

## Introduction

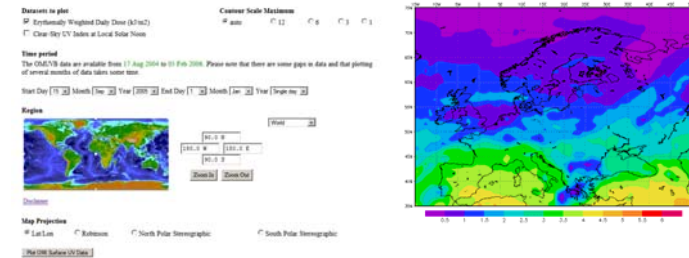
PROMOTE UV Record service provides long-term records of surface UV data to support governmental agencies and scientists to assess UV related effects on people and ecosystems. It is a part of the ESA initiated GMES Service Element for Atmosphere PROMOTE (<http://www.gse-promote.org/>) PROMOTE delivers policy-relevant services on multiple atmospheric issues to end-users. Currently the service provides maps and local time series of daily erythemally weighted dose and clear-sky UV Index derived from the various satellite data sets.

Several methods and satellite data sets have been reported to be successfully used for estimation of the amount of UV radiation reaching the Earth's surface. The various factors (solar zenith angle, atmospheric ozone, clouds, aerosols, trace gases, altitude, and surface albedo) that affect the transmission of the UV radiation to the surface of the Earth are well established, and the state-of-the-art radiative transfer models are accurate, but the input parameters required for modelling are not known with sufficient accuracy. In general, the factors that involve most of the uncertainty are clouds and in some cases absorbing aerosols and surface albedo.

## Current UV Record Service

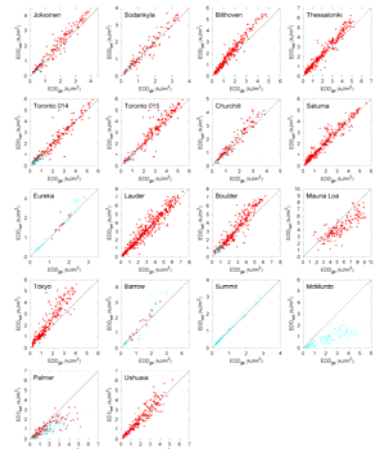
The current PROMOTE UV Record service provides maps and local time series of daily erythemally weighted dose and clear-sky UV Index derived from various satellite data sets. The service has been recently extended with the surface UV data derived from the measurements of the Ozone Monitoring Instrument (OMI). Figure 1 shows the web-based user interface of the PROMOTE UV Record for online plotting of the OMI surface UV data. It offers the user a versatile and easy way to explore the OMI surface UV data.

### Online Plotting of OMI Surface UV Data



## Validation

The erythemally weighted daily doses derived from OMI measurements have been extensively compared with doses calculated from the measurements of the 18 ground-based instruments.



### Conclusions

- For flat, snow-free regions with modest aerosol loadings the OMI-derived doses have a median overestimation of +0-10%, and some 70% of the doses are within ±20% from the ground reference
- For sites significantly affected by absorbing aerosols or trace gases one expects bigger positive bias up to 50%
- For high-latitude sites the satellite-derived doses are occasionally up to 50% too small because of unrealistically small climatological surface albedo

## Future Objectives

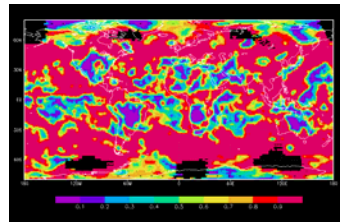
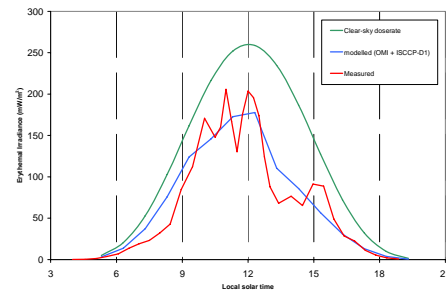
The future development objective is to construct an integrated longterm multi-sensoral UV record. It will be based on the PROMOTE Total Ozone Record service that is being developed by KNMI as a parallel activity within the PROMOTE-2 project. We are currently investigating the feasibility of various cloud and aerosol correction methods and data sources for estimation of the cloud and aerosol correction factors. One of the options for cloud correction is the International Satellite Cloud Climatology Project (ISCCP) D1 3-hour cloud fraction and optical depth data.

## Methodology

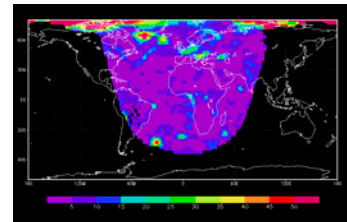
Surface UV is obtained using the Independent-Pixel-Approximation and precalculated Look-Up-Tables generated with DISORT-2 (libRadtran).

$$E = E_{cs}(z, \Omega, R_s, \theta) \times \underbrace{(1 - CF)}_{\text{contribution from the cloud-free part}} \times \underbrace{AC(\tau_a, \omega, R_s, \theta, \tau_c = 0)}_{\text{contribution from the cloud covered part}} + CF \times T(\tau_c, \theta, R_s) \times \underbrace{AC(\tau_a, \omega, R_s, \theta, \tau_c)}_{\text{contribution from the cloud covered part}}$$

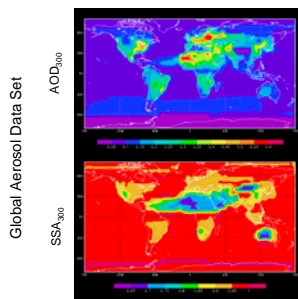
- $E_{cs}$  clear-sky irradiance
- $z$  altitude (GTOPO30)
- $\Omega$  assimilated total column ozone from KNMI
- $R_s$  surface albedo (MTW albedo climatology)
- $\theta$  solar zenith angle
- $CF$  cloud fraction (ISCCP-D1)
- $T$  transmission of the plane-parallel cloud
- $\tau_c$  cloud optical depth (ISCCP-D1)
- $AC$  aerosol correction
- $\tau_a$  aerosol optical depth (GADS)
- $\omega$  single scattering albedo (GADS)



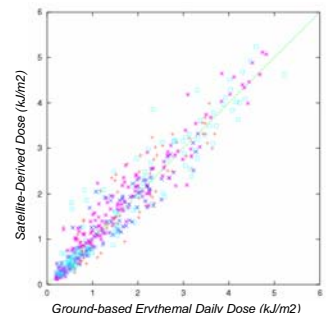
ISCCP-D1 Cloud Fraction



ISCCP-D1 Cloud Optical Depth



Global Aerosol Data Set



## Time scale

A prototype of the new integrated UV Record service will be implemented in 2008. The service is to be completed in year 2009. Validation of the UV Record service will be based on utilization of ground-based spectral measurement data from the European UV Database (<http://uvdb.fmi.fi/uvdb/index.html>) and UV time series obtained using reconstruction methods being developed within the COST action 726 on long-term changes and climatology of UV radiation over Europe. Additional future objectives include development of a web-based tool for on-demand generation of local spectral surface UV data. These data are required by various research groups that study the effects of UV radiation on human health, environment, and materials.