Status of maps reconstruction using ERA40 data

COST 726 MCM11

Rome, September 17-18, 2008

Use of ERA40 data

The maps are obtained by direct modelling of the cloudless surface UV, on which the cloud modification factor is then applied

The resulting maps have a spatial resolution of 0.05 x 0.05 deg. , even if the ERA40 data are at 1 x 1 deg. resolution

Because the process is also using the 1984-2003 JRC METEOSAT derived UV climatology, the covered area is the common part of the two data sets :

30.5 – 74.0 N   20.0 W – 35.5 E

Use of ERA40 data

A second version ERA40-derived maps is now tested

In this version (v2b), the cloudless calculation is performed with

the “COST” ozone data set up to end 1978 and then the NIWA ozone (instead of COST ozone for v01)

the AOT climatological data prepared by Natalya and Henning (instead of a climatological visibility in v01)

the procedure for inferring the UV surface albedo from ERA40 snow depth and sea ice fraction data has been modified

altitude is from the GTOPO30 DEM of USGS

the output is now erythemal dose + 7 wavelengths spectrum

Use of ERA40 CMF (as before)

The ERA40 CMFs (which are for global radiation) have been brutally "calibrated" against the CMF drawn from the satellite climatology for the erythemal radiation (at the 0.05 deg. spatial resolution of the satellite derived maps)

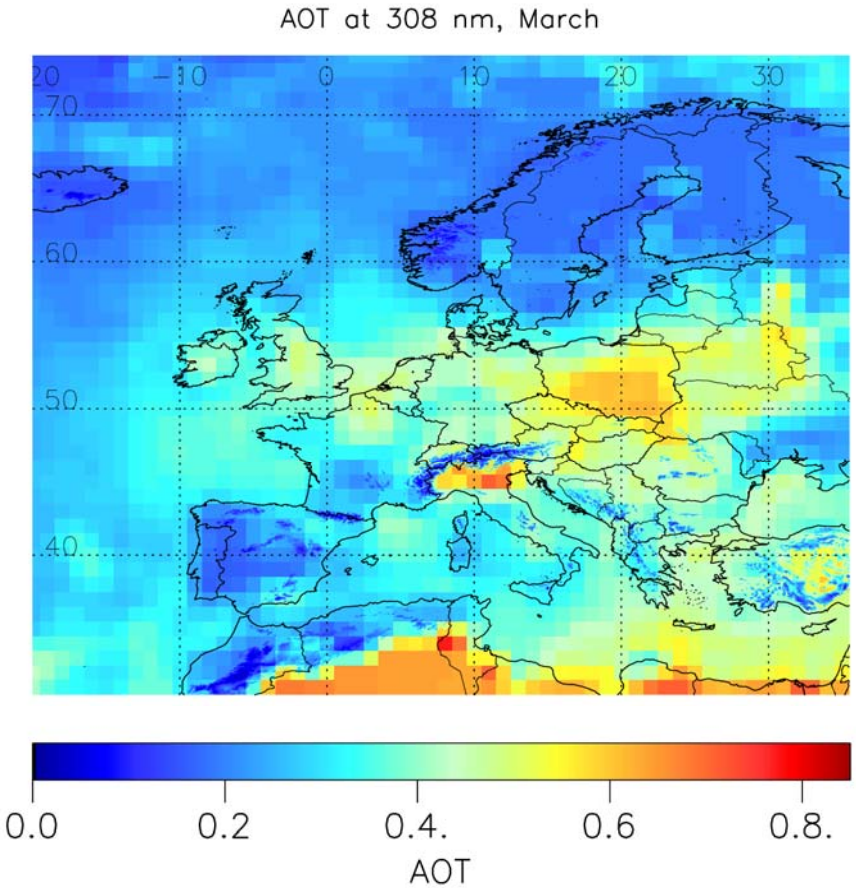
The calibration factor (calf) is itself a map and has been computed for each day of the year using a 10 days running average, i.e. each calibration coefficient is the mean of ~ 200 ratios

The reconstructed map is then simply obtained by applying the "calibrated" ERA40 CMF to the cloudless map:

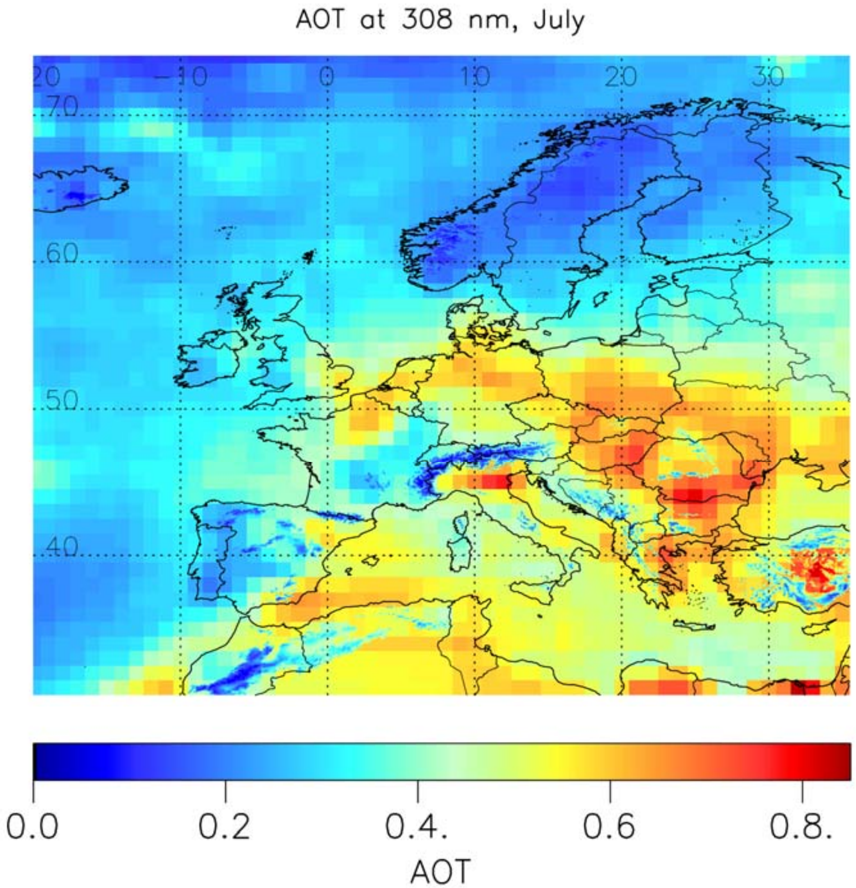
$$UV_{rec}(diy,lat,lon) = calf(diy,lat,lon) . CMF(diy,lat,lon) . CloudlessUV(diy,lat,lon)$$

