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Six years of cloud data have been collected globally from the NOAA satellite series. The High Resolution Infrared Radiometer Spectrometer (HIRS) data were used to detect clouds and estimate their optical depths in the 11 micron infrared window. The cloud detection algorithm has been called the CO_2 Slicing Algorithm because it uses the 13-15 micron infrared channels where partial CO_2 absorption occurs, to detect partially transparent clouds and correctly determine their altitude. This algorithm is designed to be sensitive to upper tropospheric cirrus clouds which are difficult to detect. The frequency of these clouds along with their global distribution and seasonal changes have been reported at past CIDOS conferences.

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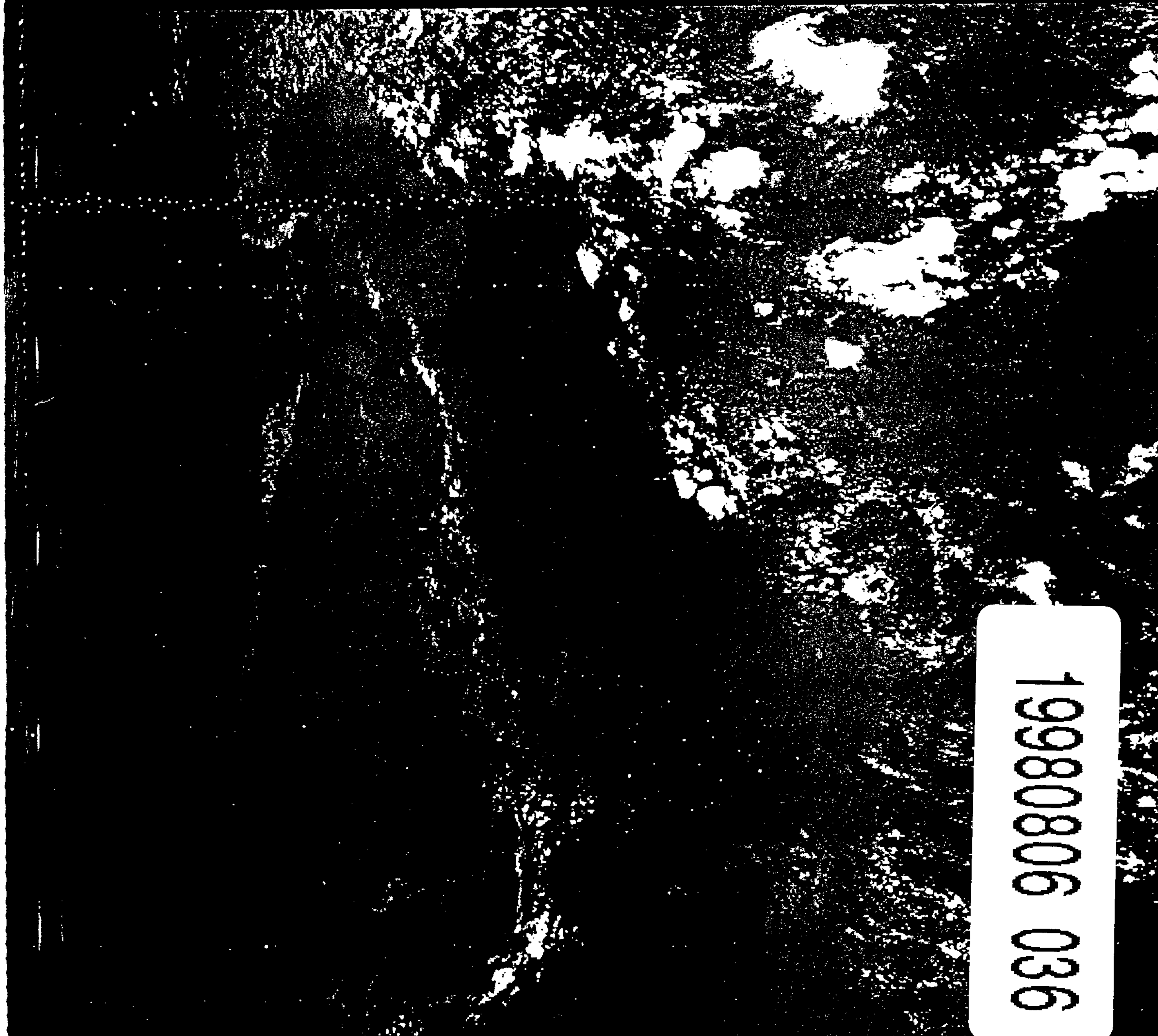

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GLOBAL STATISTICS ON CLOUD OPTICAL DEPTHS FROM SATELLITE AND LIDAR OBSERVATIONS

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Six years of cloud data have been collected globally from the NOAA satellite series. The High Resolution Infrared Radiometer Spectrometer (HIRS) data were used to detect clouds and estimate their optical depths in the 11 micron infrared window. The cloud detection algorithm has been called the CO2 Slicing Algorithm because it uses the 13-15 micron infrared channels where partial CO2 absorption occurs, to detect partially transparent clouds and correctly determine their altitude. This algorithm is designed to be sensitive to upper tropospheric cirrus clouds which are difficult to detect. The frequency of these clouds along with their global distribution and seasonal changes have been reported at past CIDOS conferences.

The optical depths of semi-transparent cirrus clouds from the CO2 Slicing data. A detailed comparison of infrared optical depths derived from satellite data to optical depths measured by the University of Wisconsin's High Spectral Resolution Lidar (HSRL) has been made. The HSRL is discussed in a separate paper by E. Eloranta in these proceedings. Coincident satellite and lidar optical depth data were collected on 21 days in the past two years. The optical depth comparison exhibited scatter because of differences in which each sensor scanned the clouds. The satellite scanned over a large area with a lower resolution field of view; typically 1-8 km in diameter, while the lidar scanned a narrow line through the cloud < 1 m wide from the wind advection of the cloud over the lidar. The spatial variability of cloud density produced most of the disagreement between the two measurements. The mean optical depths, however, did agree after accounting for differences in the radiative physics of scattering and absorption between the visible and infrared measurements. A satellite bias toward larger optical depths was found for very thin cirrus clouds at the minimum detectable density of the satellite system. This bias occurred because very thin clouds had to be at least 2 K colder than surrounding cloud free backgrounds to be distinguished from noise and natural scene variability on the satellite images. This constraint imposed a minimum IR optical depth of 0.05 (0.10 in the visible) which is near the "invisible cirrus" category.

Thicker clouds appeared to be correctly measured by the satellite in spite of the fact that they are often 3-5 km thick and composed of multiple layers.

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