

65TH INTERDEPARTMENTAL HURRICANE CONFERENCE SUMMARY REPORT

This document provides a summary of the 65th Interdepartmental Hurricane Conference (IHC), a conference that was sponsored and chaired by Mr. Samuel P. Williamson, Federal Coordinator for Meteorology, from February 28-March 3, 2011, in Miami, Florida. The summary report consists of Sections I-III as follows:

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I. OVERVIEW

Purpose and Theme:

The Office of the Federal Coordinator for Meteorological Services and Supporting Research (OFCM) annually hosts the IHC to educate attendees on the status and future plans of the Nation’s hurricane forecasting and warning program. Additionally, the IHC provides a forum for the responsible Federal agencies, together with representatives of the user communities such as emergency management, to review the Nation’s hurricane forecasting and warning program and to make recommendations on how to improve the program in the future.

During the IHC, the OFCM-sponsored Working Group for Hurricane and Winter Storms Operations and Research (WG/HWSOR) reviewed and submitted action items regarding the hurricane program, including recommended changes to the National Hurricane Operations Plan (NHOP). New approved procedures and agreements which are directly related to the provision of tropical cyclone (TC) forecasting and warning services are then documented for implementation in the NHOP, which is published annually prior to the upcoming hurricane season.

The theme of this year’s conference was *Ocean and Atmospheric Influences on Tropical Cyclone*

Predictions: Challenges and Recent Progress. With strong partnerships built over many years, the conference was attended by 226 personnel—the 12th consecutive year of more than 200—including representatives from eight federal agencies: DOC (NOAA), DOD (Navy, Air Force, and Army COE), NASA, NSF, DHS (FEMA), DOT (FAA), DOI (BOEMRE, USGS), and USDA. Attendees also included representatives from academia, industry, and the emergency management community. All of the presentations that were given at the 65th IHC can be found at: http://www.ofcm.gov/ihc11/linking_file_ihc11.htm.

Objectives:

The Opening Session and 12 other sessions that were held during the conference (see Section II below) were structured to address the following conference objectives:

1. Review the Nation's tropical cyclone forecasting and warning program
 - a. Address actions from previous IHCs
 - b. Update the National Hurricane Operations Plan for 2011
2. Review comparison of 2008 and 2010 snapshots of tropical cyclone R&D activities, including their contributions toward forecasting and warning centers' operational priorities
3. Review Joint Hurricane Testbed (JHT) projects and recognize candidates that may be successfully transitioned into operations
4. Build upon tropical cyclone partnerships, leveraging agency capabilities to meet the operational needs of the tropical cyclone forecasting and warning centers

Key Takeaways:

1. Regarding Objective #2, the co-chairs of the OFCM-sponsored Working Group for TC Research (WG/TCR) summarized their analysis of the comparisons of 2008 and 2010 TC R & D in Session 1 of the conference. The major points of Session 1 are summarized below:
 - With HFIP and four major field experiments, R&D increased markedly in 2010 snapshot compared to 2008 snapshot
 - Intensity change remains the #1 operational priority
 - Research (basic and applied) is still required, as this is a very difficult and complex problem
 - Users would like research community to take more of an interest in guidance decision tools
 - We have a process to:
 - Keep the operational priorities updated
 - Assess and evaluate how research is contributing to those priorities
 - Allow research managers to make informed decisions for future investments
 - Facilitate interagency collaboration and cooperation
2. Regarding Objective #3, a takeaway from the JHT presentations is the JHT retains its niche of facilitating the transfer of promising research into tropical cyclone forecast operations within a period of about 2 years. With 35.5 projects successfully transitioned to operations since 2001, the JHT and its associated partners are helping to pave the way for improved tropical cyclone services.
3. Regarding Objective #4, a takeaway from the panel conducted during the Opening Session, *Advances in Tropical Cyclone Predictions: A Senior Leader's Perspective*, was

the senior leaders from NOAA, NASA, Navy, and Air Force reiterated the importance of partnerships to address the complex research challenges associated with further improving TC forecasting and warning capabilities. The key Federal agency leaders involved in TC research and operations emphasized their commitment to collaboration and interagency cooperation.