AOT at 308 nm: March and July

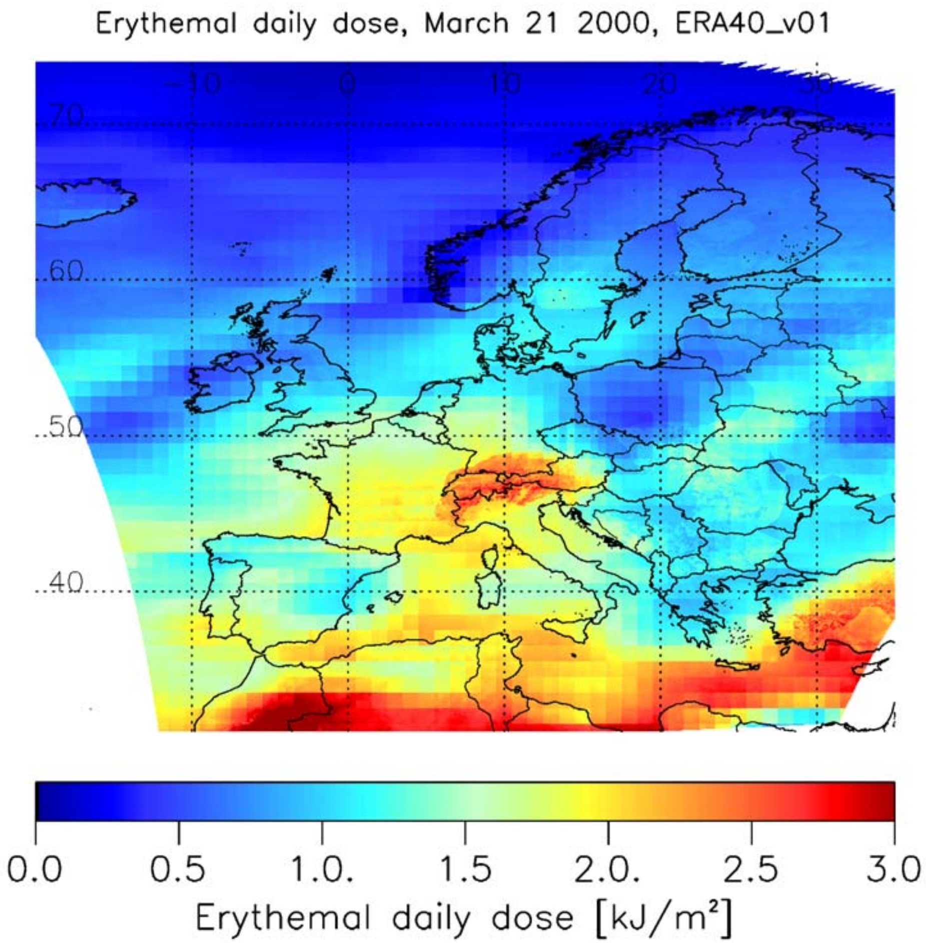
March



July

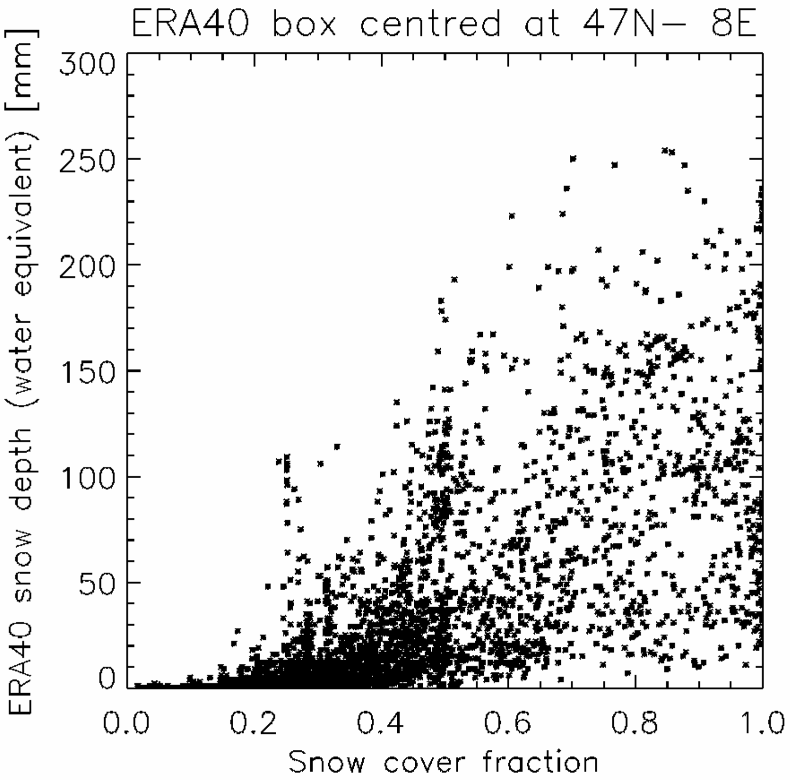


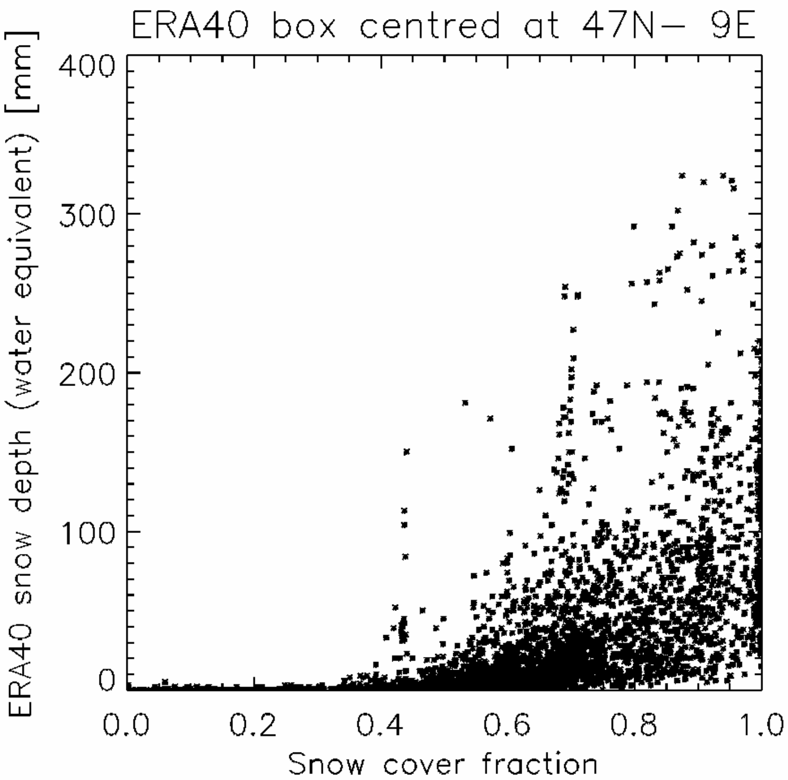
Albedo problem in version v01



ERA40 snow depth vs. snow cover

The snow cover fraction in two ERA40 boxes in Switzerland was computed from snowline data (thank you Laurent) and using a high resolution digital elevation model





New way of inferring a UV albedo

The idea is now to modulate both the snow cover and the albedo value by the ERA40 snow depth.

This is done within each of the ERA40 cell,

on the basis of a snow probability and maximun and minimum values of the albedo (all these determined from the METEOSAT climatology)

