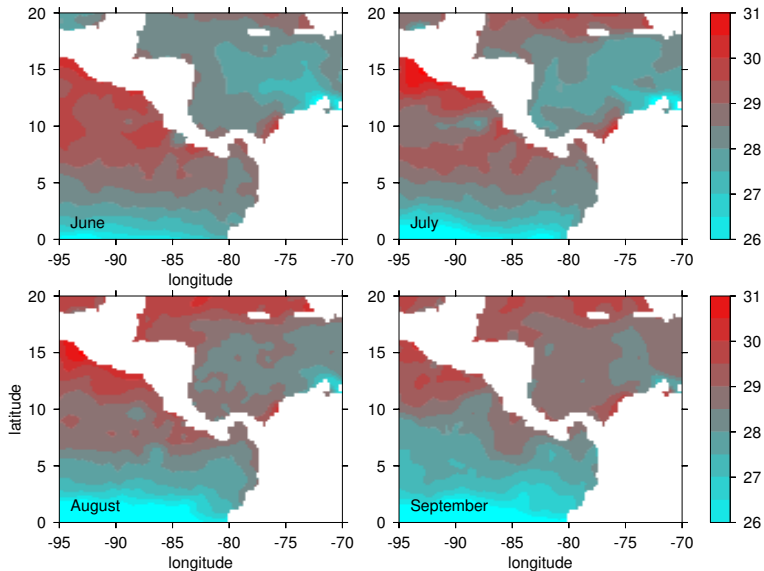# OTREC: Organization of Tropical East Pacific Convection
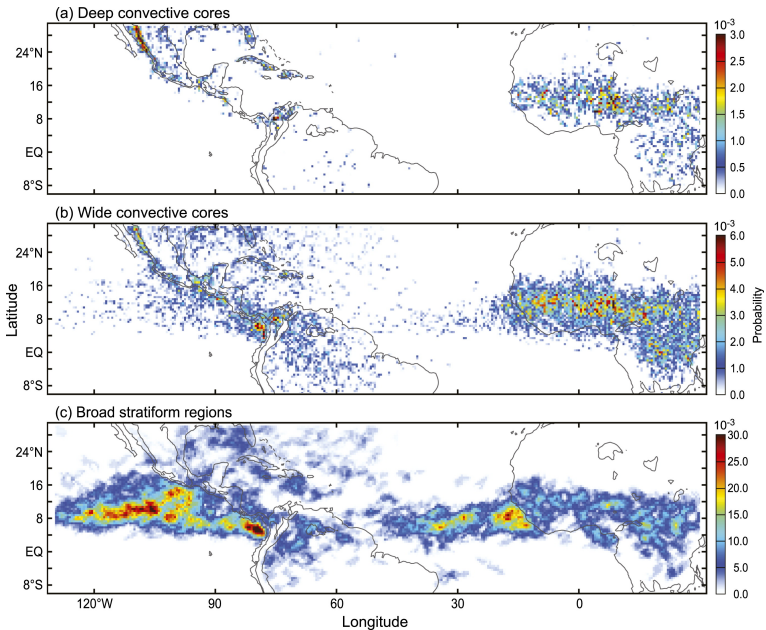
David J. Raymond and Željka Fuchs

Physics Department and Geophysical Research Center
New Mexico Tech
Socorro, NM, USA

Sea Surface Temperature, Summer 2014

JJA Precipitation (Zuluaga and Houze, 2015)

(a) Deep convective cores

(b) Wide convective cores

(c) Broad stratiform regions

Scientific Issue 1

- Strong disagreement exists in the East Pacific between vertical convective mass flux profiles inferred from TRMM Precipitation Radar algorithms and global analyses. Furthermore, the analyses themselves show substantial disagreement amongst themselves.

TRMM Mass Flux (Schumacher et al., 2004)

Mass flux profiles as a function of TRMM stratiform rain fraction (Schumacher et al., 2004).
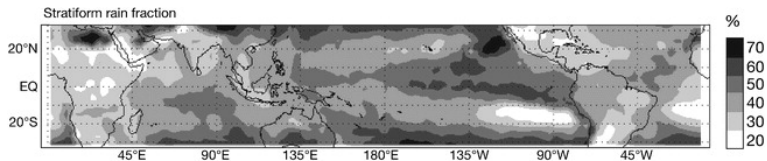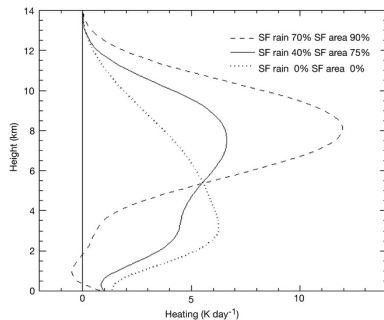
Global Analysis Mass Flux Profiles (Handlos and Back, 2014)
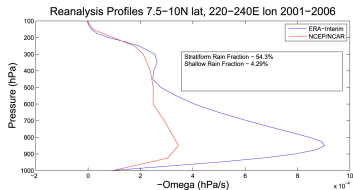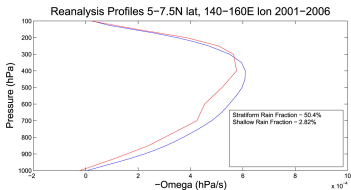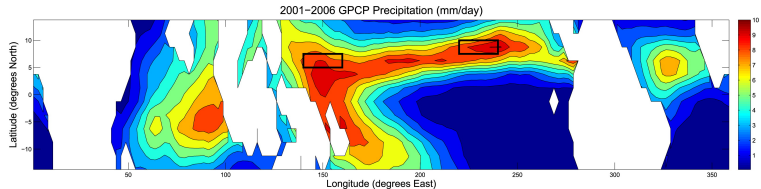
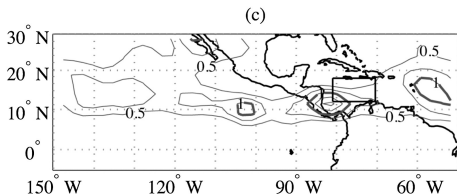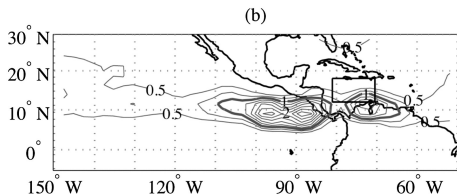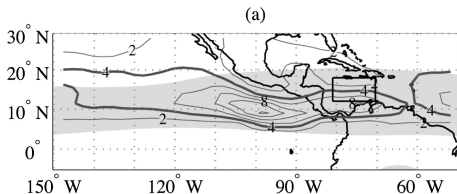# Scientific Issue 2