The importance of partnerships and the strong bonds that have been cultivated amongst the Federal agencies and academia cannot be over emphasized. The 65th IHC was a showcase for these partnerships, as the tropical cyclone community works together to solve the complex science issues, helping to provide an ever-increasing level of service to the people of our nation as we seek to minimize the impact of future landfalling hurricanes.

II. CONFERENCE SYNOPSIS

Sessions Conducted:

In addition to the Opening Session on Monday afternoon, the Poster Session on Monday evening, and the Plenary Session on Thursday morning, there was 12 sessions conducted at the 65th IHC:

Session #	Title
1	Comparisons of the 2008 and 2010 Snapshots of the Tropical cyclone R & D
2	The 2010 Tropical Cyclone Season in Review
3	Observations and Observing Strategies for Tropical Cyclones and their Environment, Part 1
4	Observations and Observing Strategies for Tropical Cyclones and their Environment, Part 2
5	Tropical Cyclone Model Development and Technology Transfer, Part 1
6	Tropical Cyclone Model Development and Technology Transfer, Part 2
7	Tropical Cyclone Model Development and Technology Transfer, Part 3
8	2010 Joint Hurricane and Field Experiments: PREDICT, GRIP, and IFEX (PGI)
9	ITOP/TCS10: Coupled Air-Sea Observations and TC Predictions
10	Other Research to Improve the Prediction of Tropical Cyclone Intensity and Structure, Track, Precipitation, Coastal and Inland Inundation, Part 1
11	Other Research to Improve the Prediction of Tropical Cyclone Intensity and Structure, Track, Precipitation, Coastal and Inland Inundation, Part 2
12	Joint Hurricane Testbed Project Updates and Improved Products

Abstracts for each session were provided in the conference program. Presentations slides are available on the OFCM web site.

Media Coverage:

The 65th IHC received television, radio, and print media coverage, including multiple interviews of NWS Director Jack Hayes, NHC Director Bill Read, and Dr. Kerry Emanuel from the Massachusetts Institute of Technology who moderated the senior leader panel. The information was centered on preparedness for the upcoming hurricane season, the purpose of the IHC, and relevant research. The Weather Channel, WLRN-FM, WGCU-FM, the *Sun-Sentinel*, *Miami Herald*, and the Associated Press Miami Bureau provided coverage.

Key Events: Key events that took place during the 65th IHC were:

- 1. Working Group for Hurricane and Winter Storms Operations and Research (WG/HWSOR):** The WG/HWSOR met on Monday morning, February 28, 2011. The WG/HWSOR addressed 29 action items. Of those, 17 were closed through incorporating

changes into the 2011 NHOP and 9 items were informational. The remaining three items (plus two actions from previous IHCs) will be worked through follow-on actions by the group. Detailed descriptions of the action items are available on the OFCM's web site at <http://www.ofcm.gov/ihc11/action-items.pdf>.

2. Conference Opening Remarks and Plenary Opening Remarks:

- The Honorable Carlos Alvarez Mayor, Miami-Dade County, Florida, was unable to attend; Representing Mayor Alvarez was Alina Hudak, Assistant County Manager. She welcomed conference attendees and described Miami's vulnerability to hurricanes. She cited the challenge of tropical hazards to the 2.5 million residents and noted that communications are complicated because of the 50 languages spoken by various parts of the population. Their good relationship with the NHC leads to better decisions as the risk of hurricanes increases.
- A special opening session presentation was given by Mr. Dan Rather, Anchor and Managing Editor of HDNet's Dan Rather Reports and former CBS Evening News Anchor via taped media. Mr. Rather, a pioneer in the broadcast field for on-scene coverage of hurricane events, drew attention—from his very personal perspective—to getting the right message to the American people and key decision makers in the face of a hurricane threat. His presentation was the highlight of the opening session and certainly helped set the stage for the rest of the week's activities.
- Major Phillip May, FEMA Region IV Administrator, represented Mr. Craig Fugate, the FEMA Administrator. He provided opening comments regarding the importance of hurricane warnings and advisories to emergency managers. He emphasized the need for the whole community to be involved. Everyone needs to be part of the emergency management team when a disaster threatens a community. We need to consider the worst case scenarios (max of max) situations in order to provide rapid and effective response.

