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A Self-Organizing Map classification of ISCCP satellite data: A Regional Assessment

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This presentation discusses the application of the Self-Organizing Map (SOM) technique to the joint frequency distribution of the cloud top pressure and optical depth from the ISCCP D1 dataset. Our results demonstrate that this algorithm can produce clusters which have geographical and seasonal patterns similar to those produced in previous studies using the k-means clustering technique, but with finer details identified in some cases. For example, this study identifies a wider range of clusters representative of low cloud cover states with distinct geographic patterns. We also demonstrate that two rather similar clusters, which might be considered the same cloud regime in other classifications are distinct based on the seasonal variation of their geographic distributions and their shortwave cloud radiative effect (CRE). Ancillary ERA-Interim reanalysis output also allows us to demonstrate that the clusters, identified based on the joint histograms, are related to an ordered continuum of vertical velocity profiles which have a clear structure within the SOM. The different clusters can also be separated by their longwave and shortwave CRE at the top of the atmosphere. We then examine whether particular clusters have varying properties in different regions using ancillary reanalysis data and CloudSat reflectivity data. In particular, this latter analysis focusses on the high topped and boundary layer cloud clusters and their distinct features in the CloudSat data. We examine four distinct regions, the tropics, the Northern Hemisphere mid-latitude storm tracks, the Antarctic and the Southern Ocean. Initial analysis focused on applying the SOM technique to CloudSat data is also discussed.