Contribution ID: **80** Type: **Oral**

A new scheme to improve the spectral representation of solar forcing for photolysis and heating in Earth System Models.

Thursday 19 September 2024 14:30 (20 minutes)

A flexible new scheme has been implemented in the Socrates radiative transfer code in order to parametrise a unified treatment of radiative heating, photolysis and photoionisation covering the whole spectrum of solar emission.

Socrates is currently used only for radiative heating within the UK Earth System Model. For CMIP7 this will represent solar spectral variability in 12 bands including 7 in the ultra-violet. The new scheme introduced here will allow much finer spectral resolution along with an integrated treatment of photolysis that is currently handled by the separate Fast-JX scheme.

Photolysis calculations generally require a higher wavelength resolution than is used for calculations of radiative heating in Earth System Models. In order to maintain accuracy for photolysis calculations whilst reducing computational cost a novel wavelength mapping technique is implemented as part of the correlated-k method. This allows the mapping of radiative fluxes onto thousands of sub-bands that are individually scaled with the time-varying solar spectrum. Photolysis is then calculated at high-wavelength resolution and absorption leading to photodissociation is not double-counted for radiative heating.

A further novel technique is introduced to replace the plane-parallel approximation with the pseudo-spherical approximation for both radiative heating and photolysis. This allows the calculation of solar radiation absorbed in the twilight regions of the atmosphere where the solar zenith angle is greater than 90°. While this is often done in photolysis calculations, the effect on radiative heating has been generally ignored.

Prototype configurations covering far and extreme-UV wavelengths will be discussed along with plans for future climate model configurations.

Solicited or Contributed

Contributed

Presenting author

James Manners

Author list and affiliations

Primary author: MANNERS, James (Met Office)

Presenter: MANNERS, James (Met Office)

Session Classification: New missions and tools

Track Classification: New missions and tools relevant to detection and attribution of solar signals and particle impacts