3. Senior Leader Panel: *Advances in Tropical Cyclone Predictions: A Senior Leader Perspective*. During the opening session on Monday afternoon, a panel of senior agency representatives provided senior leader perspectives on tropical cyclone predictions partnerships and its importance in meeting operational needs. The moderator and participants are indicated below.

Moderator:

Dr. Kerry A. Emanuel Director, Program in Atmospheres, Oceans, and Climate, and Professor of Atmospheric Science, MIT

Panelists:

Dr. John "Jack" Hayes, Assistant Administrator for Weather Services, NOAA

Colonel John Egentowich, Air Force Deputy Director of Weather

Captain Michael Angove, Commanding Officer, U.S. Naval Maritime Forecast Center/Joint Typhoon Warning Center

Dr. Jack Hayes (NWS)

Dr. Hayes stressed the progress we've made and NWS's continuing commitment to improve our forecasts for hurricanes. The current 96 hour average hurricane track forecast error (100 miles) is less than half of what it was in 1970 (250 miles).

When we compare the nation's response to Hurricane Earl last year with Hurricane Floyd

in 1999, the benefits of our work for the American people becomes clear. For Floyd, hurricane warnings were issued for 1,500 miles of coastal area, and mass evacuations overwhelmed highways from Florida to Virginia. The much more precise forecasts for Earl limited warnings to 450 miles of coastline, and evacuations were limited to portions of just one state. Mike Smith, a private weather industry executive, called it the "\$700 million hurricane forecast" because our accurate forecasts reduced the potential economic losses that a wider evacuation would have caused.

While we enhanced the economy, we were also protecting lives. Our hurricane work is giving coastal residents, businesses, and emergency managers 2 more days to prepare.

As good as our results are, we must continue to improve the accuracy of our forecasts and warnings because the nation's vulnerability continues to grow. Half of the U.S. population lives along coasts, increasing the impact of coastal storms. Population density in coastal cities complicates preparation and response, posing significant dangers to public safety and the economy.

As we work to benefit Americans, we are mindful that these are tough budgetary times. In order to address these challenges, NWS is developing cost-effective strategies that will deliver results. We can reach our goals through continuing improvements in observations, models, and forecasts; enhanced support for decision makers; and improved training for forecasters. The key to success is to continue to build partnerships between the operations and research communities. We also need to incorporate probabilistic information, better quantify uncertainty, and capitalize on all available means of communications to disseminate hurricane forecasts and warnings. Our new strategic plan, *Building a Weather-Ready Nation*, sets ambitious but attainable goals, and our Services Roadmap will guide us to making these goals a reality.

The NWS is committed to meeting the Nation's needs by applying scientific knowledge to the crucial decisions that Americans make every day.

Colonel John Egentowich

Col Egentowich focused on the challenges and strengths of tropical cyclone operational support, strengths for the future and community teamwork. He commended the collaborative efforts of the many partners involved in wide spectrum of tropical cyclone operations and research. The success of these partnerships has led to more operating space for forces because of better forecasts. Significant gains have been made in track forecasting over the past 35+years but improved intensity forecasting remains a challenge. Our top priority remains improved intensity/structure forecasts. More and better data from satellites, reconnaissance, and other technologies will provide the basis for continuing research. Collaborative work on models also promises payoffs in our operations worldwide. We must continue to work *JOINTLY* to improve analysis and forecast capability. We need significant improvement to intensity forecasts by 2015!!

Captain Michael Angove

CAPT Angove was unable to attend this session, so the presentation was given by CAPT William Nisley, C.O., Fleet Weather Center, Norfolk.

The PACOM goal is to increase US/Coalition Sea Maneuver Space. The Navy has a four-tiered strategy (environment, modeling, performance, and decision layer) to address this goal. The Navy is heavily dependent/leveraged upon partnerships for satellite based observational data. Track continues to be a top priority and the Navy views improvements to global modeling capability as the best means to improve track forecasts. Improvements in structure and intensity forecasts are dependent on first improving track forecasts and research is needed to achieve these improvements.. Forecasting tools and decision tools also need improvement. Quantifying uncertainty reduces uncertainty. Across the strategy tiers partnerships are the key to success.

