

49

Annual Report for NASA GSAPRP\*  
(1 July 1987 - 30 June 1988)

Dynamics and Energetics of the South Pacific  
Convergence Zone During FGGE SOP-1  
Contract NAS8-35187 (1 July - 31 December 1987)

and

South Pacific Convergence Zone and Global-Scale Circulations  
Contract NAS8-37127 (20 July 1987 - 30 June 1988)

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\* report prepared for GSAPRP Review  
in Huntsville, AL, August 2-3, 1988

### Significant Accomplishments in Past Year

1. Two articles by Huang and Vincent were published: one in Tellus and the other in Beitrage zur Physik der Atmosphäre (see attached publication list).
2. An article by Hurrell and Vincent was published in the Monthly Weather Review (see attached publication list).
3. Three papers were given at the Third Conference on Satellite Meteorology and Oceanography in Anaheim, CA, February 1988 (see attached publication list).
4. One manuscript was revised and resubmitted to the Quarterly Journal of the Royal Meteorological Society, by Robertson, Vincent and Kann, "The role of diabatic heating in maintaining the upper-tropospheric baroclinic zone in the South Pacific".
5. Dr. Huang spent the summer of 1987 and is spending the summer of 1988 as a visiting scientist, USRA, at MSFC/NASA, Huntsville, conducting research on water vapor and precipitation estimates from satellite measurements.
6. Dr. Robertson, Dr. Vincent, and Mr. Hurrell visited the GSFC/NASA in Greenbelt, MD and the National Meteorological Center and Climate Analysis Center in Camp Springs, MD on 17-19 November 1987. They discussed some of the research objectives of the contract with Drs. Baker and Lau at GSFC, Drs. Kalnay and Kann at NMC, and Dr. Mo at CAC.
7. A computer account at NSESCC/GSFC/NASA was established so that Dr. Vincent and Mr. Hurrell could use the Goddard Laboratory for Atmospheres (GLA) General Circulation Model (GCM) on the CYBER 205 to perform some of the research objectives of the contract.
8. Mr. Hurrell successfully passed his Ph.D. preliminary examination and is now working full time, as a Ph.D. candidate, on his doctoral research. Mr. Hurrell's work involves using the GLA GCM to examine the global-scale physical processes responsible for maintaining the South Pacific Convergence Zone (SPCZ). With the assistance of Mr. Larry Takacs at GSFC, Greenbelt, MD, a successful control forecast was produced on the CYBER-205 using the GLA general circulation model. This forecast was a 15-day average of selected variables, initialized at 10 January 1979, which we are comparing with FGGE observations for the same time period. The observed state was well simulated by the model and we plan to examine cause/effect relationships in the future, particularly as they relate to the SPCZ, which was very intense during the 15-day period.
9. Ms. Pedigo gave a departmental seminar on her M.S. research on 11 April. The title of her seminar was, "Moisture and Precipitation Analyses During the Global Weather Experiment (GWE)". Her research is progressing well and she should finish her M.S. thesis in the Fall 1988 semester.
10. Dr. Vincent, Mr. Hurrell and Ms. Pedigo visited Dr. Robertson at MSFC, Huntsville, 6-11 March 1988, to discuss our research work.

11. Three graduate students have accepted offers to come to Purdue in the Fall 1988 and work on research problems within our contract. Dr. Vincent will serve as their major professor.
12. Dr. Peter Speth of the University of Cologne, FRG visited Dr. Vincent on 8 April to discuss collaborative research, as well as Dr. Vincent's plans for sabbatical leave next year in Germany.
13. Dr. Robertson visited Dr. Vincent, Mr. Hurrell and Ms. Pedigo at Purdue University on 15-18 June 1988 to discuss their collaborative research.

#### Focus on Current Research

1. Computer scientists at GSFC/NASA, Greenbelt, MD, have now produced a second control run on the GLA GCM for Mr. Hurrell to diagnose. This forecast is averaged over the 15-day period, 28 January - 11 February, 1979, initialized on 28 January. During this period the SPCZ was considerably less active, convectively, than during the prior 15-day control run period (10-24 January). Both runs appear to be successful in that the forecast fields are in good agreement with the observed fields, except over the Indian Ocean during the second period. Mr. Hurrell is now in the process of reading the history tapes provided by GSFC so that further analyses can be achieved and comparisons can be made between the active and inactive SPCZ periods.
2. Ms. Pedigo is diagnosing the heat and moisture budgets over the tropical oceans during January and February, 1979, which was part of the period of The Global Weather Experiment, FGGE. She is using FGGE Level III-b analyses produced by GLA and will compare her results to those obtained using satellite techniques. She currently is producing daily global results of precipitation using the  $Q_1$  (heat) and  $Q_2$  (moisture) budget techniques. A preliminary assessment of the results looks very promising.
3. One abstract was recently accepted for presentation of a paper at the 7th Extratropical Cyclone Workshop to be held in October 1988 at Drexel University, PA.
4. One new graduate student, Captain Keith North, arrived in June 1988 to begin in M.S. degree work and research on our project.

#### Plans for Next Year

1. We have one manuscript in the review process which may require further work before it is acceptable.
2. Mr. Hurrell and Ms. Pedigo will continue to work on their Ph.D. and M.S. research; Ms. Pedigo should finish her M.S. thesis and receive her degree in the Fall 1988 semester. A manuscript on her research will be submitted for publication.

3. Mr. Hurrell's work should progress toward culmination within the coming year and, if he completes his dissertation, one or more papers on his research would be submitted for publication.
4. Our department moved to a new building in June 1988 which required a careful review and scrutiny of all research materials. The research space in the new building offers an improvement over our previous facility.
5. We are eagerly anticipating the arrival of two more new students, Messrs. Ko (M.S.) and Ramsey (Ph.D.). They will begin graduate work in August 1988 and their addition will bring the number of graduate students working on the project to five.

List of Publications (at Purdue only)

- Huang, H.-J. and D.G. Vincent, 1988: Daily spectral energy conversions of the global circulation during 10-27 January 1979. Tellus, 40A, 37-49.
- Huang, H.-J. and D.G. Vincent, 1988: Active and inactive phases of the South Pacific convergence zone and changes in global circulation patterns: A case study. Beit. z. Phys. d. Atmos., 61, 123-134.
- Hurrell, J.W. and D.G. Vincent, 1987: Significance of the SPCZ in the energy budget of the Southern Hemisphere tropics. Mon. Wea. Rev., 115, 1797-1801.
- Huang, H.J., D.G. Vincent and F.R. Robertson, 1988: Precipitable water derived from NIMBUS-7 SMMR measurements and its comparison to FGGE III-b data during January 10-February 13, 1979. Preprints of Third Conference on Satellite Meteorology and Oceanography, January 31 - February 5, 1988, Anaheim, CA, American Meteorological Society, Boston, MA, 02108, 64-69.
- Miller, D.K. and D.G. Vincent, 1988: An example of estimates of precipitable water derived from NIMBUS-7 SMMR satellite measurements and FGGE upper air data. Preprints of Third Conference on Satellite Meteorology and Oceanography, January 31 - February 5, 1988, Anaheim, CA, American Meteorological Society, Boston, MA, 70-73.
- Robertson, F.R. and D.G. Vincent, 1988: Vertical profiles of heating derived from IR-based precipitation estimates during FGGE SOP-1. Preprints of Third Conference on Satellite Meteorology and Oceanography, January 31 - February 5, 1988, Anaheim, CA, American Meteorological Society, 02108, 4 pp.