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Hurricanes



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[The Four Florida Hurricanes of 2004 and Their Impact on the Fleet](#)

Aug 15, 2005

30 pages

Authors: [Peter M. Klein](#); [NAVAL RESEARCH LAB WASHINGTON DC](#)

Full Text

In 2004, four **hurricanes** (Charley, Frances, Ivan and Jeanne) made landfall in the United States within 6 weeks. Each of these storms posed significant ... this context as a framework to learn from the track and intensity forecasts of the four "Florida **Hurricanes**" of August through September 2004. In this Memorandum Report, a brief discussion of Navy Guidelines and hypothetical scenarios ... of Readiness (CORs) is presented first. Review of the track and intensity forecasts in the cases of **Hurricanes** Charley, Frances, Ivan, and Jeanne follows. A Summary and Conclusions section presents lessons learned ...

[Improvements in Intensity and Track Predictions for Hurricanes](#)

Jul 9, 1996

7 pages

Authors: [T. N. Krishnamurti](#); [FLORIDA STATE UNIV TALLAHASSEE DEPT OF METEOROLOGY](#)

Full Text

Highlights of our progress include significant improvements in intensity and track predictions for **hurricanes** with the use of physical initialization techniques and high resolution (T170) global model forecasts using the FSU global spectral model. These improvements are supported by results of forecasts made for **Hurricanes** Florence (1994) and Opal (1995) which are detailed in this report.

[Improvements in Intensity and Track Predictions for Hurricanes](#)

Jun 26, 1997

6 pages

Authors: [T. N. Krishnamurti](#); [FLORIDA STATE UNIV TALLAHASSEE DEPT OF METEOROLOGY](#)

Full Text

Highlights of our progress include significant improvements in intensity and track predictions for **hurricanes** with the use of physical initialization techniques and very high resolution (T170) global and regional (T240) model forecasts using the FSU models. These improvements are supported by results of forecasts made for **Hurricanes** Erin and Opal of 1995 and Hurricane Fran of 1996.

[Hurricane Preparedness of Navy Family Housing](#)

1996

87 pages

Authors: [Thomas F. George](#); [FLORIDA UNIV GAINESVILLE](#)

Full Text

One of the greatest threats to the maintenance and up-keep of our countries naval installations is that of **hurricanes**. Each year throughout the summer and autumn months, coastlines are prey to nature's fury in the ... which inhabit the waterfront, and in some cases, much further inland. The devastation caused by past major **hurricanes** has been catastrophic, resulting in billions of dollars in lost property as well as human life. ... during the storm could have been avoided if the buildings in question had been retrofitted with equipment specifically designed to enable buildings to withstand **hurricanes**.

[Spectral Growth of Hurricane Generated Seas](#)

1997

85 pages

Authors: [William S. Finlayson](#); [FLORIDA UNIV GAINESVILLE DEPT OF COASTAL AND OCEANOGRAPHIC ENGINEERING](#)

Full Text

The characteristics of a growing sea during **hurricanes** are significantly different from those observed in ordinary storms since the source of energy generating waves is moving and the ... is very fast. This thesis presents the results of a study on the growth of sea severity during **hurricanes** with the aid of a wave spectral formulation representing the associated sea conditions. Through analysis of spectra obtained from wave data during the growing stage of five **hurricanes**, it is found that the Modified JONSWAP spectral formulation well represents field data over a wide range of frequencies. This ...

[An Investigation of Hurricane-Induced Forerunner Surge in the Gulf of Mexico](#)

Sep 1985

221 pages

Authors: [M. Bunpapong](#); [R. O. Reid](#); [R. E. Whitaker](#); [TEXAS A AND M UNIV COLLEGE STATION DEPT OF OCEANOGRAPHY](#)

Full Text

... no-flow condition is taken at all solid boundaries and the inverted barometer term is used to stipulate barotropic height anomalies on the open boundaries. **Hurricanes** Carla (1961) and Allen (1980) are used as historical storms to verify the model by comparing numerical and observed hydrographs. A parametric study utilizing three forward speeds, two radii to maximum winds, and five paths characterizing Gulf **hurricanes** is presented. The results of the study show that volume transports through Florida and Yucatan Straits consisted of in-phase (both in or both out) and out-of-phase ...

[Symmetrization, Vortex Rossby Waves, and Hurricane Motion in an Asymmetric Balance Model](#)

Sep 10, 1995

87 pages

Authors: [Randall J. Kallenbach](#); [AIR FORCE INST OF TECH WRIGHT-PATTERSON AFB OH](#)

... azimuthally. In this work we also consider the problem of vortex axisymmetrization as a model for outwardly propagating spiral bands in **hurricanes**. The basic physics is illustrated most simply for stable vorticity monopoles on an f-plane. Unlike the dynamics of sheared disturbances in ... vorticity. Expressions for both phase and group velocities are developed and verified confirming early speculations on the existence of vortex Rossby waves in **hurricanes**. Effects of radially propagating waves on the mean vortex are also analyzed and the results suggest a new mechanism of vortex intensification. ...

