Paper, Presentation, Short Abstract, & Extended Abstract: Overview of the Field Phase of the NASA Tropical Cloud Systems and Processes (TCSP) Experiment

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The Tropical Cloud Systems and Processes experiment is sponsored by the National Aeronautics and Space Administration (NASA) to investigate characteristics of tropical cyclone genesis, rapid intensification and rainfall using a three-pronged approach that emphasizes satellite information, suborbital observations and numerical model simulations. Research goals include demonstration and assessment of new technology, improvements to numerical model parameterizations, and advancements in data assimilation techniques.

The field phase of the experiment was based in Costa Rica during July 2005. A fully instrumented NASA ER-2 high altitude airplane was deployed with Doppler radar, passive microwave instrumentation, lightning and electric field sensors and an airborne simulator of visible and infrared satellite sensors. Other assets brought to TCSP were a low flying uninhabited aerial vehicle, and a surface-based radiosonde network. In partnership with the Intensity Forecasting Experiment of the National Oceanic and Atmospheric Administration (NOAA) Hurricane Research Division, two NOAA P-3 aircraft instrumented with radar, passive microwave, microphysical, and dropsonde instrumentation were also deployed to Costa Rica.

The field phase of TCSP was conducted in Costa Rica to take advantage of the geographically compact tropical cyclone genesis region of the Eastern Pacific Ocean near Central America. However, the unusual 2005 hurricane season provided numerous opportunities to sample tropical cyclone development and intensification in the Caribbean Sea and Gulf of Mexico as well. Development of Hurricane Dennis and Tropical Storm Gert were each investigated over several days in addition to Hurricane Emily as it was close to Saffir-Simpson Category 5 intensity. An overview of the characteristics of these storms along with the pre-genesis environment of Tropical Storm Eugene in the Eastern Pacific will be presented.

1A.1 OVERVIEW OF THE FIELD PHASE OF THE NASA TROPICAL CLOUD SYSTEMS AND PROCESSES (TCSP) EXPERIMENT

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1. INTRODUCTION

Although many who reside in the countries bordered by the Caribbean Sea and Gulf of Mexico can never be truly compensated for the heartbreaking losses they suffered during the highly active 2005 hurricane season, one glimmer of hope for the future is that the numerous tropical cyclones which occurred during this season were extensively studied during three Federally funded aircraft field experiments. The National Aeronautics and Space Administration (NASA), The National Oceanic and Atmospheric Administration (NOAA), and the National Science Foundation (NSF) each sponsored research experiments which used aircraft, satellite, oceanic sensors, and research models to collect an extensive body of information that will assist in improving the understanding and predictability of future tropical cyclones.

2. EXPERIMENT DESCRIPTION

The unusually early start of the 2005 Atlantic hurricane season was jointly captured by the NASA Tropical Cloud Systems and Processes (TCSP) Experiment and the initial phase of the NOAA Intensity Forecasting Experiment (IFEX) which were conducted in collaboration from a base in San Jose, Costa Rica during July 2005. The TCSP experiment was planned by NASA to investigate characteristics of tropical cyclone genesis, rapid intensification and rainfall using a three-pronged approach that emphasizes satellite information, suborbital observations and numerical model simulations. Research goals include demonstration and assessment of new technology, improvements to numerical model parameterizations, and advancements in data assimilation techniques. The goals of the NOAA IFEX are described in Rogers et al. 2006 of this conference.

The field phase of the experiment was based in Costa Rica during July 2005. A fully instrumented NASA ER-2 high altitude airplane was deployed with Doppler radar, passive microwave instrumentation, lightning and electric field sensors and an airborne simulator of visible and infrared satellite sensors. The sensor names and observations of the ER-2 instrument payload are depicted in Fig. 1. Other TCSP assets included near real-time satellite imagery and products, a low flying uninhabited aerial vehicle to sample the eastern Pacific boundary layer during both pre-genesis and inactive phases of TCSP, and a surface-based radiosonde network releasing six-hourly GPS radiosondes from Juan Santamaria International Airport to support

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scientific and aircraft operations. Costa Rican scientists and forecasters familiar with local weather also contributed to the TCSP weather forecasting and mission planning activities.

