

12.6 TRAINING ON TROPICAL CYCLONES FOR LATIN AMERICAN STUDENTS

Luis M. Farfán*

Centro de Investigación Científica y de Educación Superior de Ensenada, B.C., La Paz, Mexico

G.B. Raga

Universidad Nacional Autónoma de México, Mexico City, Mexico

1. INTRODUCTION

Tropical cyclones are well-organized circulation systems that develop over several regions of the globe. Their occurrence has the potential to affect the environment and populated regions in Central and North America (Fig. 1). In general, the approach of tropical cyclones brings changes in moisture content over relatively large areas, increased cloud cover and the potential to provide periods of heavy rainfall over mountainous terrain. Upon landfall, most of the arriving circulations are associated with strong winds, flooding and storm surges along the coastal areas.

In comparison to developed countries, in Latin America there is a lack of meteorology and climatology professionals with adequate knowledge on tropical cyclones. Therefore, major efforts are required to build capacity in these disciplines. As part of an international research project funded by the Inter-American Institute for Global Change Research (IAI), we designed a series of short courses based on the current understanding of tropical cyclones.

2. GOAL AND METHODOLOGY

Our goal is to train students from higher-education institutions in Mexico, the Caribbean, Central and South America, where capacity building is in the early stages. This, also, includes personnel from public agencies that require this type of technical knowledge. Courses last 4-5 days and have been offered during the last five years in Mexico: La Paz in 2008 and 2010, Acapulco in 2009 and Mexico City in 2012. The corresponding site locations are shown with circles, as part of Fig. 1.

Our approach includes a brief review of climatological features on tropical cyclone

formation and dissipation as well as advanced topics on thermodynamic and dynamical aspects of storm intensification. Additional topics include easterly waves and other tropical phenomena, air-sea interaction, oceanic response, long-term variability, climate predictions, and geology-related techniques (*paleotempestology*) to study coastal impacts upon landfall.

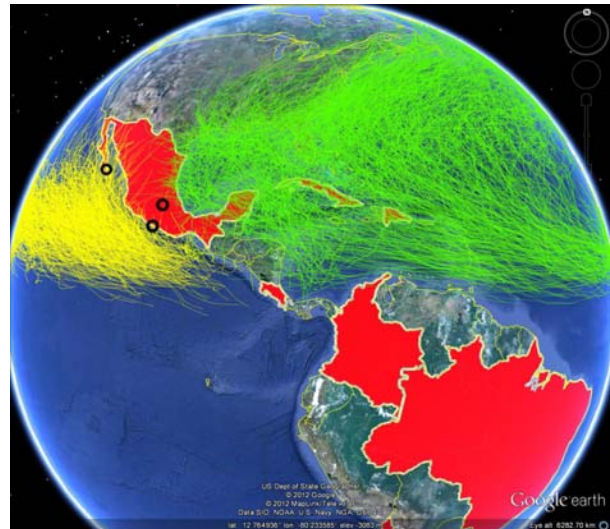


Figure 1. Tracks of tropical cyclones that developed in the eastern North Pacific (yellow) and Atlantic (green) basins. Data are from the period 1949-2010.

Additionally, practical sessions are offered to analyze recent case studies of approach and landfall over western Mexico. These sessions apply computer-based software that is available to display the best-track dataset from the United States National Hurricane Center, satellite data (GOES and TRMM) and gridded output from global- (GFS) and regional-scale (WRF) models for short-term predictions for analysis of circulation motion and changes in the structures.

*corresponding author address: Luis M. Farfán, CICESE, Unidad La Paz, La Paz, B.C.S., Mexico; e-mail: farfan@cicese.mx.

**3^{er} curso de primavera sobre
Ciclones Tropicales**
8-11 de marzo de 2010, La Paz, Baja California Sur

Objetivo:
Proveer a los estudiantes con conocimientos básicos de ciclogénesis tropical y familiarización con el manejo de observaciones y modelos de pronóstico y climáticos, aplicados a casos observados en el Pacífico Oriental.

El curso es auspiciado por el Centro de Ciencias de la Atmosfera (CCA-UNAM) y por el Inter-American Institute for Global Change Research (IAI).

Para mayor información y registro contactar a la Dra. Graciela Binimelis de Raga, CCA-UNAM, +52-55-5622-4248, graciela.raga@gmail.com, graciela@sauvignon.atmosfci.unam.mx

Dirigido a:
Estudiantes de posgrado y personal técnico trabajando en el tema.

Para ser considerado para las **becas** disponibles, enviar:
- breve descripción indicando interés en el tema y motivos para participar
- curriculum vitae
- carta de recomendación de tutor o supervisor

La solicitud deberá ser enviada **antes del 30 de diciembre por correo electrónico** a la Dra. Graciela Raga: graciela.raga@gmail.com.