[Full Text](#)

[Development of Water-Surface Elevation Frequency-of-Occurrence Relationships for the Brunswick, North Carolina, Nuclear Power Plant Site](#)

Dec 1999 84 pages

Authors: [Norman W. Scheffner](#); [David J. Mark](#); [Lihwa Lin](#); [Willie A. Brandon](#); [Martin C. Miller](#); [ARMY ENGINEER WATERWAYS EXPERIMENT STATION VICKSBURG MS COASTAL AND HYDRAULICS LAB](#)

... number of times. The Brunswick study described in this report consisted of four interrelated tasks, each employing a separate numerical model. In the first task, historical **hurricanes** impacting the study area were analyzed to determine storm statistics. From these data, a set of **hurricanes**, representative of all storms impacting the area, were chosen and subsequently simulated with a tropical wind field model to generate wind and atmospheric pressure fields. Storm ...

[Full Text](#)

[Doctrine for Domestic Disaster Response Activities](#)

May 20, 2000 59 pages

Authors: [Dave Wellons](#); [ARMY COMMAND AND GENERAL STAFF COLL FORT LEAVENWORTH KS SCHOOL OF ADVANCED MILITARY STUDIES](#)

This monograph examines two disasters, **Hurricanes** Andrew (1991) and Marilyn (1995), and the U.S. Army's support to the Federal Emergency Management Agency (FEMA) to determine whether Joint and Army doctrine provides doctrinal tools for Defense Coordination Element (DCE) planning. Two recent disasters, **Hurricanes** Andrew and Marilyn, provide detailed lessons learned and after action reports to examine the role of the DCE in planning military activities during federally declared disaster relief operations. First, this ...

[Full Text](#)

[Hurricane Relief Operations in the Caribbean: Is the Use of the Military in Hurricane Relief Operations](#)

Jun 18, 2004 82 pages

Authors: [George N. Robinson](#); [ARMY COMMAND AND GENERAL STAFF COLL FORT LEAVENWORTH KS](#)

Considering meteorological projections, the frequency and magnitude of **hurricanes** in the Caribbean appear more probable in the future. Correspondingly, this necessitates a more organized response to such threats of devastation. Additional hurricane relief ... This study examines hurricane relief operations to determine if there is an appropriate role for the Armed Forces of the Caribbean in managing the response to **hurricanes** in the Caribbean Islands. The author examines the existing Caribbean agreement that established the Caribbean Disaster Response Agency (CDERA) and compares it to an ...

[Full Text](#)

[Hurricane Ivan's Impact Along the Northern Gulf of Mexico. Volume 86, Number 48](#)

Nov 29, 2005 6 pages

Authors: [G. W. Stone](#); [N. D. Walker](#); [S. A. Hsu](#); [A. Babin](#); [B. Liu](#); [B. D. Keim](#); [W. Teague](#); [D. Mitchell](#); [R. Beben](#); [NAVAL RESEARCH LAB STENNIS SPACE CENTER MS OCEANOGRAPHY DIV](#)

Just over a year after the landfall of Hurricane Ivan, scientists have now had an opportunity to evaluate a variety of oceanographic and geologic responses to this storm. **Hurricanes** Ivan, Katrina, and Rita are among the most powerful **hurricanes** recently to enter the Gulf of Mexico. Although it weakened from a very powerful category 5 hurricane to a category 3 before making landfall along the Alabama coast, Hurricane Ivan devastated the coasts of northwestern ...

[Full Text](#)

[Windstorm Impact Reduction Implementation Plan](#)

2007 30 pages

Authors: [EXECUTIVE OFFICE OF THE PRESIDENT WASHINGTON DC NATIONAL SCIENCE AND TECHNOLOGY COUNCIL](#)

The tragedy caused by **Hurricanes** Katrina and Rita in August and September 2005, the unprecedented hurricane season of 2004 in which five **hurricanes** made landfall in Florida, and the May 1999 outbreak of damaging tornados in Oklahoma underscore the significant and growing risks to our society due to wind hazards. Public Law 108-360, known as the National Windstorm Reduction Act of 2004, was signed into law by President Bush to reduce the risk wind hazards pose to life and property. Although there are current and ongoing activities related to, or focused on, wind hazards it is clear that these ...

[Full Text](#)

[Water and Sediment Data for Chemical Indicators of Contamination](#)

Dec 2006 25 pages

Authors: [Tyler Bowley](#); [Steven Larson](#); [Anthony Bednar](#); [ENGINEER RESEARCH AND DEVELOPMENT CENTER VICKSBURG MS ENVIRONMENTAL LAB](#)

... Team (IPET) Task 9 project focuses on data mining and compilation for chemical results in four Louisiana parishes affected by flooding from **Hurricanes** Katrina and Rita Orleans, Plaquemines, St. Bernard, and St. Charles. The compounds of interest are arsenic, lead, benzo[a] ... BaP) and 1,1-dichloro-2,2- bis(p-chlorophenyl) ethylene (DDE), selected by consensus as likely candidates because of availability of data following the flooding events (**Hurricanes** Katrina and Rita) and the chemical variability between them. Arsenic and lead, although both inorganic analytes, would behave differently based on ...