4. Session: *Comparisons of the 2008 and 2010 Snapshots of Tropical Cyclone R & D:*
Session Leader:

Dr. Haiyan Jiang, Department of Earth & Environment, Florida International University

Panelists:

Dr. Frank Marks, Co-Chair, Working Group for Tropical Cyclone Research and Director, Hurricane Research Division, NOAA AOML/HRD

Dr. Ronald Ferek, Co-Chair, Working Group for Tropical Cyclone Research and Program Officer, Marine Meteorology Program (ONR)

- Dr. Marks reviewed the history, objectives and tasks of the OFCM-sponsored WG/TCR. The primary objectives are to keep the listings of operational priorities and research needs current, analyze and compare agency meteorological research in meeting the priorities and to provide a status report at the IHC.
- Dr. Ferek then compared the snapshot of 2008 R & D activities with 2010. Highlights of the comparison included:
 - With HFIP and four major field experiments, R&D increased markedly in 2010 snapshot compared to 2008 snapshot
 - Intensity change remains the #1 operational priority
 - Research (basic and applied) is still required, as this is a very difficult and complex problem
 - Users would like the research community to take more of an interest in guidance decision tools
 - We have a process to:
 - Keep the operational priorities updated
 - Assess and evaluate how research is contributing to those priorities
 - Allow research managers to make informed decisions for future investments
 - Facilitate interagency collaboration and cooperation
 - Next snapshot will be conducted in 2012

5. Sessions 8 and 9: 2010 Joint Hurricane Field Experiments: PREDICT, GRIP, and IFEX (PGI); ITOP/TCS-10: Coupled Air-Sea Observations and TC Predictions:
Sessions 8 and 9 were organized to highlight the unprecedented field experiments that took place on 2010:

- NSF-sponsored Pre-Depression Investigation of Cloud-systems in the Tropics (PREDICT)

- NASA-sponsored Genesis and Rapid Intensification Processes (GRIP)
- NOAA-sponsored Intensity Forecast Experiment (IFEX)
- Navy-sponsored Impact of Typhoons on the Ocean in the Pacific (ITOP)/Tropical Cyclone Structure (TCS)-10

Session 8 was mainly planned by Mr. Chris Velden (CIMSS/UW), while Session 9 was mainly planned by Dr. Shuyi Chen (RSMAS/UM) and Dr. Peter Black (NRL/SAIC). The multiagency efforts regarding the unprecedented 2010 field experiments were truly remarkable. If you have additional interest regarding the experiments, including additional background information, science goals, and initial findings, we invite you to review the outstanding presentations, which have been linked in the right column of the tables for Session 8 and 9 below. We want to thank the planners, moderators and participants of both sessions!

Session 8: 2010 Joint Hurricane Field Experiments: PREDICT, GRIP, and IFEX (PGI)

Session Moderator Dr. Chris Landsea (NCEP/NHC)		presentation
PGI: Program Overview and Goals		
NASA-sponsored GRIP	Dr. Ramesh K. Kakar, Weather Focus Area Leader for the NASA/Science Mission Directorate (as Dr. Kakar was unable to attend, the presentation was given by Dr. Scott Braun)	presentation
NSF-sponsored PREDICT	Dr. Michael C. Morgan, Director, Division of Atmospheric and Geospace Sciences (NSF)	presentation
NOAA-sponsored IFEX	Dr. Frank Marks, Director, Hurricane Research Division, NOAA/AOML	presentation
PGI Field Observations and Preliminary Findings		
NASA-sponsored GRIP	Dr. Edward Zipser, Professor, Atmospheric Sciences, University of Utah	presentation
NSF-sponsored PREDICT	Dr. Michael Montgomery, Professor, Department of Meteorology, Naval Postgraduate School	presentation
NOAA-sponsored IFEX	Dr. Robert Rogers (NOAA/AOML/HRD)	presentation
PGI Panel		
Audience Question and Answer		