and with an adjustable parameter set in such a way that the average over the 1984-2002 period of the ERA inferred albedo equals that of the METEOSAT retrieved albedo

New way of inferring a UV albedo

The procedure is further complicated by the fact that some areas (e.g. a thin strip in the south of Finland) are in ERA40 cells where the snow depth is always 0 (these cells are predominantly sea or ocean)

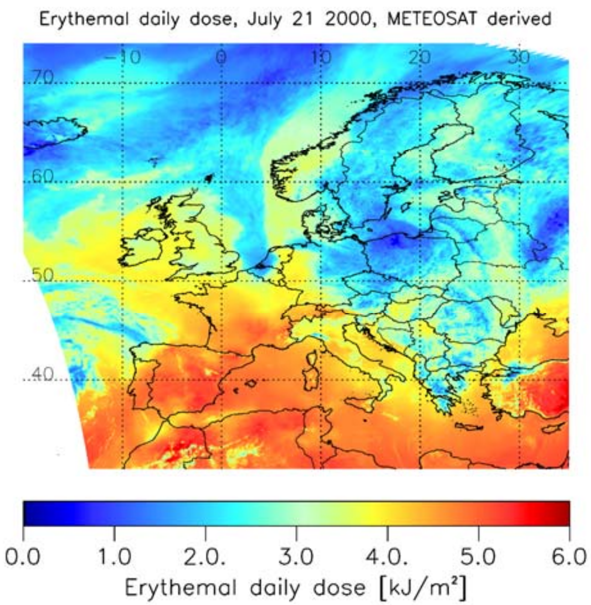
These areas have been “attached” to nearby ERA40 cells.

A similar procedure is followed for the albedo of sea ice.

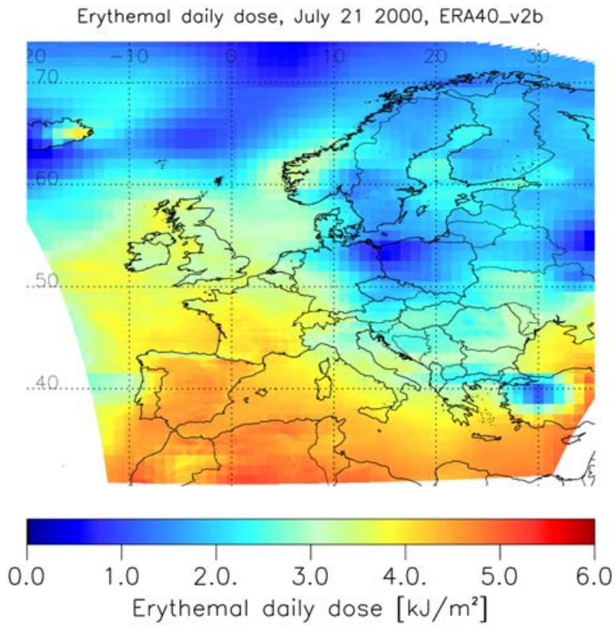
These procedures are still to be improved.