[Full Text](#)

[Geographic Concentration of Oil Infrastructure: Issues and Options](#)

Mar 24, 2007 33 pages

Authors: [Jr O'Very G. B.](#); [ARMY WAR COLL CARLISLE BARRACKS PA](#)

... of oil infrastructure in the Gulf of Mexico. After the security shock of 9/11 and the energy disruptions caused by **Hurricanes** Katrina and Rita, many analysts questioned this geographic concentration of oil infrastructure and proposed that dispersion might reduce infrastructure vulnerability. This SRP describes the vulnerabilities of geographic concentration of the oil infrastructure through a short case study of the effects of **Hurricanes** Katrina and Rita. Its assessment of the advantages and disadvantages of geographic dispersion of U.S. oil infrastructure

[Full Text](#)

is followed by ...

[Collaboration or Control?: The Struggle for Power in Catastrophic Disaster](#)

Dec 2007

121 pages

[Response](#)

Authors: [Tony S. Lombardo](#); [NAVAL POSTGRADUATE SCHOOL MONTEREY CA DEPT OF NATIONAL SECURITY AFFAIRS](#)

[Full Text](#)

Past domestic catastrophic disasters have required massive Department of Defense (DoD) Title 10 involvement. During **Hurricanes** Andrew and Katrina, DoDs initial response, although critical, was criticized as slow. The increased risks to the United States of cataclysmic events ... This thesis examines how the once strong relationship between DoD and State civil authorities deteriorated over the years contributing to DoDs slow initial response to **Hurricanes** Andrew and Katrina. Changes to disaster statutes, doctrine, and authoritative policies along with a contentious debate over the DoDs role in the ...

[Documenting Hurricane Impacts on Coral Reefs Using Two-Dimensional Video-](#)

Nov 2006

7 pages

[Mosaic Technology](#)

Authors: [Arthur C. Gleason](#); [Diego Lirman](#); [Dana Williams](#); [Nuno R. Gracias](#); [Brooke E. Gintert](#); [Hossein Madjidi](#); [R. P. Reid](#); [G. C. Boynton](#); [Shahriar Negahdaripour](#); [Margaret Miller](#); [ROSENSTIEL SCHOOL OF MARINE AND ATMOSPHERIC SCIENCE MIAMI FL](#)

[Full Text](#)

Four **hurricanes** impacted the reefs of Florida in 2005. In this study, we evaluate the combined impacts of **hurricanes** Dennis, Katrina, Rita, and Wilma on a population of *Acropora palmata* using a newly developed video-mosaic methodology that provides a high-resolution, spatially accurate landscape view of the reef benthos. Storm damage to *A. palmata* was surprisingly limited; only 2 out of 19 colonies were removed from the study plot at Molasses Reef. The net tissue losses for those colonies that remained were only 10% and mean diameter of colonies decreased slightly from 88.4 to 79.6 cm. In ...

[RADAR HURRICANE RESEARCH](#)

Nov 1969

34 pages

Authors: [Harry V. Senn](#); [Charles L. Courtright](#); [ROSENSTIEL SCHOOL OF MARINE AND ATMOSPHERIC SCIENCE MIAMI FL](#)

[Full Text](#)

A three-dimensional, quantitative study of the eye wall features in **hurricanes** Cleo, Betsy and Inez was made utilizing data from the University of Miami PPI and RHI radars. While the maximum heights reached were over 18.5 km in one storm and averaged about 10 km for the times studied, the mean height of all eye wall echoes was 8 km. Echoes with the largest areas of most intense precipitation were higher than those with smaller areas of equal intensity. The areas of several discrete precipitation intensities calculated from a radar-rainfall Z-R relation peculiar to the South Florida region, ...

[Model Vertical Profiles of Extreme Rainfall Rate, Liquid Water Content, and Drop-](#)

Sep 6, 1985

43 pages

[Size Distribution](#)

Authors: [Paul Tattelman](#); [Paul T. Willis](#); [AIR FORCE GEOPHYSICS LAB HANSCOM AFB MA](#)

[Full Text](#)

... area of the world for intense rainfall. The last two are the 42- and 1-min world record rainfalls. The surface rainfall rates were extrapolated aloft using results from previous studies. A large sample of drop-size distributions from intense rainfall collected during reconnaissance of Atlantic **hurricanes**/ tropical storms was analyzed. The data set was normalized and fit by a gamma distribution. This was used to specify the drop-size distributions and liquid water content for rainfall rates specifies at the surface and aloft. Concurrent cloud-water content was estimated. Results are presented at ...

