Key area: Evaluation

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Title: Assessment of cloud geometry in ERA-Interim and ERA-20C over the Southeast Pacific using satellite observations

Abstract:

The representation of clouds in climate models is still subject to large uncertainties. In particular this holds true for marine boundary layer clouds. As the Earth's radiation budget is strongly influenced by clouds, these uncertainties introduce a wide spread among simulations of future temperature increase. Important parameters which affect the net radiative effect of clouds are cloud cover along with cloud top and cloud base height (CBH).

In this study, we focus on the Southeast Pacific which hosts the largest subtropical stratocumulus deck on Earth. The associated stratocumulus clouds represent a critical but poorly understood component of the coupled climate system of the region that is characterized by strong coastal upwelling and one of the driest regions on Earth land inwards, i.e. the Atacama desert. Within the German Science Foundation funded Collaborative Research Center "Earth at its dry limit" our overarching goal is to understand the moisture supply to the Atacama desert and its variability which is to a large degree affected by stratocumulus clouds moving inland. Reanalyses such as ERA-Interim and ERA-20C are well suited to study trends and variability in cloud geometry with respect to interannual and interdecadal patterns such as El Niño Southern Oscillation or Pacific Decadal Oscillation.

In order to further assess the quality of the reanalyses, a comparison to satellite retrievals from Multi-angle Imaging SpectroRadiometer (MISR) on Terra is carried out. In addition, to the more traditional parameters cloud fraction and cloud top height a novel approach enables us to derive CBHs with a horizontal resolution of 0.25°x0.25°. Previous research shows a good agreement of these observations with ceilometer measurements within a continental region of the USA. Here, this new approach is applied to an area within the stratocumulus region of the Southeast Pacific over a time period of 16 years between 2001 and 2016. Furthermore, regional and seasonal variabilities of cloud heights are investigated.