

OTREC2019 (Organization of Tropical Eastern Pacific Convection)

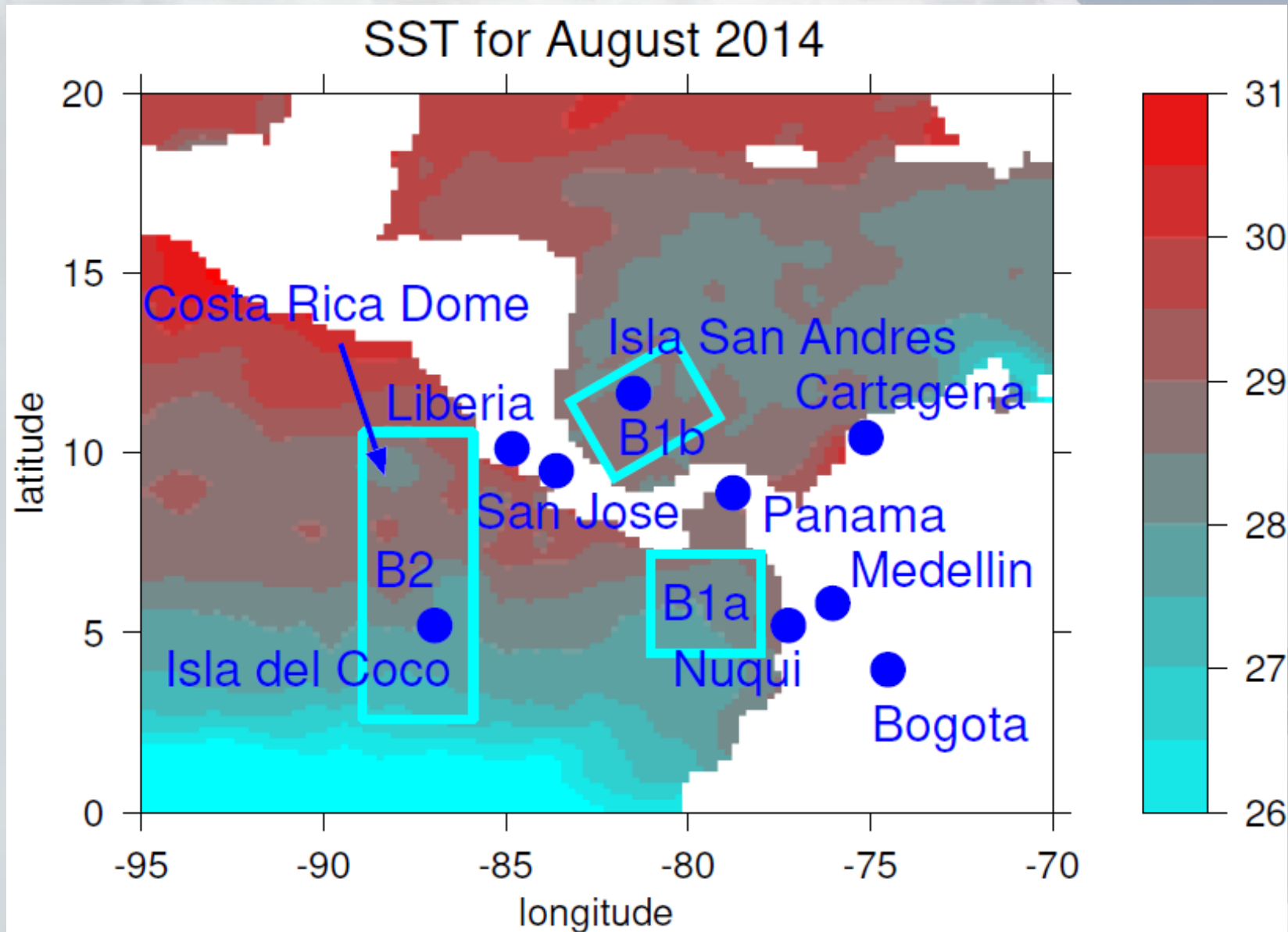
Zeljka Fuchs-Stone, David J. Raymond and Stipo Sentic

Physics Department and Climate and Water Consortium
New Mexico Tech



Supported by US National Science Foundation

Motivation behind OTREC



OTREC August 5 – October 3, 2019

NSF/NCAR Gulfstream V aircraft – 22 research flights (127 hours)

