FINAL REPORT

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PHYSICAL PROCESSES GOVERNING ATMOSPHERIC TRACE CONSTITUENTS MEASURD FROM AN AIRCRAFT ON PEM-TROPICS

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Before the mission, the PI was instrumental in securing real-time use of the new 51-level ECMWF meteorological data. During the mission, he provided flight planning and execution guidance as meteorologist for the P-3B. Mr. Yong Zhu computed and plotted meteorological forecast maps using the ECMWF data and transmitted them to the field from MIT. Dr. John Cho was in the field for the Christmas Island portion to extract data from the on-site NOAA radars for local wind profiles that were used at the flight planning meetings. When the power supply for the VHF radar failed, he assisted the NOAA engineer in its repair.

After the mission, Mr. Zhu produced meteorological data memos, which were made available to the PEM-Tropics B science team on request. An undergraduate student, Ms. Danielle Morse, wrote memos annotating the cloud conditions seen on the aircraft external monitor video tapes. Dr. Cho and the PI circulated a memo regarding the status (and associated problems) of the meteorological measurement systems on the DC-8 and P-3B to the relevant people on the science team.

Several papers by members of our project were completed and accepted by JGR for the first special section on PEM-Tropics B:

Cho et al. examined boundary layer data taken by TAMMS on the P-3B. The high resolution (22 Hz) allowed multiscale analyses that reached down into the 3D isotropic turbulence range. They were able to determine the direction (downscale) and magnitude of the kinetic energy cascade and the temperature variance cascade (also downscale) in the inertial subrange. They also observed indications for an inverse energy cascade at larger length scales, suggesting the existence of stratified 2D turbulence. They also performed multifractal characterizations that showed the log-Levy model to be a better fit than the oft-invoked log-Poisson model.

Hu et al. studied water vapor transport during PEM-Tropics B. Differences between PEM-Tropics A and PEM-Tropics B were highlighted and their import for atmospheric chemistry outlined. During the latter mission, a double ITCZ structure was observed, which likely led to suppression of interhemispheric transport. A climatological analysis showed that this double-walled structure tends to occur at a specific time of the year.

Thouret et al. continued our group's research on tropospheric trace constituent layers. In this paper we focused on ozone and water vapor, contrasting the statistics computed for PEM-Tropics A and B. Fewer layers were observed during the latter than during the former. This difference was interpreted to be a seasonal variation, since the two campaigns were held during opposing seasons. This explanation was shown to be consistent with the seasonal variation observed in layer occurrence as calculated from the SHADOZ ozonesonde network data. This paper was presented by Dr. Valérie Thouret at the second PEM-Tropics B data workshop and at the 2000 Spring AGU meeting.

The PI and Mr. Zhu worked with Fuelberg et al. to summarize the meteorological background and events during PEM-Tropics B. He also contributed meteorological analyses for the cross-ITCZ transport article of Avery et al., the large-scale air-mass characterization paper of Browell et al., and the campaign overview piece by Raper et al. Dr. Cho also provided a plot from the Christmas Island wind profiling radar for Avery et al.

Several other papers were written by the PI and will be submitted for publication soon. For example there is a draft paper about concomitant lidar measurements on March 16, 1999 of ozone, water vapor and aerosol. The value of making these aircraft measurements simultaneously is illustrated. Other MIT and Langley scientists will be included as authors.

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