A hybrid satellite fog retrieval scheme and climatology using machine learning

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We introduce a novel hybrid approach for fog retrieval based on Meteosat Second Generation (MSG) and ground truth data. The method is based on a random forest (RF) machine learning model that is trained with cloud base altitude (CBA) observations from Meteorological Aviation Routine Weather Reports (METAR) and synoptic weather observations (SYNOP). Cross validation results show good accordance with observation data with an average Heidke Skill Score of 0.58 for fog occurrence. Using this technique, a 10 year baseline fog climatology with a temporal resolution of 15 minutes was derived for Europe for the period from 2006 to 2015. A temporally highly resoluted and spatially explicit analysis of variations in fog occurrence was conducted for Europe on the basis of this data set. Characteristic fog patterns were identified by applying a Self Organizing Map approach onto the data set. It was found that the resulting fog patterns are primarily determined by terrain characteristics. Correlations between these patterns and the predominant general weather situations were computed and analyzed. This analysis showed that the general weather situations can be categorized into three main groups, each responsible for the formation of a different group of fog patterns. Additionally, distinct regional differences could be identified in the diurnal and annual fog frequency cycles and the derived region-specific frequency variations were used to draw conclusions about the fog types prevailing in these regions. The presentation will include to the new technique and will particularly focus on the spatio-temporal fog pattern during different weather types.

References:

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