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INFRARED BACKSCATTER CLIMATOLOGY AND MACAWS

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During FY91 NOAA's research activities funded under NASA's RTOP program were centered on two areas -- infrared backscatter climatology and MACAWS.

The climatology of vertical backscatter profiles at $\lambda = 10.59\ \mu m$ over Boulder, Colorado continued at a normal pace (1-2 calibrated profiles per week) through the end of July. During this period we observed 45 typical "clean period" profiles, which ranged from several times $10^{-8}\ m^{-1}\ sr^{-1}$ in the PBL to about $10^{-12}\ m^{-1}\ sr^{-1}$ at 10 km ASL. On July 27, 1991 the first stratospheric clouds from Mt. Pinatubo appeared over Boulder, and we increased the frequency of attempted data taking to daily. Since August 1, 1991 and through March 1992, we have averaged 2 profiles every 3 days, despite field trips to Utah, Kansas, and New Mexico, and the Christmas holidays. The high frequency of observation comes at high cost of manpower and expendables, but it has enabled us for the first time to accurately depict the build up of debris in the stratosphere following a major volcanic eruption. This build up centered on 16 km ASL and grew both upward and downward with time. Simultaneous with the first appearance of stratospheric debris, backscatter in the troposphere increased markedly, and has remained at levels well above the "clean period" profiles. At first there appeared to be no correllation between height of the local tropopause and the bottom of the main stratospheric/tropospheric cloud. However, after about 60 days this correllation increased significantly to the point where specific tropopause folding events, for example, were easily seen in the data. The cloud now reaches to altitudes of 27 km ASL. These results are summarized on the enclosed color figure.

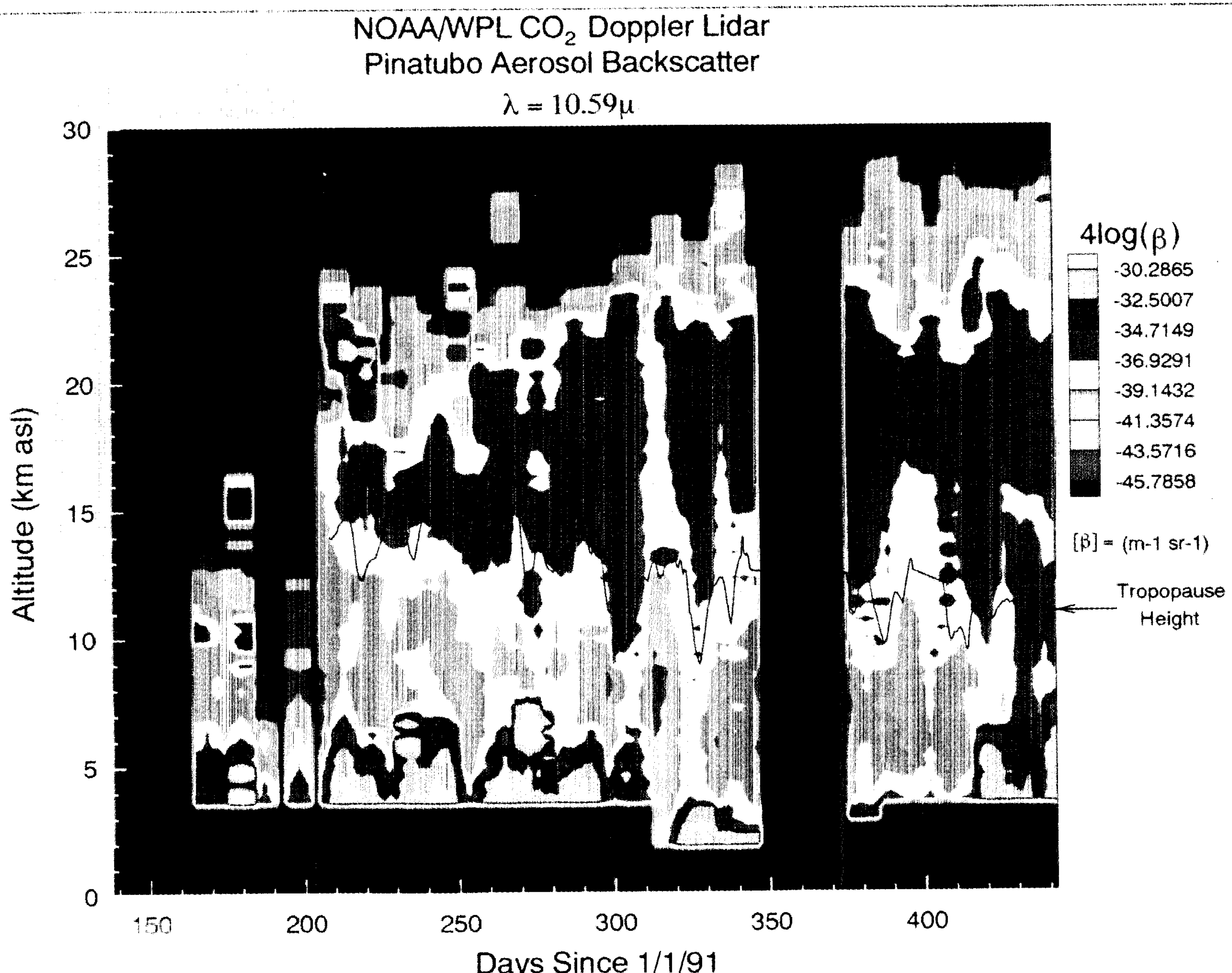
On numerous occasions we observed backscatter profiles in conjunction with other lidars of shorter wavelengths, such as NOAA's dye lidar at Fritz peak or NOAA's ruby lidar, which was at times co-located with the CO_2 system. We also attempt to take data with all lidars whenever the University of Wyoming flies its stratospheric balloons with in situ particle counters. From such data sets we can retrieve size distributions remotely, and for the first time calibrate the CO_2 lidar at long ranges.

