Analysis of Time Series of Global Surface Longwave Cloud Radiative Effect from Space Lidar Observations

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Abstract

Clouds warm the surface in the longwave (LW) by emitting LW radiations to it. This warming effect can be quantified through the surface LW cloud radiative effect (CRE) defined as the difference between all sky LW flux and clear sky LW fluxes. Here we present new estimates of the surface LW CRE derived from space lidar observations over 13 years (2008–2020). This new global time serie presents two characteristics. First, it is more reliable over continent and icy surfaces than the surface LW CRE established from the Clouds and the Earth's Radiant Energy System (CERES) over a slightly longer time period 2005–2021 (Kato et al., 2018). Second, it is based on an original retrieval method that permits to attribute the multi-annual variations in the surface LW CRE to changes of specific cloud property such as the cloud cover, the cloud altitude and the cloud opacity (eg. adaptation of Vaillant de Guélis et al., 2017b). In global mean, the surface LW CRE derived from the space lidar and from CERES radiometer lead to a similar small negative trend (about 0.02 W m-2 year-1). We will present an analysis of the trend in different regions of the Earth and discuss which cloud property drives the observed surface LW CRE changes in each region.

Keywords: Cloud radiative effect, Earth's surface, Analysis of time series, Trend, Space lidar

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