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TOWARDS A STATISTICAL CLIMATOLOGY OF THE RELATIONSHIP OF BETWEEN UPDRAFT VELOCITY, LIQUID WATER PATH, AND CLOUD DROPLET NUMBER DENSITY: PRELIMINARY ANALYSIS FROM MASRAD AND COPS

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ABSTRACT

The AMF deployment at Point Reyes, California, and in the Black Forest of Germany provided numerous measurements of thin (< 300 m thick) layer clouds from the Microwave Radiometer, AERI, MMCR, and laser ceilometer. Thin clouds are notoriously difficult to measure, and these data sets afford an opportunity to establish the foundation for a climatology of thin layer clouds at all ARM sites and to examine the viability of various techniques used to quantify thin cloud structure. The thin clouds at Pt. Reyes and in the Black Forest are shown to exhibit a wide range of liquid water paths, but a relatively narrow range of updraft velocities. The significance of this narrow range of updraft velocities lies in the aerosol-to-cloud-droplet nucleation process, which lies at the heart of the first aerosol indirect effect. These observations lead us to hypothesize that the dynamic structure of thin clouds, which in many cases are in the process of decaying and evaporating, may be insufficient to support the nucleation of aerosols in highly polluted air masses, thereby providing immunity from the first aerosol indirect effect. To estimate the potential consequences of this narrow range of velocities, we employ a technique using the surface-based measurements of the CCN activation spectrum to estimate the number of cloud droplets present in these thin clouds. Clouds are subsequently classified according to liquid water path, and a climatology of the relationship between updraft velocity and droplet number concentration is created.

This poster will be displayed at ASR Science Team Meeting.