presented below. Slight differences are detected only on days with extreme maximun and minimum values of albedo.

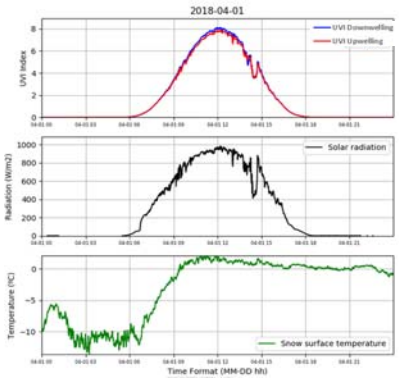
Some study cases for such season are presented in the contiguous charts.



High UV albedo cases under clear sky and fresh snow conditions



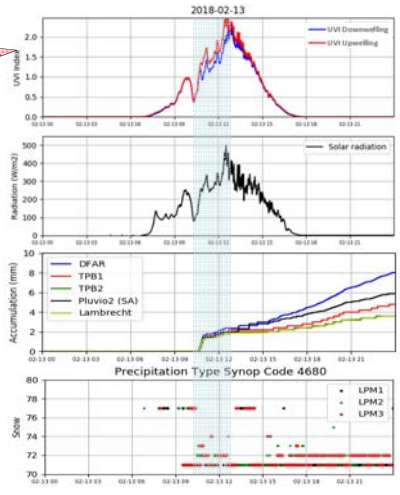
Two high-albedo cases on nearly clear sky days in early spring at Formigal–Sarrios are shown on this box: 28th March and 1st April. The ratio Upwelling/Downwelling UV radiation was over 93% and 97% respectively.



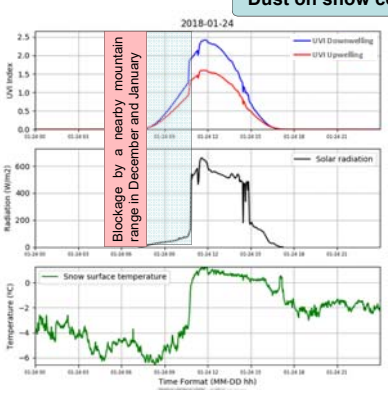
Anomalous Albedo??

During low solar altitude season and cloudy days, up and donwward-looking radiometers may register similar UV doses due to both the high diffuse component and the high albedo of the snow cover.

In this case, a high-intensity snowfall (shaded box) might have covered the upward-looking radiometer. Note the y-axis scale.



Dust on snow cover



A Saharian dust episode over the northern Iberian Peninsula resulted in a steep reduction of the UV albedo. Once fresh snowfalls followed, albedo values were back to values over 90%.

Such albedo decrease is not related to any temperature effect in the snow cover (see snow cover temperature graphs on the 28th March and the 1st April cases).