

**Observational and Modeling Studies of Heat, Moisture, Precipitation,  
and Global-Scale Circulation Patterns**

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**Annual Review for Period, June 1991 - June 1992**

**A. Background of the Investigation**

The research sponsored by this grant is a continuation and an extension of the work conducted under a previous contract, "South Pacific Convergence Zone and Global-Scale Circulations". In the prior work, we conducted a detailed investigation of the South Pacific convergence zone (SPCZ), and documented many of its significant features and characteristics. We also conducted studies of its interaction with global-scale circulation features through the use of both observational and modeling studies. The latter was accomplished toward the end of the contract when Dr. James Hurrell, then a Ph.D. candidate, successfully ported the NASA GLA general circulation model (GCM) to Purdue University.

In our present grant, we have expanded our previous research to include studies of other convectively-driven circulation systems in the tropics besides the SPCZ. Furthermore, we have continued to examine the relationships between these convective systems and global-scale circulation patterns. Our recent research efforts have focused on three objectives: (1) determining the periodicity of large-scale bands of organized convection in the tropics, primarily synoptic to intraseasonal time scales in the Southern Hemisphere; (2) examining the relative importance of tropical versus mid-latitude forcing for Southern Hemisphere summertime subtropical jets, particularly over the Pacific Ocean; and (3) estimating tropical precipitation, especially over oceans, using observational and budget methods. A summary list of our most significant accomplishments in the past year is now given.

**B. Significant Accomplishments (June 1991 - June 1992)**

1. In July 1991, a final report on our previous contract, "South Pacific Convergence Zone and Global-Scale Circulations", was submitted.
2. In August 1991, Dr. Vincent presented two papers at the IUGG/IAMAP meetings in Vienna, Austria. These were: (1) "Mean monthly precipitation rates over tropical oceans", by Vincent, North (former M.S. graduate) and Velasco (former B.S. Honors graduate), presented at the Workshop on Precipitation Measurements, and (2) "The relationship between tropical heating and subtropical wind maxima: Observational and modeling study", by Hurrell (former Ph.D. graduate) and Vincent, presented at the Symposium on Large-Scale Flow and Atmospheric Variability.

3. In October 1991, Dr. Vincent presented a paper, "Relationship between intraseasonal oscillation and subtropical wind maxima over the South Pacific Ocean", by Vincent, Hurrell (former Ph.D. graduate), and Dr. Speth and Messrs. Sperling, Fink and Zube (Dr. Vincent's colleagues at the University of Cologne, Germany). This paper was given at the Fifth Conference on Climate Variations, held in Denver, Colorado.
4. In January 1992, Dr. Vincent presented a paper, "A case study of analyzed versus satellite-derived water vapor distributions over the Atlantic Ocean", for which he was the sole author. This paper was given at the Sixth Conference on Satellite Meteorology and Oceanography, held in Atlanta, Georgia.
5. In January 1992, three Ph.D. students on the project (Messrs. Bourassa, Ko and Ramsey) and former B.S. Honors graduate, Mr. Velasco, were awarded partial support from the American Meteorological Society to participate in the conference on Global Change Studies, held at Atlanta, Georgia.
6. In April 1992, Dr. Speth from the Institute for Geophysics and Meteorology, University of Cologne, Germany, visited Dr. Vincent at Purdue University for one week. They conducted research and discussed plans for the continued collaboration between their research groups.
7. Several refereed papers and conference preprints were published which contained research sponsored by the grant. These are listed in section E.

**C. Focus on Current Research (summer 1992)**

By the time this review takes place (July 1992), we will be in the midst of a busy summer of research activities. At the time of this writing (April 1992), Mr. Bourassa is preparing to take his Ph.D. preliminary examination. If all goes well, he will become the second Ph.D. candidate on the project (Mr. Ramsey is the other). Both Mr. Bourassa and Mr. Ramsey, as well as the other two graduate students on the project (Messrs. Ko and Sliwinski), are looking forward to the summer period when it is possible to focus most of their attention toward research. Dr. Vincent, together with his colleagues and students, will spend much of the summer preparing conference presentations, invited lectures, and manuscripts for publication in the coming year. These are listed below in section D.

**D. Plans for Next Year (July 1992 - July 1993)**

1. In August 1992, Mr. Ramsey will present a paper, "Improvements in  $Q_1$  budget derived precipitation estimates: Calculation of radiation terms using operational analyses and ISCCP C1 cloud statistics", at the Eleventh International Conference on Clouds and Precipitation, held in Montreal, Canada.
2. In August 1992, our project will welcome a new M.S. student, Mr. Jon Schrage, who is a graduate of Creighton University. He received a fellowship from the American Meteorological Society for his first year of graduate study.
3. In November - December 1992, Dr. Vincent will present an invited 6-week course in "Tropical Meteorology" at the Institute for Geophysics and Meteorology, University of Cologne, Germany. The course is currently being prepared.

4. In January 1993, Dr. Vincent, and perhaps one or more of his graduate students, will attend the meetings associated with the AMS Annual Meeting in Anaheim, California. One or more preprint paper(s), is (are) currently in preparation.
5. In March - April 1993, Dr. Vincent will present a review paper on the South Pacific convergence zone (SPCZ) at the Fourth International Conference on Southern Hemisphere Meteorology and Oceanography in Hobart, Australia. An Abstract is currently in preparation and the paper will be written in the coming fall-winter period. In addition, Dr. Vincent has been invited to chair a session at the conference.
6. In April - May 1993, Dr. Vincent and perhaps one of his graduate students plan to present papers at the Twentieth Conference on Hurricanes and Tropical Meteorology to be held at a yet-to-be-named location in the Southwest U.S.A. Abstracts and preprints would be prepared during the coming fall-winter period.
7. Dr. Vincent will prepare his contribution to two manuscripts he is co-authoring with his colleagues at the University of Cologne, Germany (Dr. Speth and Ph.D. students, Messrs. Fink and Sperling).
8. Dr. Vincent will continue to act in an advisory capacity to two of Dr. Speth's Ph.D. students (Messrs. Fink and Sperling) at the University of Cologne, Germany.

**E. Publications (June 1991 - June 1992)**

**1. Refereed**

Hurrell, J.W. and D.G. Vincent, 1991: On the maintenance of short-term subtropical wind maxima in the Southern Hemisphere during SOP-1, FGGE. Journal of Climate, 4, 1009-1022.

Vincent, D.G., K.H. North, R.A. Velasco and P.G. Ramsey, 1991: Precipitation rates in the tropics based on the Q<sub>1</sub>-budget method: 1 June 1984 - 31 May 1987. Journal of Climate, 4, 1070-1086.

Hurrell, J.W. and D.G. Vincent, 1992: A GCM case study on the maintenance of short-term subtropical wind maxima in the summer hemisphere during SOP-1, FGGE. Quarterly Journal Royal Meteorological Society, 118, 51-70.

**2. Preprint papers**

Vincent, D.G., J.W. Hurrell, P. Speth, T. Sperling, A. Fink and S. Zube, 1991: Relationship between intraseasonal oscillation and subtropical wind maxima over the South Pacific Ocean. Preprint from the Fifth Conference on Climate Variations, October 14-18, 1991, Denver, CO, American Meteorological Society, Boston, MA, 240-243.

Vincent, D.G., 1992: A case study of analyzed versus satellite-derived water vapor distributions over the Atlantic Ocean. Preprint from the Sixth Conference on Satellite Meteorology and Oceanography, January 5-10, 1992, Atlanta, GA, American Meteorological Society, Boston, MA, 329-332.

