Ultraviolet Radiation evolution during the 21st century

To cite this version:
Kévin Lamy, Béatrice Josse, Thierry Portafaix, Hassan Bencherif, Sophie Godin-Beekmann, et al.. Ultraviolet Radiation evolution during the 21st century. CCMI 2017, Chemistry-Climate Model Initiative Science Workshop, Jun 2017, Toulouse, France. hal-01648231

HAL Id: hal-01648231
https://hal.univ-reunion.fr/hal-01648231
Submitted on 30 Nov 2017

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L’archive ouverte pluridisciplinaire HAL, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d’enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.
Introduction

In the context of a changing climate, the acceleration of the Brewer-Dobson circulation (Butchart 2014) leads to a decrease of the ozone total column in the tropics. This decrease affects directly surface ultraviolet radiation, which are already very high in this area. Following the work of (Bais et al., 2011), (Butchart, 2014) and (Heglin & Shepherd, 2009) on the future evolution of surface irradiance derived from Chemistry Climate Models (CCM) projections, we projected here surface irradiance from 2010 to 2100 with focus on the tropics. We used the latest chemistry climate projection exercise; Chemistry Climate Model Initiative (CCMI) coupled with a radiative transfer model (TUV (Madronich, 1993)) to calculate the evolution of surface ultraviolet radiation throughout the 21st century. Ultraviolet Index (UV) has been specifically considered (McKenzie, Matthews, & Johnston, 1991).

Validation of CCMI and CCMI+RT result against climatological observations from present period.

Radiative Transfer Modelling

Radiative Transfer Model used is the Tropospheric Ultraviolet Model (TUV) (Madronich, 1993), with Corrigan, Penkett, & Penkett (2014) ozone cross section and (Chance & Kurucz, 2010) extra terrestrial spectra. Modelling was done in clear sky conditions and with aerosols optical thickness (Serdyuchenko, Gorshelev, Weber, Chehade, & Burrows, 2014).

MONTHLY OUTPUT BETWEEN 2000-2100
- Irradiance every 1 degree at 1 degree integration weighted by Action Spectra
- Ultraviolet Index (UVi) or UV erythemal
- Vitamin D3
- Inhibition of phytoplankton carbon fixation (Boucher et al., 1994)

While CCMI-Median-TOZ shows a Mean Relative Difference of 14.13% versus OMI-TOZ product, CCMI-Median-TUV are higher than OMI-UV by about 9.15%.

Projections

As expected, ozone layer recovery will lead to a decrease in UV radiation in mid to high latitudes. Tropical variation of UVI radiation are very small and will need further research.

Conclusions

CCMI-TZO Model slightly underestimate compared to TOZ satellite observations.

CCMI-Median-TUV are 9.15 % higher than observed OMI UV product.

Surface UV decreases in mid to high latitude

Tropical Change are very small for the entire 21st century. A thorough statistical analysis is required in order to conclude.

Acknowledgements

Regional Réunion

Doctoral School of Réunion Island University

Meteo France

CCMI Modeling Team

References