[Coastal Modeling System \(CMS\) User's Manual](#)

Sep 1991

705 pages

Authors: [Mary A. Cialone](#); [COASTAL ENGINEERING RESEARCH CENTER VICKSBURG MS](#)

[Full Text](#)

... The numerical models documented here include: SPH, WIFM, CLHYD, RCPWAVE, WIFM Coastal Modeling System(CMS), SHALWV, cms, SPH, RCPWAVE, CLHYD, and SHALWV. Numerical model SPH is a parametric model for representing wind and atmospheric pressure fields generated by **hurricanes**. Numerical model WIFM solves the vertically integrated Navier-Stokes equations in stretched Cartesian coordinates. The model simulates shallow-water, longwave hydrodynamics such as tidal circulation, storm surges, and tsunami propagation. Numerical model RCPWAVE is a short-wave model used to predict linear, plane wave ...

[Coastal Modeling System \(CMS\) Users Manuel](#)

Aug 1992

389 pages

Authors: [Mary A. Cialone](#); [David J. Mark](#); [Lucia W. Chou](#); [David A. Leenknecht](#); [Jack E. Davis](#); [ARMY ENGINEER WATERWAYS EXPERIMENT STATION VICKSBURG MS](#)

[Full Text](#)

... in CMS can be considered tested, reliable, and mature. The numerical models documented here include: SPH, WIFM, RCPWAVE, CLHYD, SHALWV, STWAVE and HARBD. Numerical model SPH is a parametric model for representing wind and atmospheric pressure fields generated by **hurricanes**. Numerical model WIFM solves the vertically integrated Navier-Stokes equations in stretched Cartesian coordinates. The model simulates shallow-water, long-wave hydrodynamics such as tidal circulation, storm surges, and tsunami propagation. Numerical model RCPWAVE is a short-wave model used to predict linear, plane wave ...

[Evolution of Popponeset Beach and Its Effects on Popponeset Bay](#)

Sep 1993

49 pages

Authors: [Mary A. Cialone](#); [COASTAL ENGINEERING RESEARCH CENTER VICKSBURG MS](#)

[Full Text](#)

Popponeset Beach is an approximately 1 -mile-long barrier beach (or spit) fronting Popponeset Bay located on Nantucket Sound in Mashpee, Cape Cod, Massachusetts. Popponeset Spit has experienced dramatic changes in the last 40 years, beginning with a major breach in 1954, which resulted from a series of **hurricanes** (Carol, Edna, and Hazel). Breaches near Popponeset Island, Little Thatch Island, and Big Thatch Island were observed at various times between 1892 and 1991. The main purpose of the study was to determine the likelihood of a breach of Popponeset Spit and the impact (in terms of ...

[Optimizing Emergency Sorties and Storm Evasion Planning](#)

Sep 23, 1993 66 pages

Authors: [John J. Costello](#); [NAVAL POSTGRADUATE SCHOOL MONTEREY CA](#)**Full Text**

... utilizes the available pilots and tugs, and observes necessary safety constraints on basin congestion, nested berthing, and tidal-restricted ships. In a test of the model using data for Naval Station Norfolk during Hurricane Andrew, the model evacuated the ships 40 minutes earlier than the actual 11 hour schedule. In only 22 minutes on a personal computer the model provided a realistic estimate of the minimum time required to complete an Emergency Sortie, based on known information, not educated guesses. Emergency sortie, Ship scheduling, Naval Station Norfolk, **Hurricanes**, Storm evasion.

[Gulf Stream Surface Front Displacement by the Local Wind Stress: A Two-Dimensional Numerical Model](#)

Apr 1983 35 pages

Authors: [Charles W. Horton](#); [NAVAL OCEANOGRAPHIC OFFICE NSTL STATION MS](#)**Full Text**

The displacement of the surface front of the Gulf Stream due to normally short but intense wind events such as **hurricanes** is modelled. The model is a relatively simple extension of a one-dimensional bulk mixed-layer model to two dimensions to allow the representation of the cross section of the mixed layer in the frontal zone of a strong current such as the Gulf Stream. The wind event is assumed to be a rapidly moving (11 m/s) circularly symmetric cyclone. Three different storm paths are modelled. All generate net shifts of the surface front relative to the subsurface front with inertial ...

[Cultural Resources Survey and Testing for Davis Pond Freshwater Diversion, St. Charles Parish, Louisiana. Volume 2](#)

May 1994 393 pages

Authors: [EARTH SEARCH INC NEW ORLEANS LA](#)**Full Text**

... on the west shore of Lake Netherlands in recognition of the newly arrived Dutch farmers promotional literature provided glowing descriptions of the area and of the farming experiment in an attempt to recruit farmers, investors, and businessmen. The demise of the farming experiment was hastened by flooding and **hurricanes**, culminating in a rather severe storm in 1914. The farm was not a successful venture. In less than three years, the Winter Garden Experimental Farm was defunct. A potential cause of the farm's demise may have been the difficulty of keeping the land dry. The pumps seemingly ...