Costa Rica was chosen as a deployment site to take advantage of the geographically compact tropical cyclone genesis region of the Eastern Pacific Ocean near Central America. However, the unusual start to the Atlantic basin 2005 hurricane season provided numerous opportunities to sample tropical cyclone development and intensification in the Caribbean Sea and Gulf of Mexico as well. Development of Hurricane Dennis and Tropical Storm Gert were each investigated over several days in addition to Hurricane Emily as it intensified to nearly Saffir-Simpson Category 5 status. Overviews of the characteristics of these storms along with the pre-genesis environment of Tropical Storm Eugene in the Eastern Pacific are described in more detail in Halverson et al. 2006.

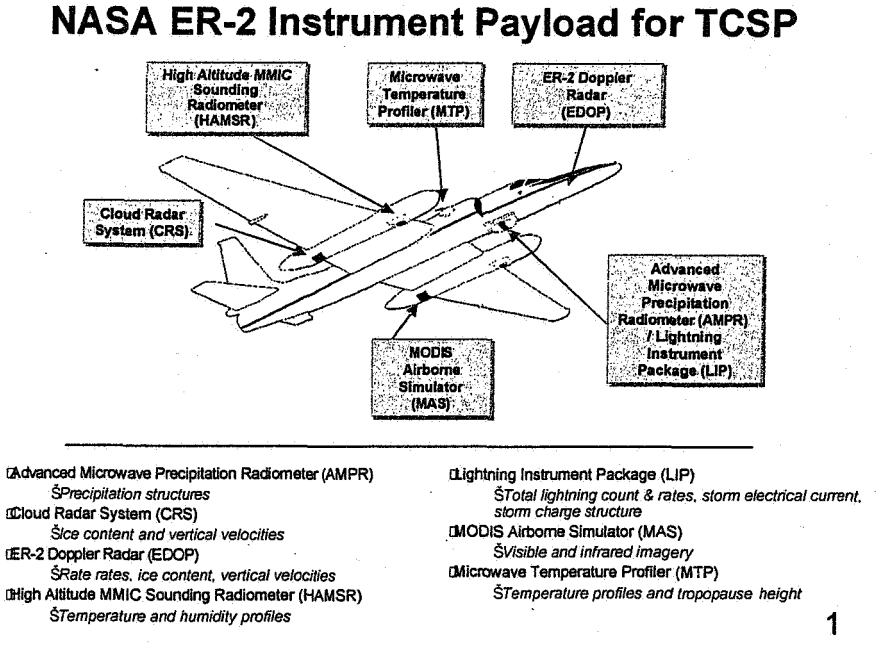

Figure 1. Scientific instrumentation flown on board the NASA ER-2 aircraft during TCSP.

3. CONCLUDING REMARKS

Detailed information about the TCSP campaign, daily mission summaries, satellite animations, flight tracks, instrument data and quicklook images of the data can be found by visiting the TCSP website at http://tcsp.nsstc.nasa.gov. This information has considerable merit for research pertaining to tropical cyclone life cycle and intensity changes. However, the true value of the July TCSP observations increase significantly when combined with NOAA IFEX information collected during July-November and the NSF Rainband and Intensity Experiment (RAINEX) observations collected during August-September to characterize the unique behavior of the unusually long and active 2005 hurricane season in the Atlantic Ocean, Caribbean Sea, and Gulf of Mexico.. The TCSP observations also increase the value of the tropical cyclone data collected during the previous NASA Convection and Moisture Experiments (CAMEX) of 1998 and 2001 (described in Kakar et al. 2006) which provided an unprecedented body of 3-dimensional information of tropical cyclone behavior, structure, and life cycle collected by

high altitude NASA aircraft and lower altitude NOAA aircraft. The comprehensive scope and diverse variety of the NASA, NOAA, and NSF tropical cyclone field data provides a very important opportunity for collaborative research across Federal agencies, academia, and private industry to improve the understanding and predictability of future tropical cyclones.

4. REFERENCES

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