During FY 91 NOAA received about $40K for its backscatter climatology work, but we have received nothing for FY 92. Unless NASA provides some support for FY 92, it will be difficult for NOAA to continue data acquisition and processing at the current feverish pitch, and valuable information on the dissipation of the Pinatubo event will be lost.

The other area of activity was developing the scientific rationale and technical plans to install NOAA's CO_2 Doppler lidar in NASA's DC-8, as part of a multi-agency joint proposal labels MACAWS (Multi-Agency Coherent Atmospheric Wind Sounder). This work entailed considerable debate over the scientific merit of various scanning geometries possible from the DC-8, and the importance of the scientific contribution of MACAWS to such other programs as TOGA, STORM, GEWEX, GLOBE, and LAWS. A great deal of time was spent both internally and in collaboration with STI Optronics planning and costing the hardware modifications necessary for moving the lidar from NOAA's trailer to the DC-8. Considerable time was also spent soliciting proposals and awarding a contract to procure the computing/control/display systems required by NASA and NOAA for MACAWS.

MACAWS is now funded over 4 years, with checkout flights scheduled for FY95. A large percentage of future RTOP funding from NASA to NOAA likely will be spent on implementing the proposed hardware and software modifications. NOAA is pursuing the acquisition of additional funds from NOAA to assist in the high cost of these modifications.

NOAA also attended and contributed to the 1991 workshop put together by NASA Headquarters to review the status of solid-state lidar technology. We plan to attend the upcoming 1992 workshop as well, but again have received no support (even for travel) to do so.



NOAA/WPL CO2 Doppler Lidar
Pinatubo Aerosol Backscatter
λ = 10.59μ
Altitude (km asl)
0
5
10
15
20
25
30
150
200
250
300
350
400
Days Since 1/1/91
4log(β)
-30.2865
-32.5007
-34.7149
-36.9291
-39.1432
-41.3574
-43.5716
-45.7858
[β] = (m-1 sr-1)
Tropopause
Height