[Inviscid Disturbance Dynamics in Barotropic Shear Flows](#)

1994 96 pages

Authors: [Gerald B. Smith Ij](#); [AIR FORCE INST OF TECH WRIGHT-PATTERSON AFB OH](#)**Full Text**

... conditions are found to be critical factors in determining how rapidly a disturbance is compressed or elongated. This in turn controls the rate of disturbance growth or decay. For swirling flows, a definition of an effective shear that accounts for both the radial variations in the initial conditions as well as the radial variation in the angular velocity is proposed. Using the reciprocal of this effective shear, time scales for a disturbance to decay to half its initial energy, the half-life time, are calculated for initial conditions and symmetric wind profiles that are found in **hurricanes**.

[Upgrade of Tropical Cyclone Surface Wind Field Model](#)

Jul 1994 103 pages

Authors: [Vincent J. Cardone](#); [Andrew T. Cox](#); [J. A. Greenwood](#); [Edward F. Thompson](#); [OCEANWEATHER INC COS COB CT](#)**Full Text**

... profile. This upgrade can be used to create wind fields with maxima at two different radii or with a broad maximum extending over a range of radii. It also provides more flexibility in fitting the shape of single peaked wind profiles. The upgraded model is demonstrated with historical **hurricanes**. The five- and seven- nest models are applied to Hurricane Camille. The fully upgraded model, with seven nests and general pressure specification, is applied to Hurricane Gilbert. This hurricane was chosen because it is well-documented by Black and Willoughby (1992) and it evolved into some ...

[Coastal Modeling System \(CMS\) User's Manual. Supplement 3 to September 1991 Manual](#)

Aug 1994 200 pages

Authors: [Mary A. Cialone](#); [David J. Mark](#); [Lucia W. Chou](#); [David A. Leenknecht](#); [Jack E. Davis](#); [COASTAL ENGINEERING RESEARCH CENTER VICKSBURG MS](#)**Full Text**

... and have been rigorously tested over a wide range of conditions. The models in CMS can be considered tested, reliable, and mature. The numerical models documented here include: SPH, WIFM, RCPWAVE, CLHYD, SHALWV, STWAVE, and HARBD. Numerical model SPH is a parametric model for representing wind and atmospheric pressure fields generated by **hurricanes**. Numerical model WIFM solves the vertically integrated Navier-Stokes equations in stretched Cartesian coordinates. The model simulates shallow-water, long-wave hydrodynamics such as tidal circulation, storm surges, and tsunami propagation.

[A Cost-Loss Ratio Model for Hurricane Sortie Decisions](#)

Sep 1994 135 pages

Authors: [Mary T. Hatton](#); [NAVAL POSTGRADUATE SCHOOL MONTEREY CA](#)**Full Text**

... may contain large errors, despite improvements in forecasting over the past two decades. Furthermore, decision makers may have difficulty interpreting forecasts without the use of a decision aid. Analysis includes interviews with several tropical cyclone experts, a literature review of the economics of **hurricanes**, and a critique of a number of hurricane decision aids. Based upon this research, this thesis concludes that the CHARM model for setting hurricane readiness conditions is currently the best decision aid available for reducing the number of unnecessary sorties without putting the fleet ...

[Conference on Hurricanes and Tropical Meteorology \(21st\) Held in Miami, Florida on April 24 - 28, 1995](#)

Apr 28, 1995 4 pages

Authors: [Jeffrey D. Hawkins](#); [Kim Richardson](#); [Glenn Sannudin](#); [Gene Poe](#); [Chris Velden](#); [AMERICAN METEOROLOGICAL SOCIETY WASHINGTON DC](#)

A satellite multi-sensor approach is being evaluated to extract improved estimates of tropical cyclone intensity and storm structure. Forecast centers have operationally relied on intensity estimates derived from the Dvorak method (Dvorak, 1984) applied to visible and infrared imagery. This methodology has several shortcomings inherent with this type of imagery, such as when multiple cloud decks obscure the features required for accurate classification. Problems also arise when dealing with storms that rapidly change intensity, storms spun off of monsoon depressions, and midjet typhoons.

[Full Text](#)

[Analysis of Cloud-to-Ground Lightning in Hurricane Andrew](#)

May 1995

77 pages

Authors: [William R. George](#); [AIR FORCE INST OF TECH WRIGHT-PATTERSON AFB OH](#)

... United States has provided such an excellent opportunity to study the cloud-to-ground (CG) lightning associated with this type of storm. While numerous thunderstorm systems, particularly the severe storms of the Great Plains, have been studied for lightning characteristics, the ability to conduct similar studies on **hurricanes** has been limited due to the small number which have occurred since the relatively new National Lightning Detection Network has been operational. 17,036 CG strikes over a 77 hour period were attributed to either the eyewall region or the primary spiral rainbands of Andrew. ...

[Full Text](#)

[Tropical Cyclone Intensity Relationships](#)

Sep 10, 1995

97 pages

Authors: [Gary B. Kubat](#); [AIR FORCE INST OF TECH WRIGHT-PATTERSON AFB OH](#)

... and sea surface temperatures (SST) wherein intensity is characterized in terms of both minimum central sea level pressure (MSLP) and maximum tangential wind velocity (VTmax). SSTs are represented as monthly mean climatological values on a one degree(lat x lon) grid spacing. Observational data for **hurricanes** and typhoons are from the Gray and Shea (1976) data summary and from the U.S. Navy Typhoon Analysis (TYAN) data set. Gridded upper-air data from the Climate Analysis Center are used to describe climatological upper air features. A highly variable range of TC intensity values is ...