Instructores :
Luis Farfan Molina, CICESE Unidad La Paz
Jorge Zavala Hidalgo, CCA-UNAM
Rosario Romero Centeno, CCA-UNAM
Fernando Oropeza CCA-UNAM
Juan Manuel Caballero (Semar, Mexico)
Eleonora Romero-Vadillo (UABCS)
Sergio Abarca, UCLA (USA)
Kam Biu Liu, Louisiana State University (USA)
Daniel Martínez, INSMET (CUBA)
Ida Mitrani, INSMET (CUBA)
David Raymond, New Mexico Tech (USA)
Graciela Raga, CCA-UNAM (Coordinadora General)

Fecha límite de inscripción **sin beca: 15 de febrero**

Figure 2. Announcement for the third training course held in La Paz.

3. COURSE SUMMARY

Between 2008 and 2010, we offered more than 75 hours of lectures on tropical cyclones for graduate and undergraduate students from Mexico, Costa Rica, Cuba, Dominican Republic, Colombia, Brazil, Chile and Argentina. These countries are indicated in Fig. 1. The majority of these students were from central Mexico.



Figure 3. Participants from the training courses in 2008, 2009 and 2010.

Course instructors are project investigators affiliated with academic and research institutions from Mexico (UNAM, IMTA, IPN, UABCS, and CICESE), the United States (New Mexico Institute of Mining and Technology, Louisiana State University, University of California at Los Angeles and Naval Postgraduate School), Cuba (Institute of Meteorology), and Costa Rica (University of Costa Rica).

In addition to the courses, we have convened symposia, to discuss social and economic issues associated with the landfall of tropical cyclones. Topics include coastal impacts and flooding, the link between cyclones and water resources, flow of weather and climate information from scientists to policy-makers, the role of emergency managers, and impacts on public health. Discussions included flow of information from scientists to society and the key role that scientists should play. Speakers on human dimensions represent educational institutions and public and private agencies, including emergency managers from regions with frequent storm activity throughout the Mexican coasts.

The 2010 course included a field trip to a coastal lagoon, located near La Paz. Sediment cores were taken and, later, they were analyzed for evidence of storm impacts during the last 5,000 years. This is part of another IAI-funded project, lead by Prof. Kam-biu Liu from Louisiana State University.



Figure 4. Louisiana State University personnel collecting core samples. March 10, 2010.

4. MEXICO CITY, March 26-30 2012

A 32-hour course was held at the Mexican Academy of Sciences, in Mexico City, focused on training personnel from the Mexican Meteorological Service. A total of 20 students participated, some of them with operational responsibilities. Other participants were from the Civil Defense, the Federal Communications and Transportations Agency and the Mexican Air Force. One session was dedicated to learn basic aspects of the Integrated Data Viewer, a multiplatform tool from the Unidata Program Center and used to display specific datasets from the landfalls affecting Mexico during the season of 2011: Jova in the state of Jalisco and Rina in the Yucatán Peninsula.

On 30 March, four speakers covered a variety of topics related to human dimensions and the afternoon session was devoted to a forum on **tropical cyclones and climate change**. The first speaker in the human-dimensions session was a leader of the development and implementation of an early warning system. This system is activated upon tropical cyclone approach and currently used by the National Center for Disaster Prevention (CENAPRED, its Spanish acronym). So far the system only considers the risk from strong winds over land and there is on-going work on incorporating the effect of heavy precipitation over land and the impact of storm surge.

Later, there was a presentation on historical and sociological research on the impact of landslides associated with a landfall event in 1959. This was a category-5 hurricane that affected Minatitlán, Colima, and was responsible for the death of hundreds of people. The presentation includes a video in which disaster survivors relived the infamous day and the slow recovery that followed afterwards. This case provided poignant evidence of how accurate and timely forecasts, in conjunction with evacuation strategies, can save lives. It is not often that technical training courses on meteorology offer this aspect that brings the human factor into play.

Two other speakers showed results from the historical reconstruction of tropical cyclones in Mexico's history since 1500. The aim, of the social anthropologists and historians involved, was to determine the strategies that different communities had developed over time to cope with a recurring natural phenomenon. Clear evidence

of the interactions among scientists working on social sciences and climatology was presented by the final speaker, showing results of a reconstruction of landfalling cyclones back to 1850. This appears to be modulated by the Pacific Decadal Oscillation, with some evidence of inter-annual variability, most likely linked to the El Niño phenomenon.

During the last session, five teams of students made brief presentations, discussing the results of papers that they read prior to the course. In all of our courses, the students chose several papers from a list of about 30. This is an assignment to develop skill in determining the relevant results, main uncertainties, strengths and weaknesses of the methodologies, etc. This time, it was clear that operational personnel need this type of exercise since, usually, they are not required as part of their tasks. This fact highlights the role that academia can play with respect to the operational activities in Mexico.



Figure 5. Participants from the training course in Mexico City, 2012.

5. FUTURE PLANS

Given the need to continue with the capacity building for Latin America on this topic, there are plans underway, sponsored jointly by IAI, Centro de Ciencias de la Atmósfera at UNAM and other institutions such as CICESE, to offer more courses on an annual basis. In particular, our plans include an upcoming course in March of 2013.

ACKNOWLEDGEMENTS

These courses were carried out with the aid of a grant from the Inter-American Institute for Global Change Research (IAI) CRNII #2048 which is supported by the U.S. National Science Foundation (Grant GEO-0452325). Additional support was provided by Servicio Meteorológico Nacional and UNAM.