Surface Sensible Heat Loss in the Tropics
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Abstract
A study using reanalysis data from the Earth Systems Research Laboratory to examine the difference in heat loss for precipitation compared to that of the heat loss from the sensible heat flux near the boundary layer. Using GrADS, grid analysis and display system, the data was analyzed in order to look for a circumstance that would give similar heat losses. The main area of focus was in the tropics from 30°N to 30°S. It was found that the area of the Maritime Continent during a La Niña had very similar value for heat flux.

Introduction
The top layer of the ocean is generally a well-mixed layer due to wind-generated turbulence. This top layer can have abrupt changes in temperature with depth, which often indicates the base of the mixed layer. The first law of thermodynamics governs that rate of change through the mixed layer, “The sensible heat of rainfall in the tropical ocean” (Fairall, Gosnell, and Webster 1995).

The equation for the first law of thermodynamics, above, shows the change in heat content if a water column. The schematic diagram in figure 1 will show how the right side of the equation works.

\[ Q_{net} = Q_{in} - Q_{out} \]

Q_{net}, the net heat flux at the surface, and Q_{in}, cooling due to precipitation are a large focus of this study. The other variables control the entrainment at the base of the mixed layer (Q_{out}), advection (A), and penetration of solar radiation (R_{p}). “The sensible heat of rainfall in the tropical ocean” (Fairall, Gosnell, and Webster 1995).

Mean Sensible Heat Loss (1996-2000)

Conclusion
- Sensible heat loss is larger than the heat loss due to precipitation
- Both variables are closest in the Maritime Continent during La Niña events
  - Sensible heat loss: 6-7 W/m^2
  - Heat loss from precipitation: 4-5 W/m^2
- This shows that heat loss due to precipitation could be an important part of the system and needs to be included in climate models

Future Work
- To quantify the major factors that influence the sensible heat loss and precipitation heat loss
- Separate precipitating and non-precipitating days to compute the sensible heat loss
- Estimation and addition of the precipitation heat loss into climate models

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Resources
- Stull, R., Wet-Bulb Temperature from Relative Humidity and Air Temperature. University of British Columbia, 2267 pp, 2011
- Cold & Warm Episodes by Season. Climate Prediction Center NOAA, 1 pp, 2014