[Full Text](#)

[A Post-Hurricane Andrew Review of Trends in Department of Defense Disaster Relief Operations](#)

1996

38 pages

Authors: [Terry R. Youngbluth](#); [ARMY WAR COLL CARLISLE BARRACKS PA](#)

In a three week period in the early Fall of 1992, three **hurricanes** hit three different parts of the United States causing devastating damage and incredible misery. These storms became a watershed event for federal disaster relief operations. After-action reviews and Congressional hearings spurred the Department of Defense to alter the doctrine, plans, and procedures it used to provide disaster assistance in the United States. With these changes in hand, DoD has since tested its improved concepts on over two dozen occasions. This paper will first analyze the post-disaster after-action reviews ...

[Full Text](#)

[Computing and Communications in the Extreme: Research for Crisis Management and Other Applications](#)

1996

173 pages

Authors: [NATIONAL ACADEMY OF SCIENCES-NATIONAL RESEARCH COUNCIL WASHINGTON DC](#)

Crises are extreme events. They cause significant disruption and put lives and property at risk. Some crises arise from natural disasters such as earthquakes, **hurricanes**, fires and floods. Man-made crises can be accidental such as oil spills or the release of toxic substances, or they may be intentional, such as bombings by terrorists. Crises require an immediate response and a coordinated application of resources facilities, and efforts beyond those regularly available to handle routine problems. Crisis management was the primary application area examined in the Workshop Series on High ...

[Full Text](#)

[Coast of Delaware Hurricane Stage-Frequency Analysis](#)

Jan 1997

114 pages

Authors: [David J. Mark](#); [Norman W. Scheffner](#); [ARMY ENGINEER WATERWAYS EXPERIMENT STATION VICKSBURG MS](#)

This report describes the procedure and results of a hurricane stage frequency analysis for the open coast of Delaware. This analysis consisted of three interrelated tasks, each employing a numerical model. In the first task, historical **hurricanes** impacting the study area were analyzed to determine storm statistics and correlations. In the second task, storm surge events developed with the wind model output were simulated using a long-wave, finite element based hydrodynamic model to obtain peak storm surge elevations. With the hurricane parameters serving as input to the wind field model, ...

[Full Text](#)

[Enhancing the Strategic Roles of the National Guard: Domestic Support Operations](#)

Apr 7, 1997

39 pages

Authors: [Isaac D. Pickering](#); [ARMY WAR COLL CARLISLE BARRACKS PA](#)

The primary responsibility for responding to and recovering from disasters or other emergencies such as **hurricanes**, earthquakes, floods, wild fires, chemical spills nuclear accidents/incidents, prison riots or other forms of civil disturbance rests with the private sector and local/State authorities. They provide the first level of support during the response to any disaster or emergency. Included in the first line is the National Guard. In domestic support operations, the National Guard operating under the command of governors in a state (nonfederal) status assumes the primary responsibility ...

[Full Text](#)

[Domestic Support Operations: Military Roles, Missions, and Interface with Civilian Agencies](#)

Mar 26, 1997

36 pages

Authors: [Stanley W. Johnston Jr](#); [ARMY WAR COLL CARLISLE BARRACKS PA](#)

The United States Army, United States Army Reserve, National Guard of the various states, and Federal Departments and agencies are frequently called upon to mitigate the effects of civil emergencies: earthquakes, **hurricanes**, floods, tornadoes, range and forest fires, snow removal, and civil disturbances through cooperative

Full Text execution of Domestic Support Operations (DSO). This paper will examine and discuss the DSO planning process, notification procedures for an emergency requiring assistance from the military, execution of emergency operations, termination of assistance, and the primary ...

[The Performance of Low-Rise Open Span Heavy Steel Structures In Extreme Winds](#) Jun 1997 76 pages

Authors: [Joe R. Charlton](#); [TEXAS TECH UNIV LUBBOCK DEPT OF CIVIL ENGINEERING](#)

Full Text This report is an engineering study of the field performance of open span low-rise steel frame structures that have been subjected to extreme wind events such as **hurricanes** and tornadoes. The wind velocities in these events either approached or slightly exceeded the normal design values specified in ASCE 7-95. This report focuses specifically on the performance of heavy steel structures and does not include pre-engineered metal buildings. All types of building failures are observed and analyzed in this report, including roofing and secondary cladding component failures as well as main ...