- 648 dropsondes (NCAR/EOL AVAPS)
- Hiaper cloud radar
- Cloud probe

Radiosondes: Santa Cruz and Limon (Costa Rica), Nuqui (Colombia)

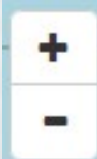
Weather and GPS PW network

Rainfall samples

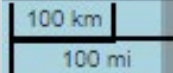


OTREC August 5 – October 3, 2019

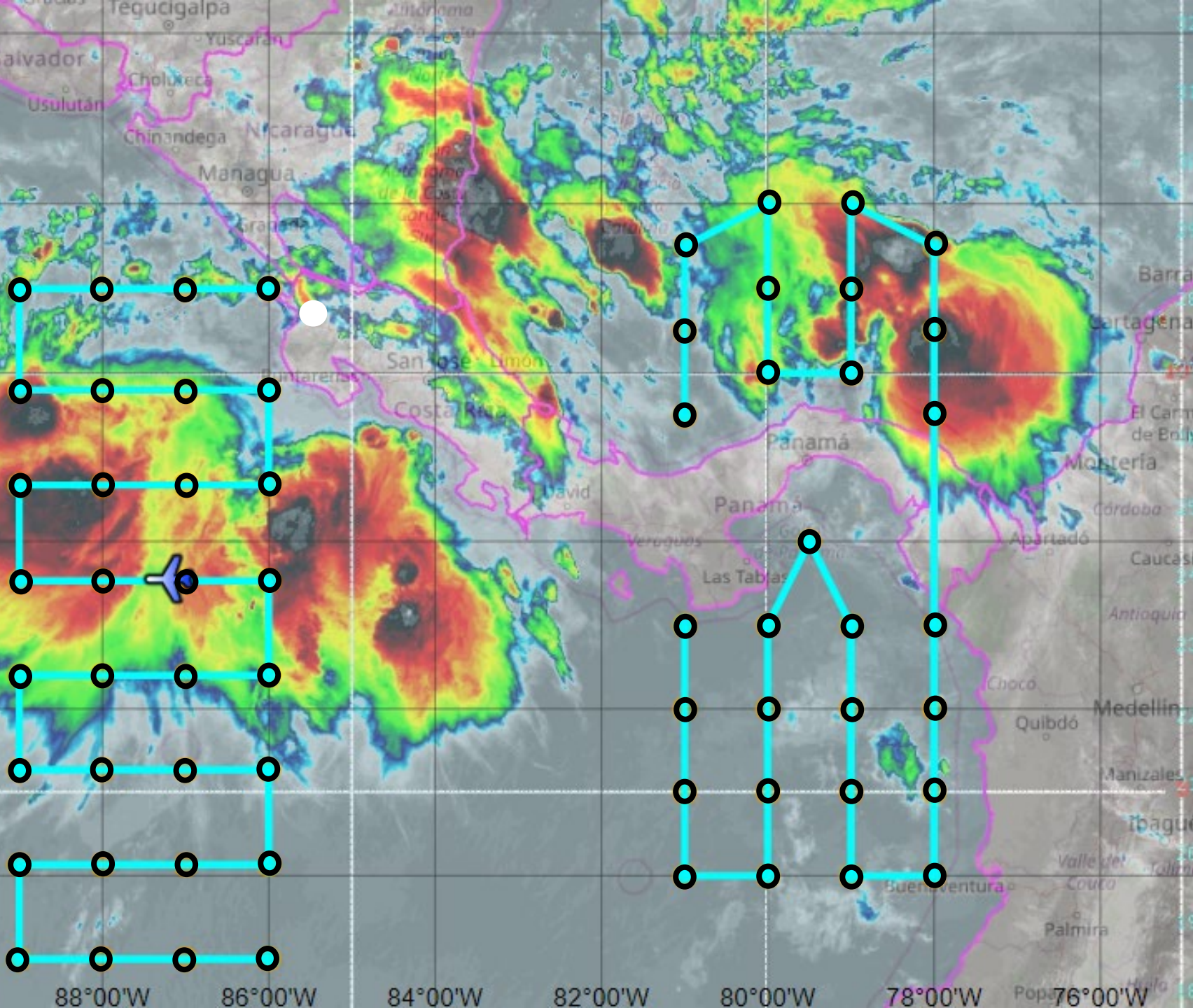




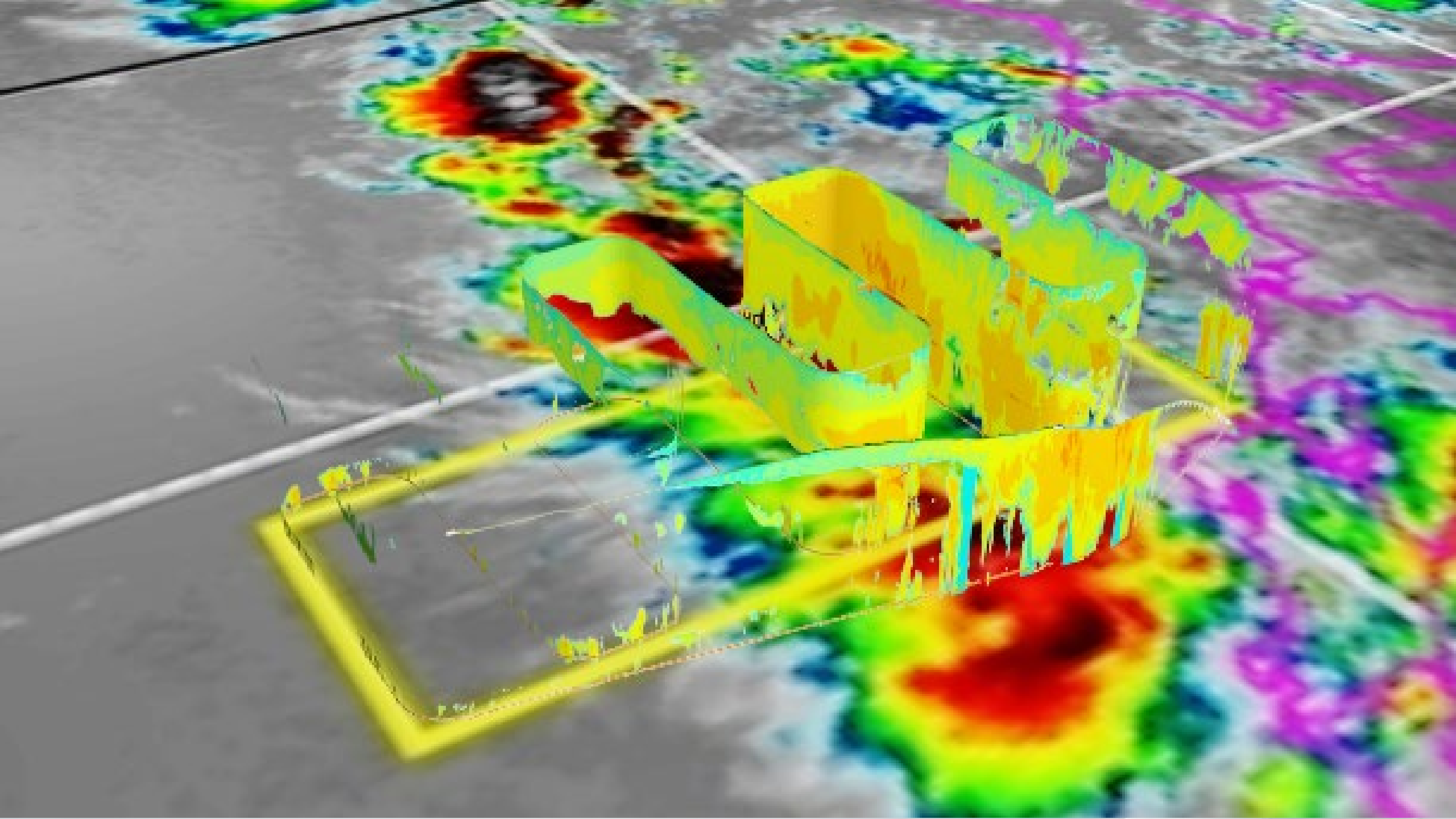
12°00'N
10°00'N
08°00'N
06°00'N
04°00'N



CatalogMaps / OTREC
© 2019 UCAR. All Rights Reserved.
© OpenStreetMap contributors



88°00'W 86°00'W 84°00'W 82°00'W 80°00'W 78°00'W 76°00'W



Research Flights

22 research flights

9 flights in Colombian box B1a and in southwest Caribbean box B1b

12 flights in eastern Pacific box B2

1 joint flight with HRD NOAA P3 (tropical storm Ivo)