Example: daily erythemal map in July

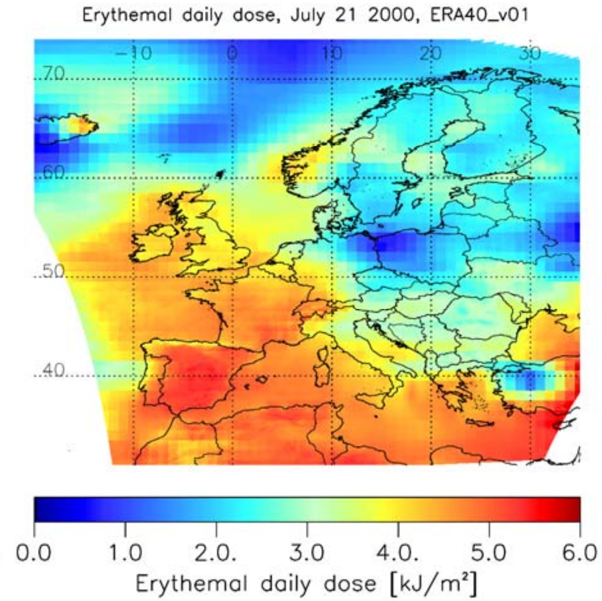
METEOSAT



ERA40 v2b

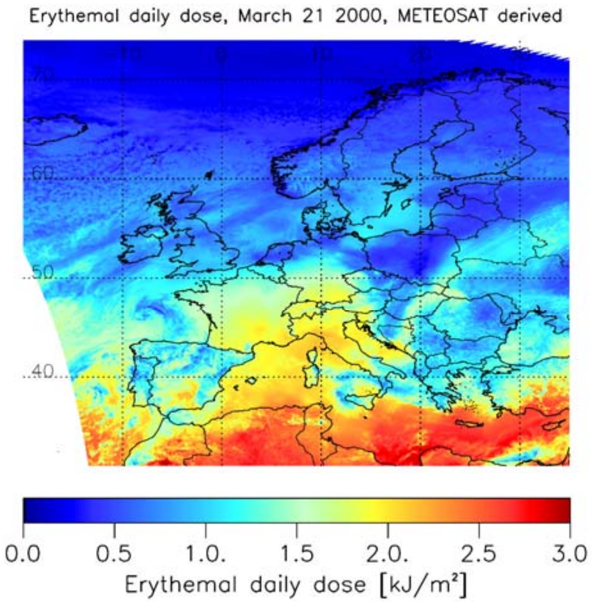


ERA40 v01

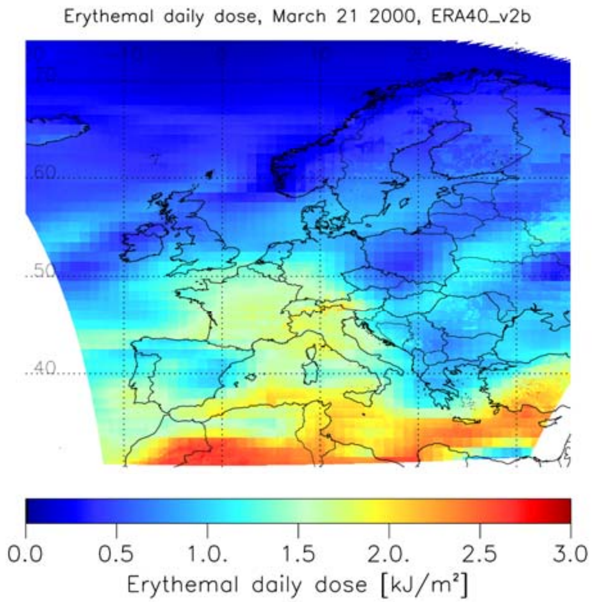


Example: daily erythemal map on March 21st 2000

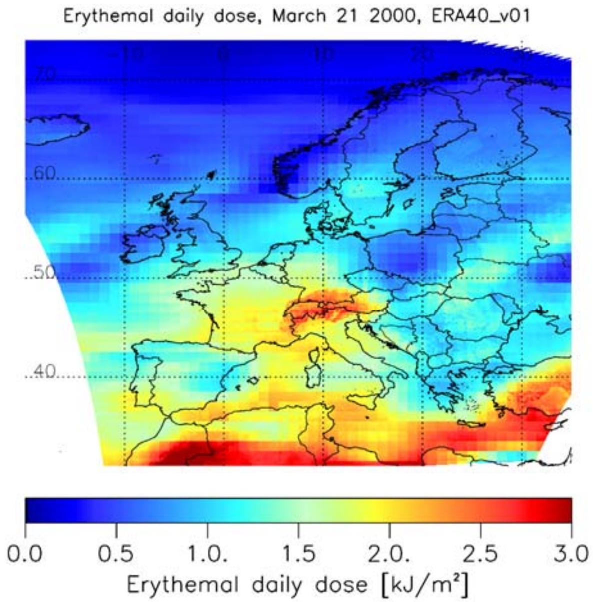
METEOSAT



ERA40 v2b

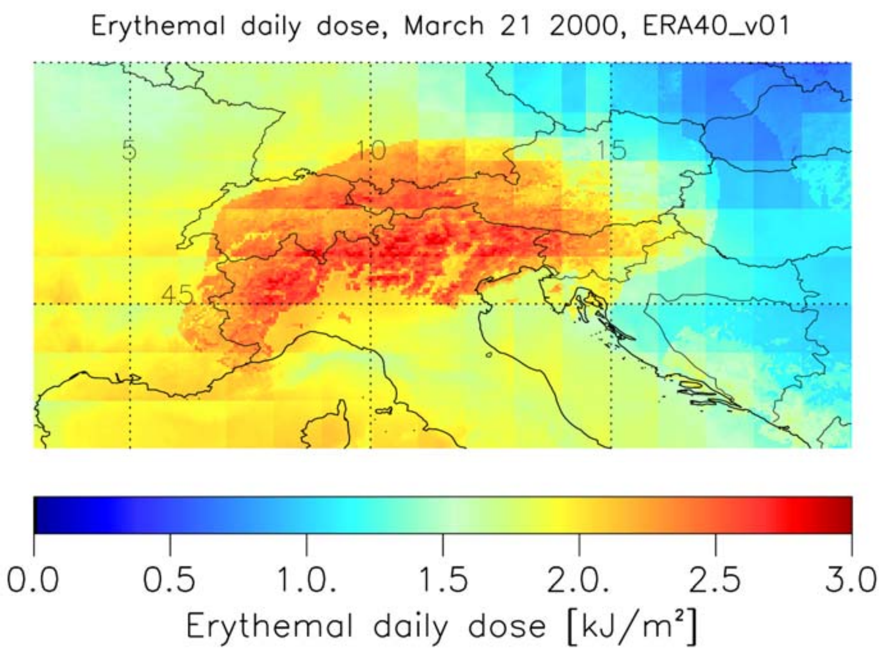


ERA40 v01

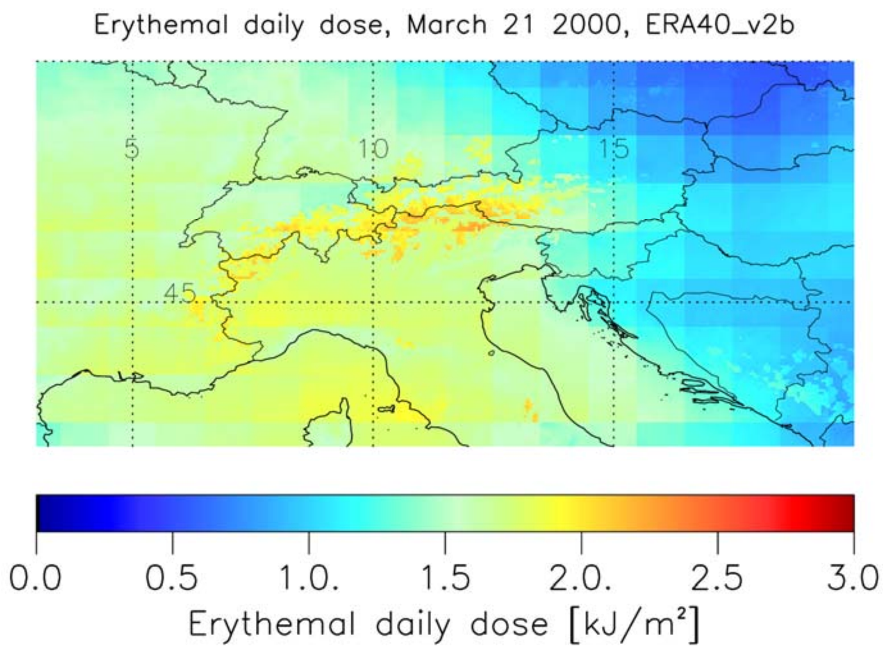


Erythemal daily dose on March 21st 2000, zoom on the alps

v01

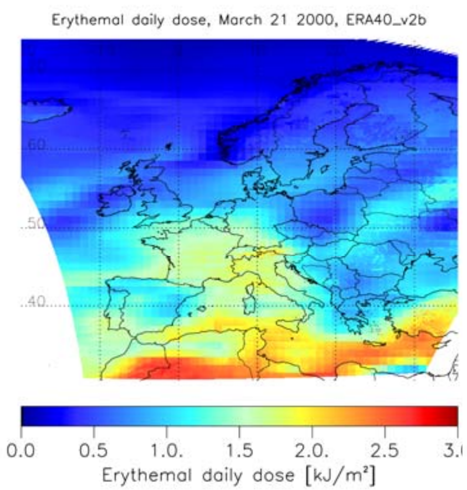


v2b

