

CHAPTER V - APPLIED TROPICAL CYCLONE RESEARCH SUMMARY

1 NAVENVPREDRSCHFAC RESEARCH

TROPICAL CYCLONE HAVEN STUDIES

(Brand, S., NAVENVPREDRSCHFAC)

Tropical cyclone haven studies are being developed for 22 ports and harbors in the Atlantic and Gulf of Mexico, and being published in the Hurricane Havens Handbook for the North Atlantic Ocean (NAVENVPREDRSCHFAC Technical Report 82-03) as available. In addition, Pearl Harbor is presently being evaluated as a hurricane haven.

THE NAVY TWO-WAY INTERACTIVE NESTED TROPICAL CYCLONE MODEL (NTCM)

(Fiorino, M., NAVENVPREDRSCHFAC)

1983 was the first year the CY205 version of the NTCM went into operational evaluation (OPEVAL). Results in WESTPAC were significantly better than for the 1982 OPEVAL version that was run on the CY175. We have further demonstrated that the NTCM, and other dynamic models, are capable of producing better forecasts than climatology-persistence aids, particularly for the long range (48-72 hours) and the general track. However, the model's performance on very large storms, like supertyphoon Abby, has forced us to consider expanding the fine mesh so that the tropical cyclone circulation is always contained within the high-resolution grid.

We will experiment with the bias-corrector technique that forces initial model storm motion to be the same as that observed. We anticipate significant improvements in short term (12-24 hours) skill as well as for the longer term. We will also test time-dependent boundary conditions, after the bias corrector has been implemented. Monitoring of the performance of the CY205 NTCM in the southern hemisphere will continue.

TROPICAL CYCLONE OPTIMUM FORECAST AID

(Tsui, T., NAVENVPREDRSCHFAC)

A comprehensive review of the performance of all JTWC objective tropical cyclone forecast aids shows that during 1979-82 the "one-way tropical cyclone" model (OTCM) has the best overall performance. The "nested tropical cyclone" model (NTCM) has the

superior track prediction ability, while the OTCM has the best speed of tropical cyclone movement forecast. The blend of climatology (CLIM) and persistence (XTRP) is still a good objective aid.

Through experiments, two alternate objective aids are suggested. One; JTWC forecasters are recommended to use NTCM as a track forecaster and to use one statistical aid's output as the guide of the speed forecast. This statistical aid's forecast track should be closest to the NTCM track. Two; the blending of the CLIM and the XTRP is recommended to be 1:3, 2:2, 3:1 for the 24-, 48-, and 72-hr forecast respectively.

TROPICAL CYCLONE OBJECTIVE FORECAST CONFIDENCE AND DISPLAY SYSTEM

(Nuttall, K., System and Applied Sciences Corp., Tsui, T., NAVENVPREDRSCHFAC)

The system has been installed on FNOC operational computers at the end of 1983. Forecasters at JTWC now can issue one single ARQ command to activate up to 12 objective tropical cyclone forecast aids. The results of the activated objective aids will return to the system for coordination for dissemination of the forecast guidance and the display graphics; and for archival of all objective aid forecasts. The system is also capable of processing JTWC's official forecasts and best track information; and can be applied to western North Pacific, Indian Ocean, and Southern Hemisphere regions.

A weighted combined tropical cyclone forecast composed from all available objective aids is issued upon each combined ARQ request. The weights of the combination are reduced from the past (1979-82) performance of the aids.

SATELLITE BASED TROPICAL CYCLONE INTENSITY FORECASTS

(Cook, J. and T. Tsui, NAVENVPREDRSCHFAC)

Results from a recently completed study show the usefulness of a newly developed objective spiral analysis technique as a forecasting aid. Algorithms using persistence and derived spiral parameters show significant skill at estimating current intensity and in making 12 hour intensity forecasts. The 24 hour intensity forecasting skill is only slightly better than persistence. This nowcasting skill is unique because of the stand-alone nature of the SPADS based method.

Also under investigation is a method of studying the relationship of cyclone intensity and cloud patterns in quasi-Lagrangian coordinates. Satellite images of tropical cyclones are rotated and correlated with various intensity parameters.