Thermodynamic parameters

Saturation fraction

$$SF = \frac{\int r dp}{\int r_s dp}$$

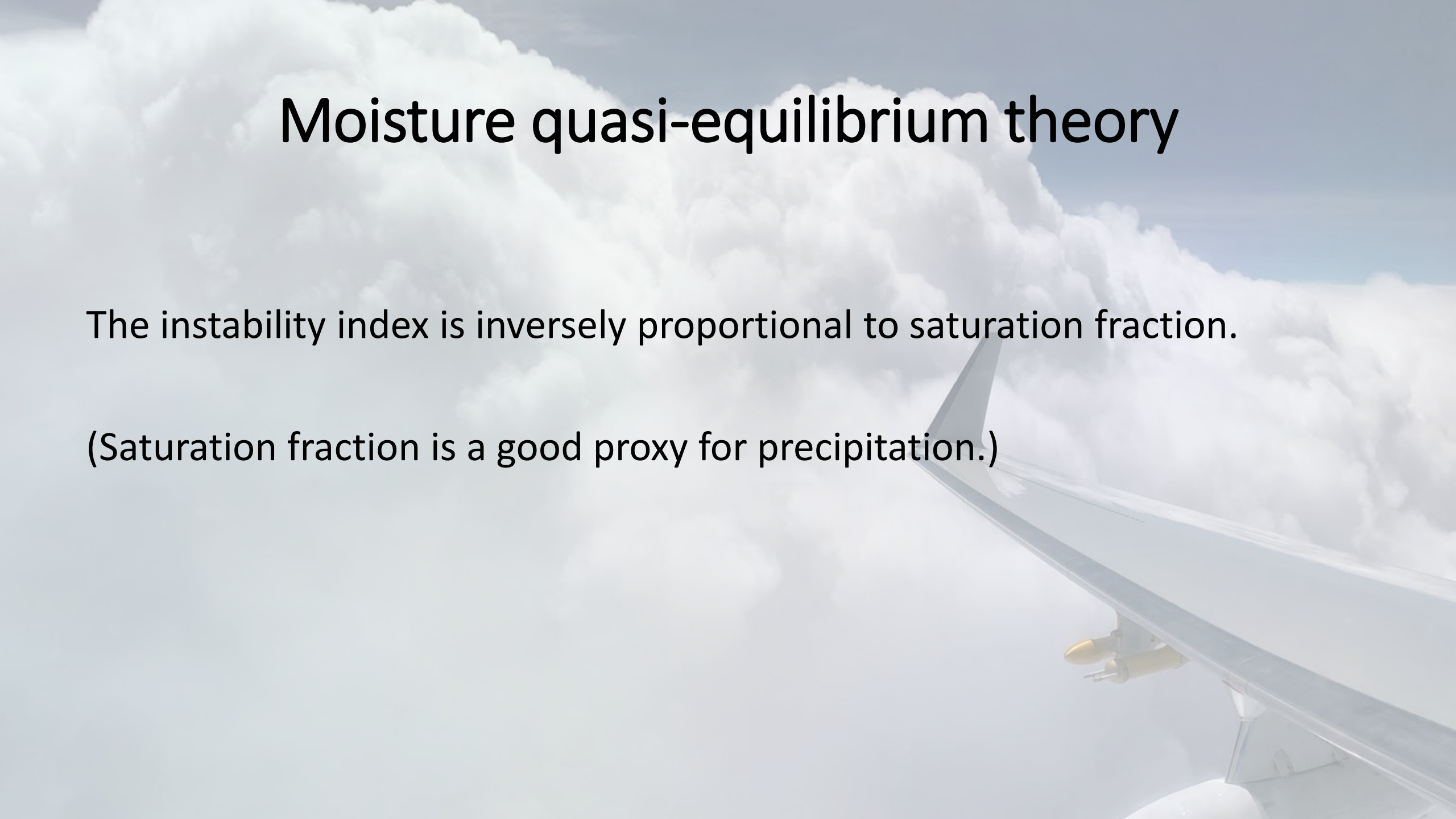
Instability index (low to mid-tropospheric moist convective instability)

$$II = S^*_{1-3km} - S^*_{5-7km}$$

Moisture quasi-equilibrium theory

The instability index is inversely proportional to saturation fraction.

(Saturation fraction is a good proxy for precipitation.)