[Civil Engineers Hone Search, Rescue Skills at Combat Town](#) Aug 27, 1998 4 pages

Authors: [Brent C. Powell](#); [MARINE CORPS WASHINGTON DC](#)

Full Text When disasters such as earthquakes, **hurricanes** or even a bombing devastate a city, someone has to sift through the rubble and look for survivors. A group of civil engineers recently journeyed here in order to prepare themselves to do just that. The System To Locate Survivors (STOLS) team which consist of 12 civil engineers from the Japan Engineer District (JED) from Camp Zama in mainland Japan, and three civil engineers from Honolulu, Hawaii, was formed approximately one-year ago. They came to Combat Town here to conduct three days of search and rescue operations to sharpen their skills ...

[Comparisons of Observations by WSR-88D and High Resolution Mobile Doppler Radar in Tornadoes and a Hurricane](#) 1998 122 pages

Authors: [Jennifer L. Winslow](#); [AIR FORCE INST OF TECH WRIGHT-PATTERSONAFB OH](#)

Full Text ... Hurricane Fran, the reflectivity features and velocity features were compared. Small scale features in the wind field, believed to be sub-kilometer scale boundary layer rolls were discovered. It has been suggested that these are responsible for some of the small scale intense damage found in the aftermaths of some **hurricanes**. These rolls were also visible in the KLTX data but were not as well defined. For the two tornado cases the strength (the difference between the maximum inbound velocity and the maximum outbound velocity) were examined. As expected the strength observed by the WSR-88D was ...

[Case Study: Structural Evaluation of Steel Truss Aircraft Hangars at Corpus Christi Army Depot, Texas](#) Feb 1999 723 pages

Authors: [Ghassan K. Al-Chaar](#); [Jason Ericksen](#); [Pramod Desai](#); [CONSTRUCTION ENGINEERING RESEARCH LAB \(ARMY\) CHAMPAIGN IL](#)

Full Text A number of steel truss aircraft hangars at Corpus Christ Army Depot (CCAD) are similar to those that have performed poorly during recent **hurricanes** in other parts of the country. Engineering analysis of such structures currently in use can identify structural vulnerabilities, and retrofit schemes may be developed to reduce or eliminate these vulnerabilities to severe wind loads. The objective of this work was to evaluate the structural adequacy of four steel truss aircraft hangars at CCAD by conducting structural analyses using the most recent building code guidelines. State-of-the-art ...

[A Semi-Spectral Numerical Method for Modeling the Vorticity Dynamics of the Near-Core Region of Hurricane-Like Vortices](#) 1999 68 pages

Authors: [Juan M. Hidalgo](#); [AIR FORCE INST OF TECH WRIGHT-PATTERSONAFB OH](#)

Full Text ... of the nearly circular flow of a strong hurricane, we hypothesize that SS formulations may prove useful in helping to elucidate the asymmetric vorticity dynamics in the hurricane's near-core region. This study examines the effectiveness of the semi-spectral approach for two classes of problems. The first problem concerns the redistribution of vorticity anomalies within a "master" vortex possessing a vorticity profile which decreases monotonically with radius. The second problem concerns barotropic instability, vortex breakdown, and vorticity mixing that is observed in mature **hurricanes**.

[On the Initialization and Simulation of a Landfalling Hurricane Using a Variational Bogus Data Assimilation Scheme](#) Sep 17, 1999 42 pages

Authors: [Qingnong Xiao](#); [Xiaolei Zou](#); [Bin Wang](#); [FLORIDA STATE UNIV TALLAHASSEE DEPT OF METEOROLOGY](#)

Full Text ... with the available observations, including the surface wind analysis and the radar reflectivity captured on-shore during Fran's landfall. The sensitivity study of the BDA scheme showed that the simulations of the hurricane track and intensity were sensitive to the size of the specified bogus vortex. **Hurricanes** with a larger radius of maximum sea-level pressure gradient are prone to a more westward propagation. The larger the radius, the weaker the predicted hurricane. Results of the hurricane initial structures and prediction were also sensitive to the bogus variables specified in the ...

[Los Angeles and Long Beach Harbors Model Enhancement Program: Long Waves and Harbor Resonance Analysis](#) Oct 1999 133 pages

Authors: [William C. Seabergh](#); [Leonette J. Thomas](#); [ARMY ENGINEER WATERWAYS EXPERIMENT STATION VICKSBURG MS ENGINEER RESEARCH AND DEVELOPMENT CENTER](#)

Full Text ... for reproduction in a physical model of the harbors. The analysis of prototype wave data indicated correlation between the long wave spectrum and the short wave spectrum. Information was examined to determine the effect of the source of the short period waves (Southern Hemisphere swell, **hurricanes**, or winter storms, typically from the west) on the nature of the long period component of the waves. Relationships between the

origin of the wave energy and long wave period were determined. Wave statistics were used to interpret effects of the energy level on the wave transformation into the ...

[Potential Vorticity Mixing in Hurricanes: Comparison of Nondivergent and Divergent Barotropic Vortices](#)

Jan 1999 3 pages

Authors: [Scott R. Fulton](#); [Wayne H. Schubert](#); [Michael T. Montgomery](#); [CLARKSON UNIV POTSDAM NY DEPT OF MATHEMATICS AND COMPUTER SCIENCE](#)

Full Text

This paper concentrates on the minimum enstrophy vortex (MinEV) problem, generalizing previous results for the unforced nondivergent barotropic model and extending the analysis to the divergent barotropic (shallow water) model.