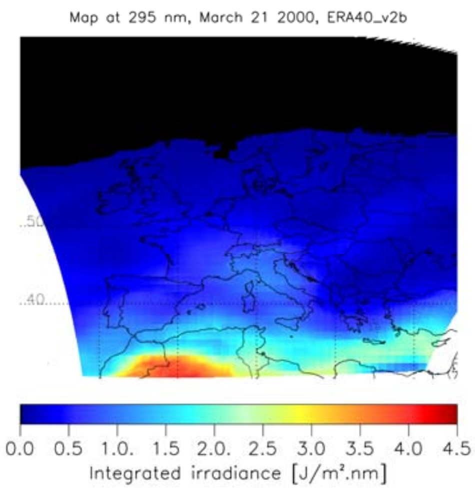


March 21st 200: Erythemal + 7 wavelengths

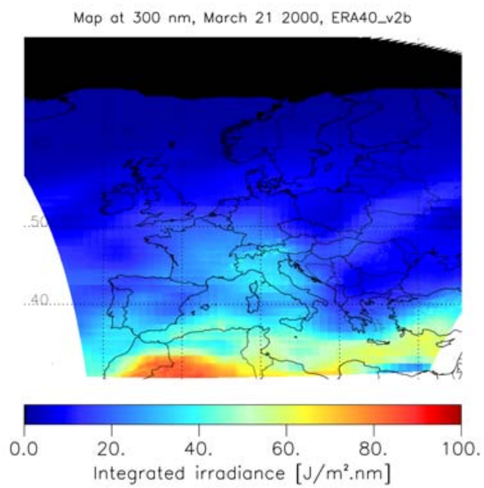
CIE87



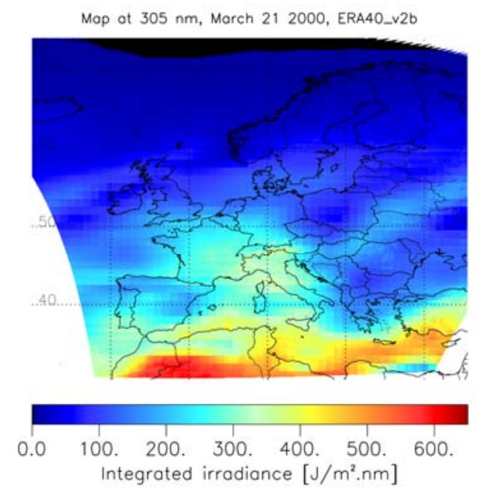
295 nm



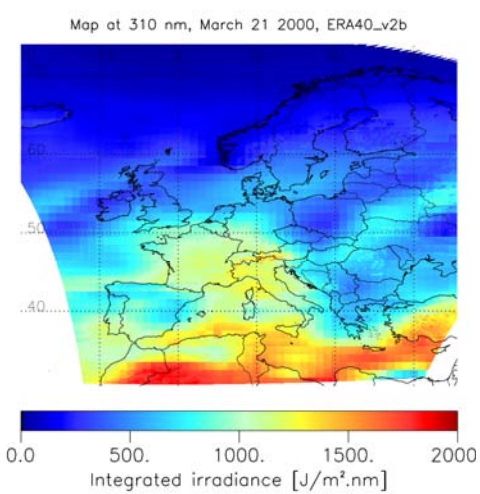
300 nm



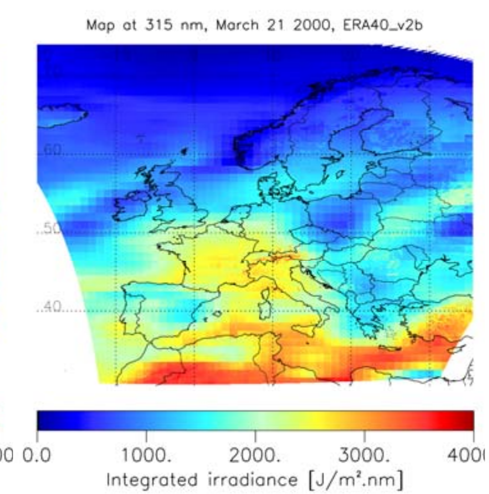
305 nm



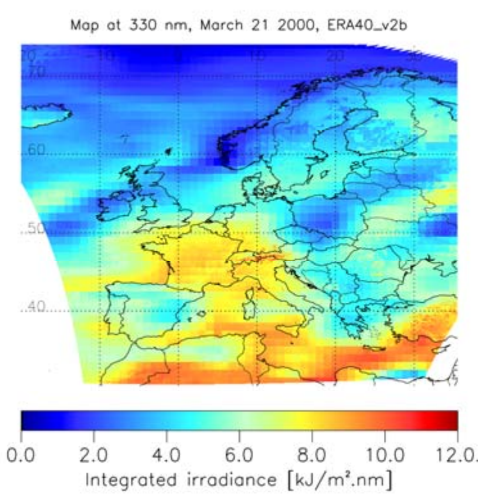
310 nm



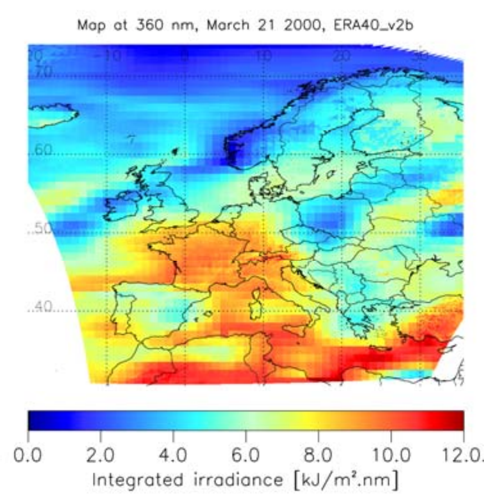
315 nm



330 nm



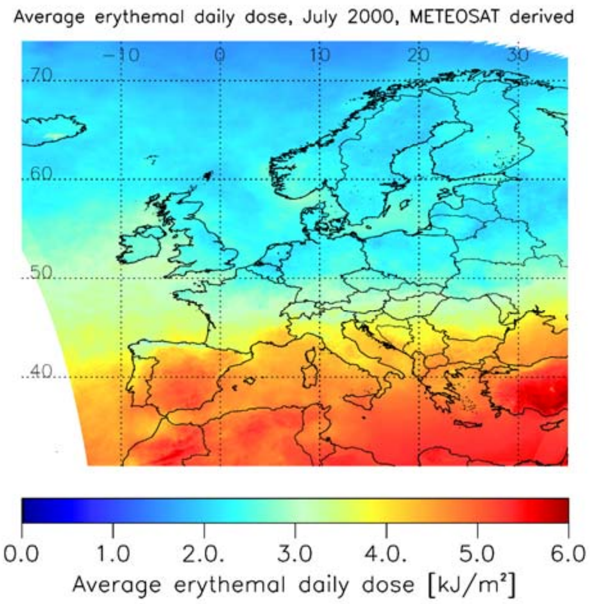
360 nm



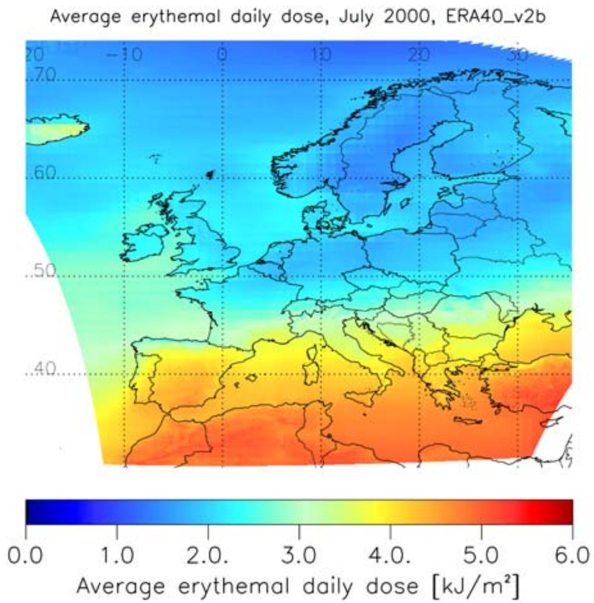
EUROPEAN COMMISSION