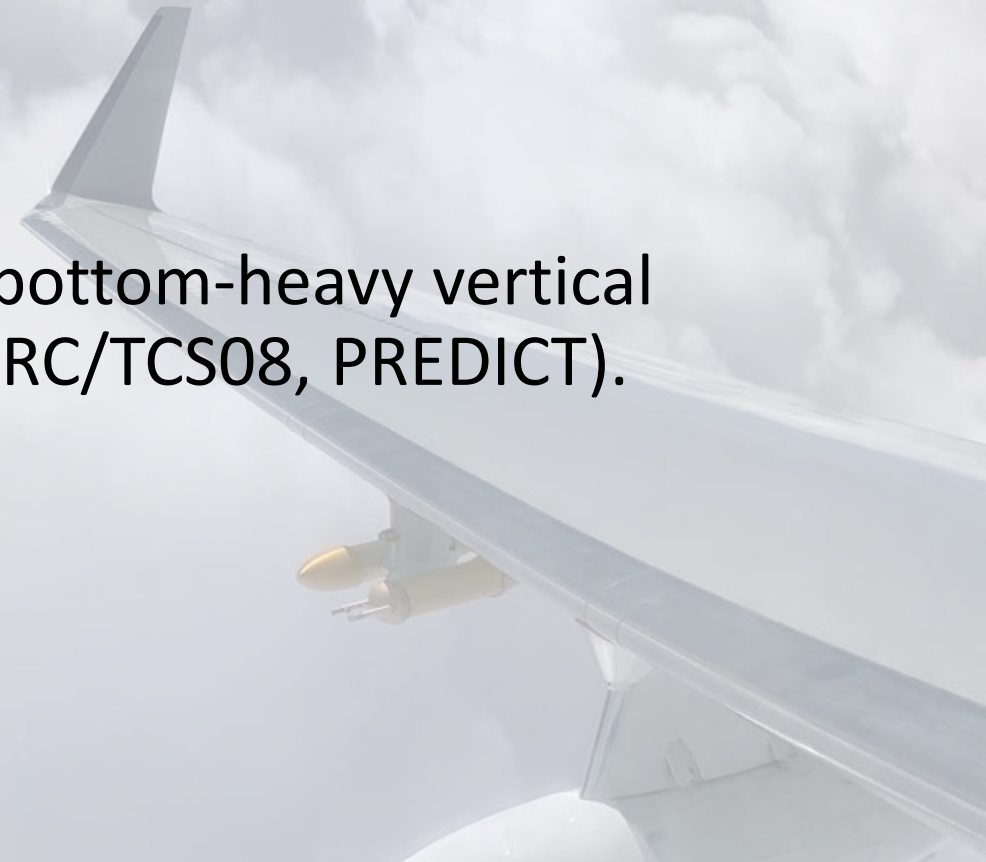


Vertical mass flux profiles

Vertical mass flux profiles

$$M(z) = \overline{\rho w}$$

Decrease in instability index is associated with bottom-heavy vertical mass flux profiles, Raymond et al., [2014] (T-PARC/TCS08, PREDICT).