Session 9: ITOP/TCS-10: Coupled Air-Sea Observations and TC Predictions

Session Leaders Dr. Ronald Ferek (ONR) and Mr. Robert Falvey (JTWC)		
Program Overview of ITOP/TCS10	Linwood Vincent (ONR)	presentation
Overview of the Impact of Typhoons on the Pacific (ITOP)	Eric A. D'Asaro (U. of Washington)	presentation
Multi-Scale Observations of Cloud Clusters and Tropical Cyclones in ITOP/TCS10	Shuyi S. Chen (RSMAS/UM), B. Kerns, E. Ryan, and C. Lee	presentation
The Challenge of Measuring the Atmosphere-Ocean Interface in Tropical Cyclones: Observations from Air-Deployed Drifters	Jan Morzel (Rosetta Consulting), L. Centurioni, and P.P Niiler	presentation
Pre-Genesis Monitoring of the 3-D Atmospheric and Oceanic Environment Via High Altitude Aircraft Observations	Jeff Hawkins (NRL), P. Black, P. Harr, and R. Elsberry	presentation
Ocean Observations in Developing and Mature TCs Based on a New Airborne Observing Strategy: 'Combo' Deployments of AXBTs and GPS Dropsondes from Long-Endurance, Multi-Altitude Reconnaissance Flights	Peter G. Black (NRL/SAIC) and J. D. Hawkins	presentation
An Overview of COAMPS-TC Forecasts and Targeting for ITOP	Sue Chen (NRL), J. Doyle, R. Hodur, H. Jin, J. Cummings, and J. Schmidt	presentation
Multi-Model Coupled Air-Sea Forecasts of Typhoons during ITOP	Brandon Kerns (RSMAS/UM), S. Chen, and C. Lee	presentation

6. Session 12: Joint Hurricane Testbed Project Updates and Improved Products:

As has been the custom for the last 9 years, the IHC provides a forum to update IHC participants on the progress of JHT projects. From 2001-2010, there have been 62 projects supported, with 51 projects completed and 11 in progress. Of the 51 projects completed, 35.5 have been accepted for operational implementation.

The 11 projects in progress, which are from the 5th round (FY09-11), were tested and evaluated during the 2010 hurricane season. Principle investigators for the 11 projects provided updates on the projects at the 65th IHC. Although Session 12 from the 65th IHC was mostly related to JHT projects, some of the JHT presentations were put in other sessions that fit their primary area of focus (e.g., modeling, observing). The table below provides a breakout of the primary areas of focus for the 11 projects.

Primary Area of Focus	# of Projects
Improvements to dynamical models (for track, intensity, and precipitation forecasts)	5
Statistical intensity forecast guidance	3
Enhancements to observed data, assimilation	1
Tropical cyclone structure/wind/wave distribution	1
Enhancements to operational environment	1
Total	11

Some examples of candidates being transitioned or nearly ready for transition include:

- Developments in 2010 in in-flight real-time reporting of the directional ocean wave spectra using Wide Swath Radar Altimeter (WSRA) from the NOAA WP-3D hurricane reconnaissance aircraft (PopStefaniaija and E. J. Walsh)
- Progress towards developing a coupled atmosphere-wave-ocean framework for research and operational hurricane models (Ginis et al.)
- ATCF requirements, intensity consensus and sea heights consistent with NHC forecasts (Sampson et al.)

The JHT retains its niche of facilitating the transfer of promising research into tropical cyclone forecast operations within a period of about 2 years. With 35.5 projects successfully transitioned to operations since 2001, the JHT and its associated partners are helping to pave the way for improved tropical cyclone services.

7. Invited Presentations:

- **Mr. X. William (Bill) Proenza**, Director, National Weather Service Southern Region: Mr. Proenza described a post-modernization service improvement of local/state tropical cyclone decision support services. He reviewed the progress made in local warning lead times over the past 20+ years, which has resulted in saving countless lives. He reviewed hurricane statistics for the Southern Region and stated that historically this regions sees 90% of all US hurricane landfalls and 97% of all US major hurricane landfalls (cat 3+). He stressed that the NOAA-sponsored Hurricane forecast Improvement Project (HFIP) is designed to improve the accuracy and reliability of hurricane forecasts. He then described some forthcoming radar network

improvements, which included dual polarization radar (1-3 years) and phased array Doppler (10 years). Finally, he highlighted some important products changes for the upcoming 2011 hurricane season that included hurricane local statement improvements and watch/warning terminology that improves consistency between the WFOs and NHC. The end result will be vital weather services delivered locally to partners and the public in the best possible manner.

