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Determination of Earth outgoing radiation using a constellation of satellites

Jake Gristey (1), Christine Chiu (1,2), Robert Gurney (1), Shin-Chan Han (3), and Cyril Morcrette (4)

(1) Department of Meteorology, University of Reading, Reading, UK, (2) NERC National Centre for Earth Observation at University of Reading, Reading, UK, (3) School of Engineering, University of Newcastle, Callaghan, Australia, (4) Met Office, Exeter, UK

The outgoing radiation fluxes at the top of the atmosphere, referred to as Earth outgoing radiation (EOR), constitute a vital component of the Earth's energy budget. This EOR exhibits strong diurnal signatures and is inherently connected to the rapidly evolving scene from which the radiation originates, so our ability to accurately monitor EOR with sufficient temporal resolution and spatial coverage is crucial for weather and climate studies. Despite vast improvements in satellite observations in recent decades, achieving these criteria remains challenging from current measurements. A technology revolution in small satellites and sensor miniaturisation has created a new and exciting opportunity for a novel, viable and sustainable observation strategy from a constellation of satellites, capable of providing both global coverage and high temporal resolution simultaneously.

To explore the potential of a constellation approach for observing EOR we perform a series of theoretical simulation experiments. Using the results from these simulation experiments, we will demonstrate a baseline constellation configuration capable of accurately monitoring global EOR at unprecedented temporal resolution. We will also show whether it is possible to reveal synoptic scale, fast evolving phenomena by applying a deconvolution technique to the simulated measurements. The ability to observe and understand the relationship between these phenomena and changes in EOR is of fundamental importance in constraining future warming of our climate system.