



## Mechanisms and model diversity of trade-wind shallow cumulus cloud feedbacks

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Shallow cumulus clouds in the trade-wind regions are at the heart of the long standing uncertainty in climate sensitivity estimates. Our study aims to synthesize the physical understanding of the key factors controlling trade-cumulus, based on model experimentations and process-oriented analyses using model hierarchies and observations. The trade-wind cloud feedbacks appear to depend on two important aspects : (i) how cloudiness near cloud base is controlled by the local interplay between turbulent, convective and radiative processes; (ii) how these trade-wind boundary-layer processes interact with their surrounding environment, and particularly the mesoscale organisation. Studies that have explored these aspects suggest that the large diversity of model responses are related to fundamental differences in how the processes controlling trade-cumulus operate in models, whether they are parameterized (in GCM) or resolved (in LES). Furthermore, uncertainties are difficult to narrow using current observations as the trade-cumulus variability and its relation to large-scale environment factors strongly depend on the time and/or spatial scales at which the mechanisms are evaluated. New opportunities for testing our physical understanding of the factors controlling shallow cumulus cloud responses using observations and high-resolution modelling on very large domains are discussed.