[Hurricane Inner-Core Structure as Revealed by GPS Dropwindsondes](#)

Jun 21, 2000 62 pages

Authors: [Robert N. Leejoe](#); [AIR FORCE INST OF TECH WRIGHT-PATTERSON AFB OH](#)

Full Text

... inner-core is now available from aircraft released Global Positioning System (GPS) dropwindsondes. This is a great technical advancement because now it is possible to sample the inner-core structure of tropical storms in detail. This study presents insights concerning the structure of mature **hurricanes** from dropwindsonde data obtained during the 1997 and 1998 hurricane seasons. Storm center fixes enable the inner-core calculation of radial and tangential winds. It will be shown that the radial inflow around the eye-wall cloud is approximately twice as large as that determined from ...

[Rhode Island Hurricane Evacuation Study Technical Data Report](#)

May 1995 180 pages

Authors: [CORPS OF ENGINEERS WALTHAM MA NEW ENGLAND DIV](#)

Full Text

... the Rhode Island Emergency Management Agency and Rhode Island coastal communities with realistic data quantifying the major factors involved in hurricane evacuation decision-making. To accomplish this, the study provides information on the extent and severity of potential flooding from **hurricanes**, the associated vulnerable population, capacities of existing public shelters and estimated sheltering requirements, and evacuation roadway clearance times. The report also provides guidance on how this information can be used with National Hurricane Center advisories for hurricane evacuation ...

[Structural Evaluation of Aircraft Hangar 46, Corpus Christi Army Depot](#)

Feb 2001 59 pages

Authors: [Ghassan K. Al-Chaar](#); [Daniel J. Randolph](#); [Gregory E. Lamb](#); [Pramod J. Desai](#); [ENGINEER RESEARCH AND DEVELOPMENT CENTER CHAMPAIGN IL CONSTRUCTION ENGINEERING RESEARCH LAB](#)

Full Text

A number of steel truss aircraft hangars at Corpus Christi Army Depot (CCAD) are similar to those that have performed poorly during recent **hurricanes** in other parts of the country. Engineering analysis of such structures currently in use can identify structural vulnerabilities, and retrofit methods may be developed to reduce or eliminate these vulnerabilities to severe wind loads. The objective of this work was to evaluate the structural adequacy of one steel truss aircraft hangar at CCAD by conducting structural analyses using the most recent building code guidelines. The current condition of ...

[Foreign Assistance: Implementing Disaster Recovery Assistance in Latin America](#)

Mar 21, 2001 22 pages

Authors: [GENERAL ACCOUNTING OFFICE WASHINGTON DC](#)

Full Text

I am pleased to be here today to discuss our work on the U.S. governments disaster recovery and reconstruction program for hurricane-affected countries. In the fall of 1998, **Hurricanes** Mitch and Georges struck Central America and the Caribbean. The storms left thousands dead and many more homeless; damages were estimated at more than \$10 billion. The international donor community pledged \$9 billion to assist in the recovery and reconstruction of Mitch-affected countries in Central America. In May 1999, the Congress passed emergency supplemental legislation that, among other things, provided \$...

[Population Viability of Avian Endangered Species: the PVAves Program](#)

Mar 2001 41 pages

Authors: [Robert H. Melton](#); [Leslie A. Jette](#); [Timothy J. Hayden](#); [Timothy A. Beaty](#); [ENGINEER RESEARCH AND DEVELOPMENT CENTER CHAMPAIGN IL CONSTRUCTION ENGINEERING RESEARCH LAB](#)

Full Text

... Fort Stewart, GA. The results showed that extinction risks were significantly underestimated, and prospects for achievement of long-term population goals were significantly overestimated, if hurricane catastrophes were not included in the population viability model. This suggests that the effects of **hurricanes** should not be ignored in future population viability analysis of coastal RCW populations. Some potential uses of PVAves include estimating population viability effects of: (1) ecological catastrophes, (2) long-term (chronic) ecological disturbance of survival and/or reproduction rates, ...

[Gulf of Mexico Helicopter Offshore System Technologies Engineering Needs Assessment](#)

May 1999 33 pages

Authors: [Edmund J. Koenke](#); [Elisabeth J. Carpenter](#); [Larry Williams](#); [Caesar Caiafa](#); [SYSTEM RESOURCES CORP EDGEWOOD MD](#)

Full Text

... and promote the needs of all user classes. The Gulf of Mexico (GoMex) airspace has unique needs. A large number of helicopters operate in this area with only limited surveillance and sometimes-severe environmental conditions. Thunderstorms are the most frequent weather hazard during the spring, summer, and fall. In winter, reduced hours of daylight, low ceilings, strong winds, and icing conditions may restrict operations. **Hurricanes** impose the most severe weather hazard. The hurricane season, from June through October, normally requires at least one mass evacuation of all offshore platforms.

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