Institute for Environment and Sustainability

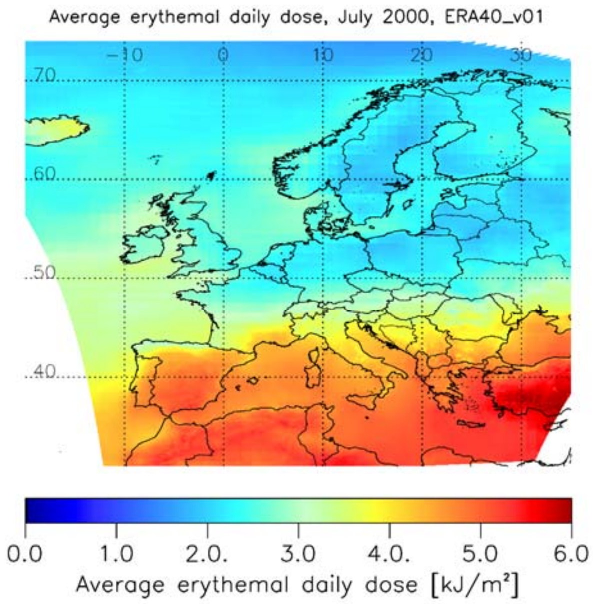
METEOSAT



ERA40 v2b

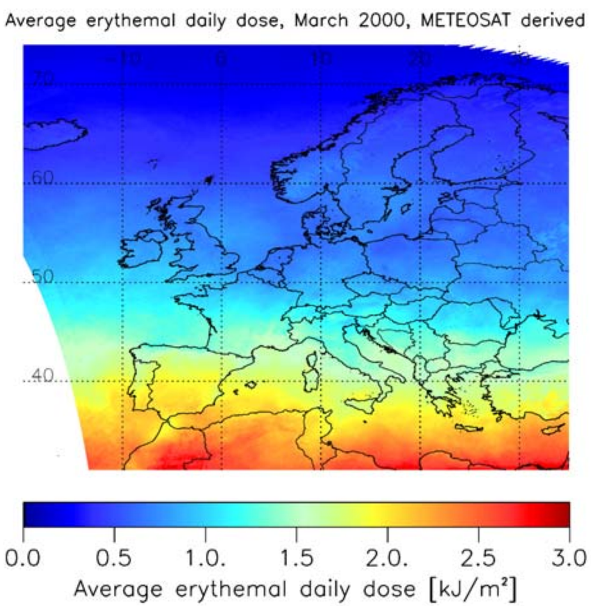


ERA40 v01

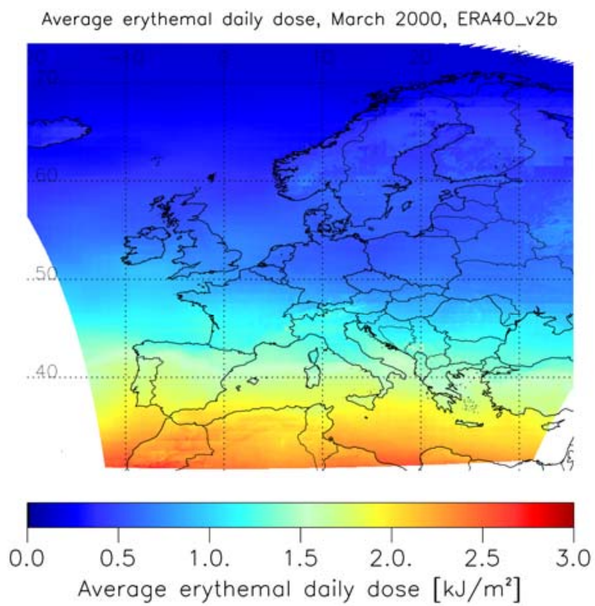


Example: monthly erythemal map – March

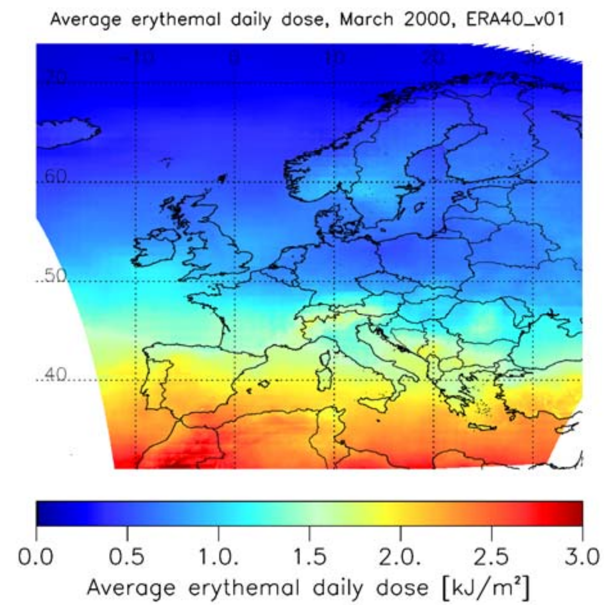
METEOSAT



ERA40 v2b

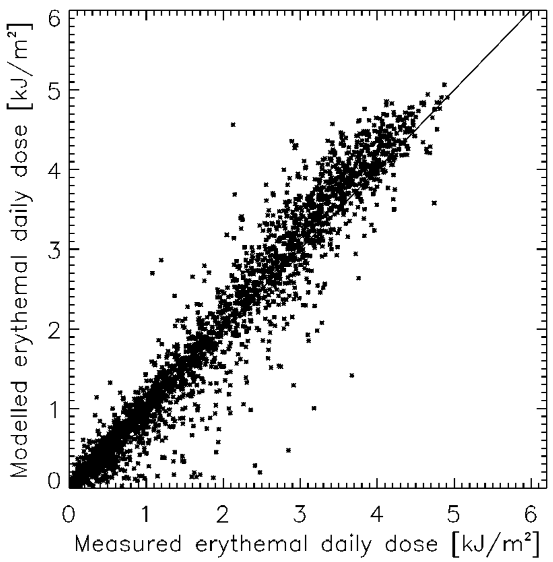


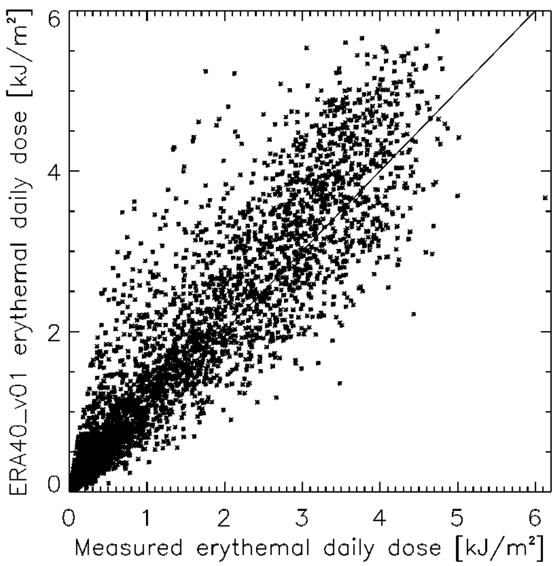
ERA40 v01

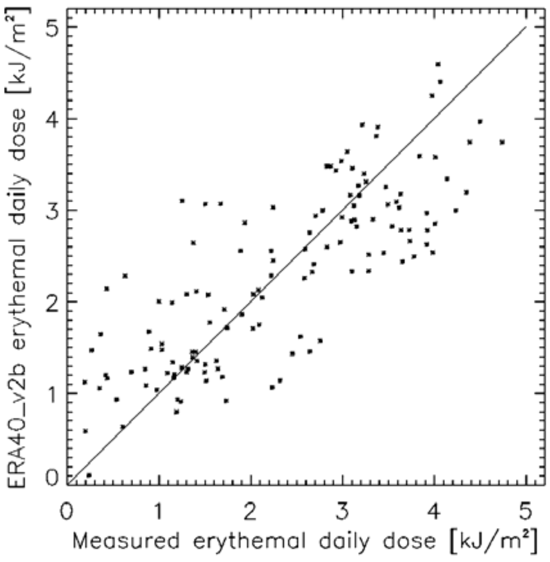


Comparison with Erythemal daily doses in Ispra

METEOSAT | **V01 1991-2002** | **V2b**







Only 03-05 and 07-08 2000

A few numbers

In order to accommodate the extra 7 wavelengths and to have an acceptable accuracy on the shorter wavelengths, the LUT for v2b is 72 times bigger then for v01 (CIE87 only)

As a consequence, and because 8 times more maps have to be generated, the processing time is much longer. It now takes about 1 day of CPU for processing 1 month

Jan. 1958 to Aug. 2002 = 524 months = 524 CPU days

In the form of floating point numbers, the map data set size will be ~ 486 Gb (~ 105 DVDs)

Summary

The version v02 (final ?) of the processor is nearly ready

The surface albedo is now more realistic

The v2b maps systematically show lower values than the v01 version; good or bad ?

Comparison with ground measurements in the most recent period ?

But the time to generate a full data set is long.

Possible strategy: generate only the erythemal (~ 10 days / two weeks processing), compare with ground measurements and produce the final data set (~ two months of processing at best) only when satisfied with the erythemal maps.