

EGU2020-10692

<https://doi.org/10.5194/egusphere-egu2020-10692>

EGU General Assembly 2020

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PATMOS-x v6.0: Improvements to AVHRR Cloud Climate Record and Analysis of the Updated Data

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Since 1978, an Advanced Very-High-Resolution Radiometer (AVHRR) has flown onboard 17 polar-orbiting satellites. Together, they are the longest global record from a homogeneous set of satellite sensors. The Pathfinder Atmosphere's Extended (PATMOS-x) dataset is a long-term cloud record derived from the AVHRR radiances, and suitable for climate analysis. It has demonstrated intersensor stability and has been rigorously compared with other cloud datasets.

However, the AVHRR alone has only limited spectral information, so cloud detection during nighttime or over ice is challenging. Therefore, performance degrades over regions with extreme diurnal patterns or low temperatures such as the poles, despite our interest.

The next production version of PATMOS-x will include numerous algorithmic changes as well as the use of High-resolution Infrared Radiation Sounder (HIRS) spectral channels to improve detection accuracy in previously difficult conditions. The low-resolution HIRS soundings are upsampled to match the AVHRR pixels through an edge-preserving process called "fusion". The higher-resolution AVHRR imagery guides the upsampling and the resulting combination is spectrally consistent with the AVHRR and has a high spatial resolution.

For cloud detection, the difference between the AVHRR and HIRS 11 μ m and HIRS 6.7 μ m brightness temperatures has been added as a feature in the naive Bayesian cloud detector. The effect on cloud precision is seen especially in the Antarctic where false-positive cloud detections have decreased dramatically.

Other cloud properties can be improved with the new spectral channels. For example, the new cloud phase algorithm uses the HIRS 6.7 μ m to determine cloud phase and the AVHRR and HIRS 11 μ m-13.3 μ m beta ratio identifies overlapping clouds. Also, the 11 μ m, 12 μ m, and HIRS 13.3 μ m are used in the new cloud height algorithm.

We report on the development of this new version of the PATMOS-x cloud climate dataset, and the methods used to calibrate and homogenize the participating sensors. Finally, observed trends in the improved dataset will be examined and related to the old dataset. In particular, attention will be given to whether high-latitude analysis of climatic trends is finally possible on the new dataset.