SYNOPTIC TROPICAL CYCLONE INTENSITY
FORECAST

(Gray, W., Colorado State University)

Extensive investigation on tropical cyclone intensity change characteristics is now underway. The study will include: (1) individual case analysis tropical cyclone intensity change with FGGE year and JTWC hand analysis and (2) rawinsonde composite analysis of groups of cyclones experiencing rapid, moderate, weak and negative intensity change. The goal of this study is to develop practical empirical relationships for cyclone intensity change which can be used in an operational forecast environment such as exists at JTWC.

TROPICAL CYCLONE INTENSITY FORECASTS USING
THE VERTICAL WIND SHEAR

(Cook, J., and T. Tsui, NAVENVPRDRSCHFAC)

A study of the relationship of tropical cyclone intensity to the large-scale vertical wind shear is currently underway. The data being used are various combinations of the radially averaged vertical shear of the Global Band zonal-wind component for all the western North Pacific tropical cyclones from 1974-81. The wind shear parameters will be related to cyclone intensity by using linear regression techniques.

TROPICAL CYCLONE STRIKE AND WIND
PROBABILITIES

Tropical cyclone strike and wind probability is a method for determining up through 72 hours that a tropical cyclone will affect geographic points of interest to the user. Applications presently being developed, tested and implemented for the western North Pacific, and North Indian Ocean, western North Atlantic, and Gulf of Mexico include: strike/wind probabilities and geographic depictions; optimum track ship routing (OTSR) aids; HP-9845/Tactical Environmental Support System (TESS) software for shipboard environmentalists and decision makers; terrain adjusted probabilities; and condition setting aids.

STATISTICAL TROPICAL CYCLONE FORECASTING
AIDS FOR THE SOUTHERN HEMISPHERE

(Keenan, T., Bureau of Meteorology,
Australia)

Various statistical techniques are being tested for use by JTWC in the southern hemisphere. Australian schemes using multiple linear regression, eigenvector and discriminant analysis of past track data and

synoptic data, are being run on 82/83 storm data over the JTWC area of responsibility. In addition, a technique incorporating both geographic and track orientated prediction schemes is being developed using the FNOG Global Band fields as the developmental data base.

3. PUBLICATIONS

Allen, R.L., 1984: COSMOS: CYCLOPS Objective Steering Model Output Statistics. Proceedings, 15th Technical Conference on Hurricanes and Tropical Meteorology.

COSMOS, a new objective aid used in forecasting the movement of western North Pacific tropical cyclones, is presented. The aid accepts CYCLOPS forecasts at the 850, 700, and 500 mb levels and produces its own forecast based on a statistical analysis of the past performance of CYCLOPS. The design of COSMOS as well as the results of the statistical analysis are presented. Verification of COSMOS during the first eight months of 1983 indicates that the technique may be an improvement over other techniques currently available at JTWC.

Weir, R.C., 1984: Predicting the Acceleration of Northward-moving Tropical Cyclones Using Upper-Tropospheric Winds. Proceedings, 15th Technical Conference on Hurricanes and Tropical Meteorology.

Inconsistent forecasting of the acceleration of northward-moving tropical cyclones entering the domain of the mid-latitude westerlies has been a long-standing weakness in tropical cyclone forecasting. The tracks of tropical cyclones traversing a relative high-density data area of the western North Pacific have been analyzed to verify the acceleration phenomenon, and to correlate the movement with features of the upper-tropospheric wind field. The resultant forecast technique is described and the results obtained with its use during the 1982 tropical cyclone season in the western North Pacific are presented.

Weir, R.C., 1983: Tropical Cyclones Affecting Guam (1671-1980). NAVOCEANCOMCEN/JTWC TECH NOTE 83-1.

An update of a previous paper (Holliday, 1975) which presents a climatology of tropical cyclones passing within 180 nm of Guam for the period 1948 to 1980. A review of all typhoons of the 1600's is included. The survey encompasses the frequency, behavior, meteorological effects and descriptive chronicles of Guam tropical cyclones. The major emphasis is on the period since World War II.