- **Dr. Brenda Phillips**, Professor of Political Science, Fire and Emergency Management Program, Oklahoma State University: Dr. Phillips described the results of an OFCM-sponsored mini-workshop entitled, *FRAMING THE QUESTIONS – ADDRESSING THE NEEDS; Moving To Incorporate Social Science Results into Meteorological Operations/Services*. The key takeaways from the presentation were:
 - Social science-related work is evident in the delivery of meteorological services as the majority of the public remains safe during severe weather and technological hazard events.
 - Participants expressed a need to further use, disseminate and communicate meteorological information in ways that the public understands.
 - Risk communication, the development and dissemination of effective messages for the different sectors of the public, was consistently identified as the most important need for the agencies.
 - More effective mechanisms should be developed for learning about, accessing, and implementing the breadth of social science research and expertise that exist in academia, professional organizations, governmental agencies and non-governmental agencies.
 - Some possible ways forward include:
 - Develop a repository of ‘best practice’ warning messages and graphics, categorized by type of weather event, which is tailored to various sectors of the public.
 - Can especially aid in improving services to new and emerging hazards (e.g., space weather, technological hazards, transportation sector).
 - Of particular importance for populations that remain at higher risk.
 - Explore partnerships to address the weather needs of the traveling public.
 - Perform a prototype field study, led by an interdisciplinary team to document the flow of weather information, identify gaps in communication, how people understand weather information and actions taken.
 - Identify a regular and realistic means to engage agencies— with social scientists, emergency managers and others—on issues related on ways to safeguard the public.

8. 65th IHC Banquet and Richard Hagemeyer Award: The significant events that occurred during the banquet are described below:

- Banquet Address was given by Mr. Scott B. Gudes, Vice President, Legislative Affairs, Space Systems and Operations, Lockheed Martin Corporation. He related stories of his previous hurricane flight in a NOAA aircraft and other previous activities in the executive and legislative branches of government and the private sector. Additionally, he provided thought-provoking information regarding the federal budget process.

- For 2010, the Richard Hagemeyer Award—which is presented annually in honor of the longtime Director of the NWS Pacific Region and supporter of the IHC—was awarded to Dr. Peter Black, Naval Research Laboratory, Marine Meteorology Division and SAIC, Inc.
- A special award was also presented by the Navy’s Office of Naval Research to the 53rd Weather Reconnaissance Squadron for their outstanding contributions to the Navy-sponsored ITOP/TCS10 field experiment.

III. OUTCOMES

Conference Action Items: The 65th IHC action items were:

- By May 1, 2011, update the National Hurricane Operations Plan, reflecting changes accepted by the WG/HWSOR
- Utilize interagency coordination and collaboration through WG/TCR to continue to focus R&D on #1 operational priority—intensity change
 - Track is still important
- Continue to stress the importance of transitioning research to operations
- Facilitate and support availability of the data sets resulting from the four 2010 major field experiments
- Support and promote efforts underway to assimilate new and existing inner core TC observations into operational models to evaluate their impact on TC forecasting capabilities
- The WG/TCR will continue to:
 - Keep operational priorities up to date
 - Assess and evaluate how research is contributing to those priorities
 - Provide information to support decisions on future investments
- Coordinate and collaborate with NSF to explore using the Science, Engineering and Education for Sustainability (SEES) and Creating a More Disaster Resilient America (CaMRA) programs to advance TC research
- Integrating Social Sciences into Meteorological Operations and Services; possible ways forward include:
 - Explore partnerships to address the weather needs of the traveling public
 - Perform a prototype field study, led by an interdisciplinary team to document the flow of weather information, identify gaps in communication, how people understand weather information and actions taken
 - Identify a regular and realistic means to engage agencies—with social scientists, emergency managers and others—on issues related on ways to safeguard the public

Tentative Location for Next Year: The tentative location for the 2012 IHC (66th IHC) is Charleston, South Carolina.