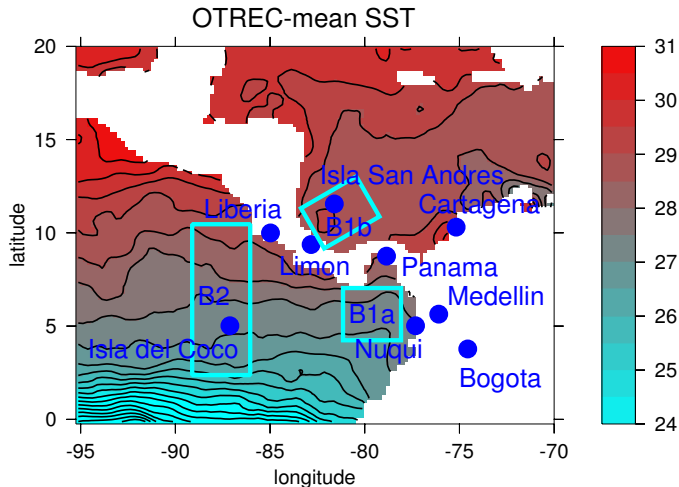# Convection and its Environment in OTREC and PREDICT[1]

David J. Raymond and Željka Fuchs
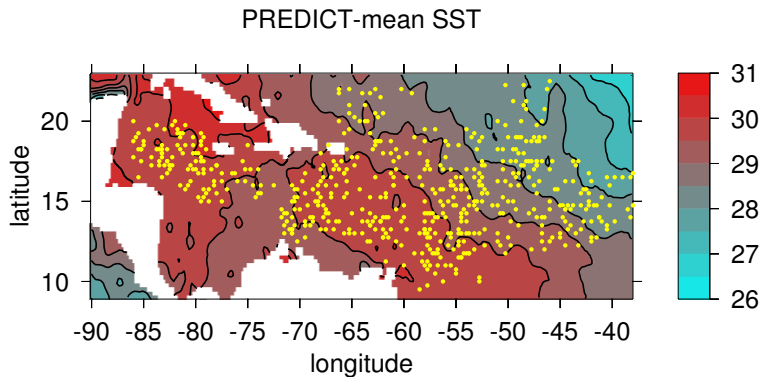
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Socorro, NM, USA

OTREC (Organization of Tropical East Pacific Convection
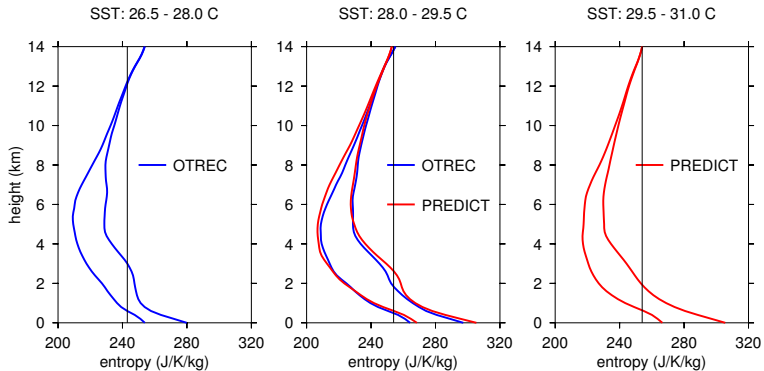

OTREC-mean SST

PREDICT (Pre-Depression Investigation of Cloud-Systems in the Tropics)

PREDICT-mean SST

3DVar analysis of dropsondes

- $0.25° \times 0.25°$ columns
- Pure data
- Composite columns over each field program
- OTREC: ≈ 8000 columns
- PREDICT: ≈ 11000 columns

Soundings sorted by SST

What predicts convection?

- ▶ Predicted quantities:
  - ▶ Vertically integrated moisture convergence
  - ▶ Vertically integrated moist entropy divergence
  - ▶ Vertical mass flux 3-5 km (MFLUXLO)
  - ▶ Vertical mass flux 7-9 km (MFLUXHI)
  - ▶ MFLUXDIF = MFLUXHI - MFLUXLO (top-heaviness)
- ▶ Predictors:
  - ▶ Saturation fraction (SF; column relative humidity)
  - ▶ Instability index (II; low-mid-trop moist conv instability)
  - ▶ Deep conv inhibition (DCIN; lift parcel from lowest km)
  - ▶ Surface heat and moisture fluxes?
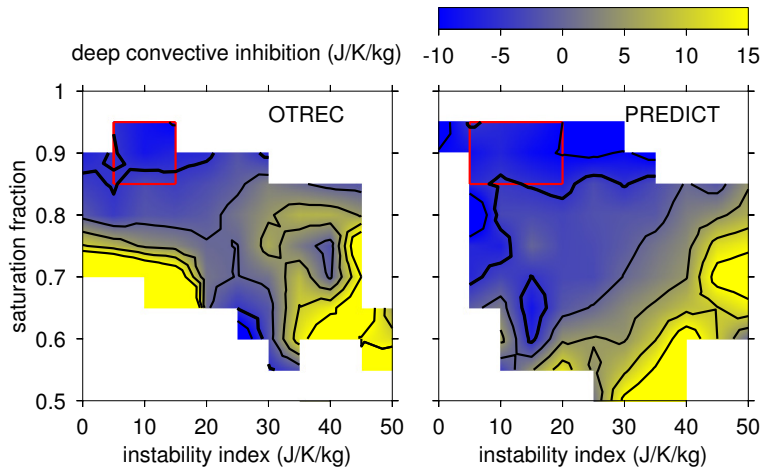 - ▶ SST