Convective Systems

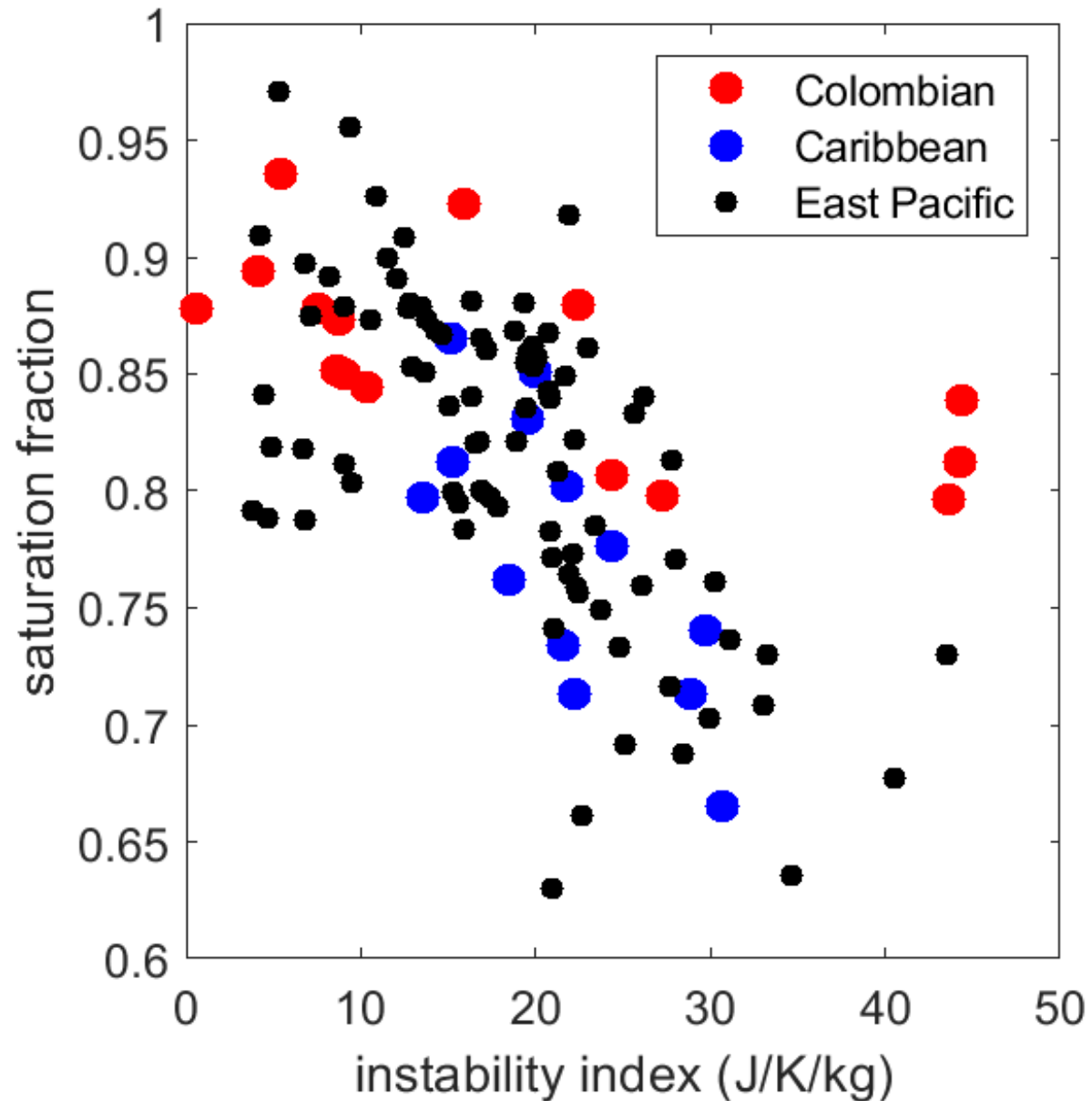
5 out of 9 flights in Colombian box B1a

3 out of 9 flights in Caribbean box B1b

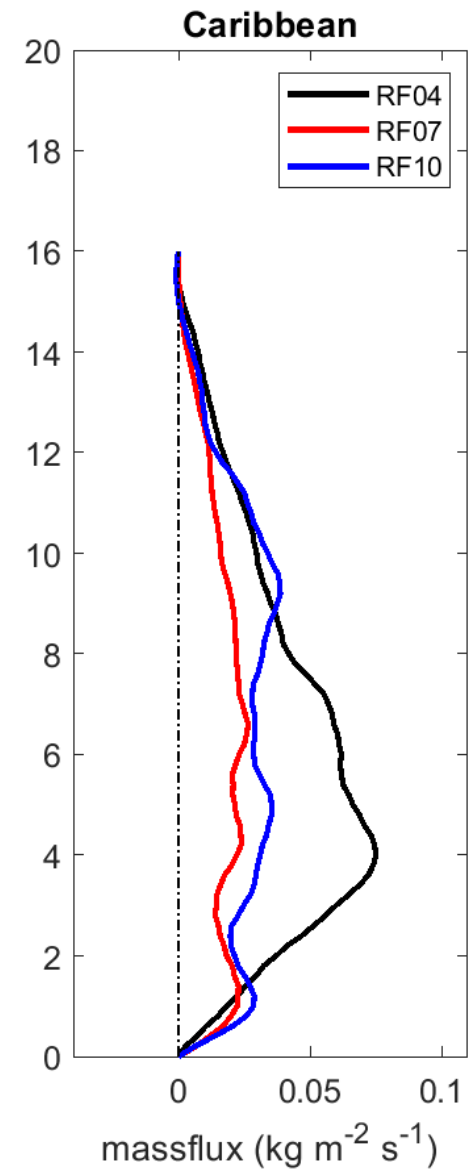
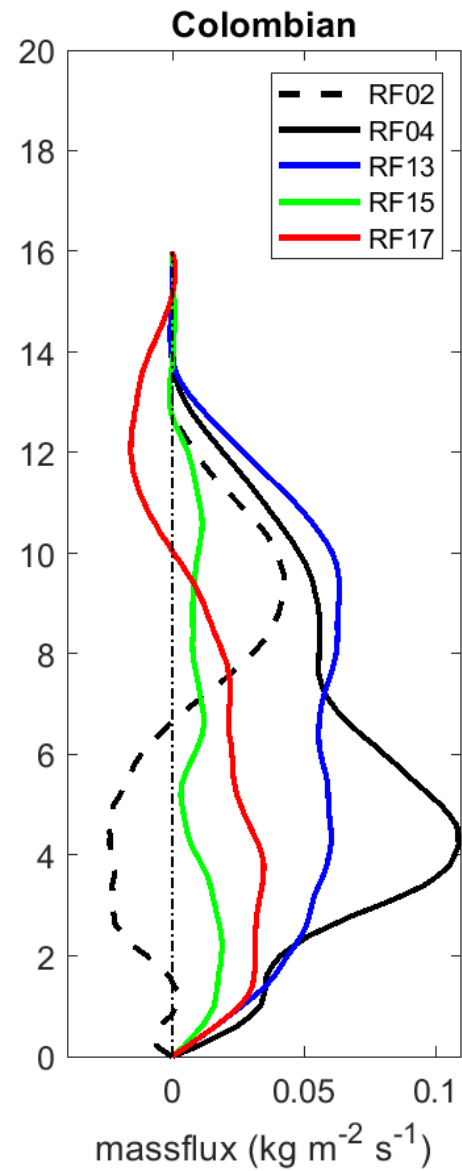
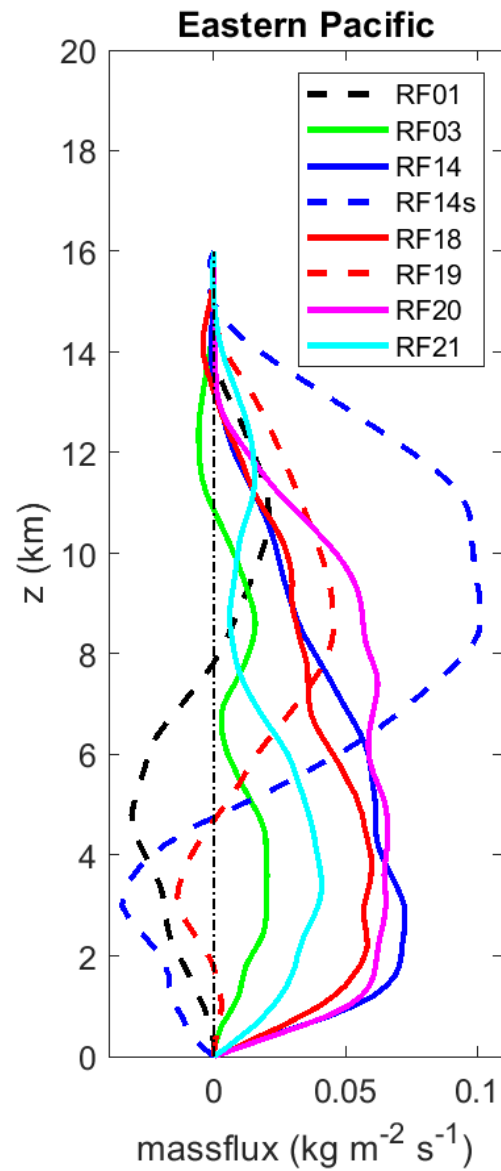
8 out of 12 flights in eastern Pacific box B2



Instability index vs Saturation fraction



Vertical mass flux profiles



Conclusions

- Thermodynamic parameters instability index and saturation fraction show anti-correlation, as explained by moisture quasi-equilibrium theory.
- Vertical mass flux profiles are bottom heavy for developing convection and top heavy for decaying convection.
- Strong differences exist between convection in the East Pacific ITCZ and in the Caribbean and Pacific coast of Colombia.

Fuchs-Stone, Ž., Raymond, D. J., & Sentić, S. (2020). OTREC2019: Convection over the East Pacific and Southwest Caribbean. Geophysical Research Letters, 47, e2020GL087564. <https://doi.org/10.1029/2020GL087564>

THANK YOU OTREC TEAM!!!