- The above uncertainties have major consequences for the effect of convection on tropical disturbances, among them tropical easterly waves, Kelvin waves, the MJO, and the ITCZ itself.

East Pacific Easterly Waves (Serra et al., 2010)

(a) Density of easterly wave tracks, 600-850 hPa.
(b) Density of track formation.
(c) Density of track dissolution.

Summary of OTREC Scientific Objectives

▶ Measure vertical mass flux profiles and other characteristics of East Pacific and SW Caribbean convection as a function of environmental conditions.

▶ Determine the radar signature of observed convection, especially convective initiation and broad stratiform regions, for comparison with satellite observations.

▶ Characterize the interaction of convection with ITCZ flows, the SW Caribbean jet, East Pacific easterly waves and by extension, with other balanced tropical disturbances.

OTREC Broader Impacts

- Provide ground truth for global analyses and satellite observations of convection in the East Pacific and SW Caribbean.
- Establish a scientific basis for better treatments of convection in global weather and climate models.
- Introduce early career investigators to airborne observational science.
- Nurture scientific relations with Latin America, in particular, with Costa Rica and Colombia.

The Tools

- NSF/NCAR Gulfstream V based in San José or Liberia, Costa Rica (Deployment Pool)
    - AVAPS dropsonde system
    - Hiaper Cloud Radar
- Soundings in Costa Rica and other locations
- COCONet and possibly other GPS met stations
- Colombian C-Band dual polarization Doppler radars
    - Bogotá
    - Cartagena
    - Isla San Andrés
    - Buenaventura (projected)
    - Medellín (city of Medellín)
- Rainwater collection for oxygen isotope ratios (Buenaventura, Medellín)

GV Operations – 8 weeks in Jun.-Sep. 2019
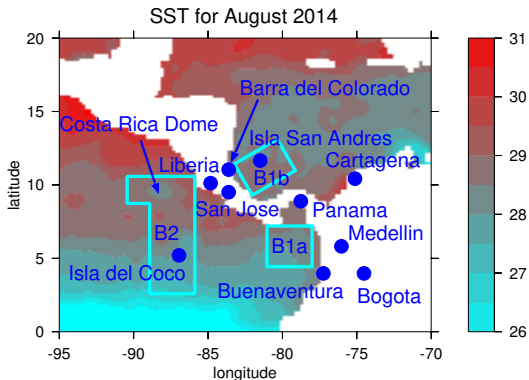
- 10 flights each in B1a/B1b (same flight) and B2, 8 hr each, 160 hr total
- 30 dropsondes per flight, 600 sondes total

US Team

- Larissa Back, University of Wisconsin
- Željka Fuchs, New Mexico Tech
- George Kiladis, NOAA/ESRL
- Zhiming Kuang, Harvard University
- Eric Maloney, Colorado State University
- David Raymond, New Mexico Tech
- Yolande Serra, University of Washington
- Sharon Sessions, New Mexico Tech
- Adam Sobel, Columbia University

International Collaborations

- David Adams, National Autonomous University of Mexico.
- Peter Bechtold, ECMWF.
- Walter Fernández, University of Costa Rica.
- Marcial Garbanzo, University of Costa Rica.
- Daniel Hernández, National University of Colombia, Bogotá.
- Graciela Raga, National Autonomous University of Mexico.
- Manuel Zuluaga, National University of Colombia, Medellín.

Possible Participation from Other Agencies

- NOAA/HRD may be interested in studying East Pacific tropical cyclogenesis with NOAA aircraft, which would benefit from the context provided by G-V operations.
- NASA??? Similar scientific interests, shorter time horizon.
- ONR???

Possible Applications of Results

- Provide better ground-truth on convection in the East Pacific ITCZ for the interpretation of satellite observations.
- NOAA/EMC is developing the next generation global forecast system. Convective parameterization may benefit from knowledge gained.
- Similar possibilities with ECMWF.