Distribution of SF and II values
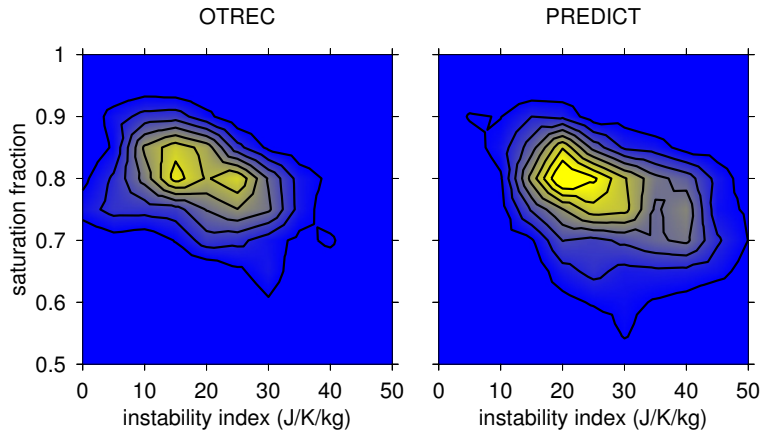
Demonstrates moisture quasi-equilibrium – II small where SF large and vice versa.
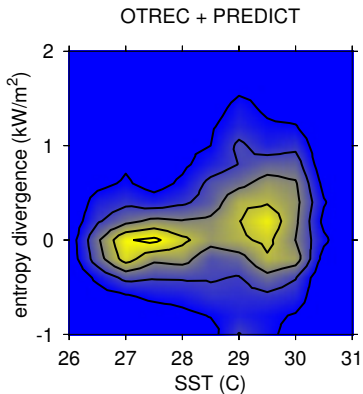
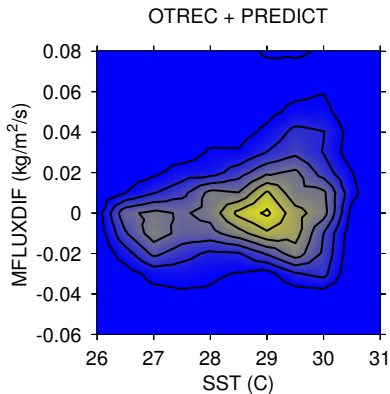# Where does it rain in this phase space?
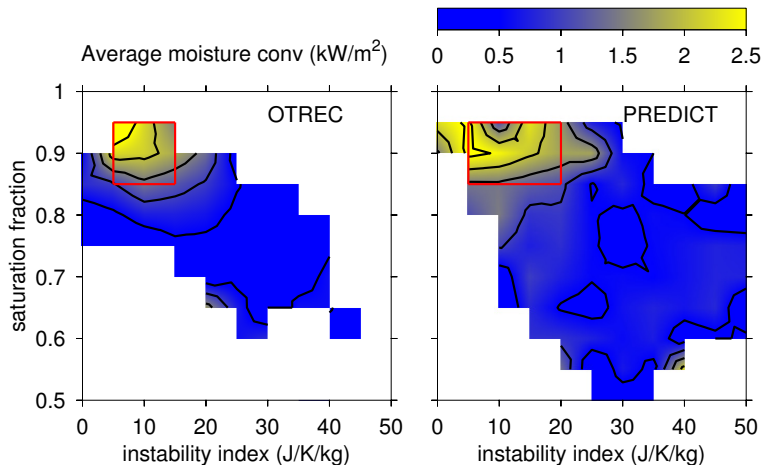
High saturation fraction and low instability index!

What about DCIN?

deep convective inhibition (J/K/kg)

What is the effect of SST on MFLUXDIF and entropy divergence?

Conclusions

- ▶ Moisture quasi-equilibrium holds for both OTREC and PREDICT.
- ▶ The strongest moisture convergence (and heaviest rain) occurs where SF is high and II and DCIN are low in both cases.
- ▶ DCIN is more important than II in OTREC.
- ▶ The reverse is true in PREDICT.
- ▶ *Local* surface heat and moisture fluxes are not correlated to moisture convergence or entropy divergence. (Broad area fluxes are a different story.)
- ▶ Top-heavy convective mass flux profiles and strong entropy export increase with SST.