

Severe Thunderstorms in the LPB Region As Compared To Other Active Regions

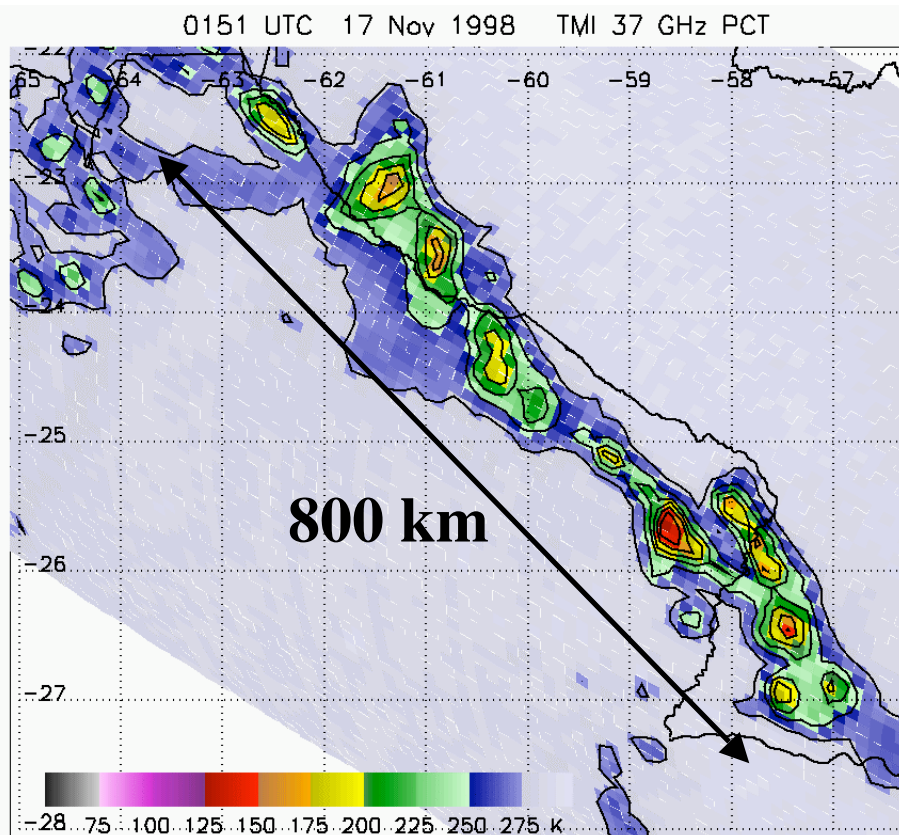
Daniel J. Cecil

University of Alabama - Huntsville

cecild@uah.edu

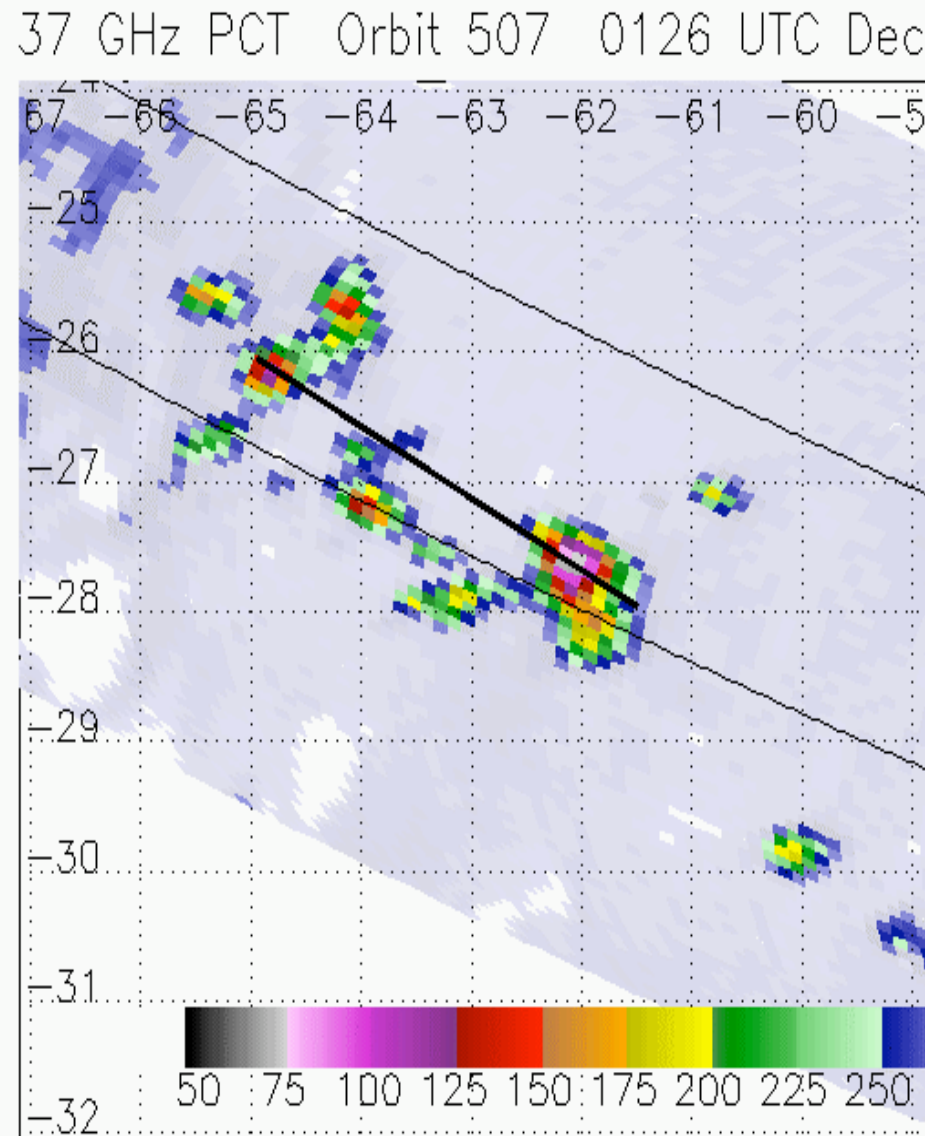
Please interrupt me if you see something interesting you want to talk about!

Example Intense MCS



Some long lines (above) - This case had ~1300 flashes / minute

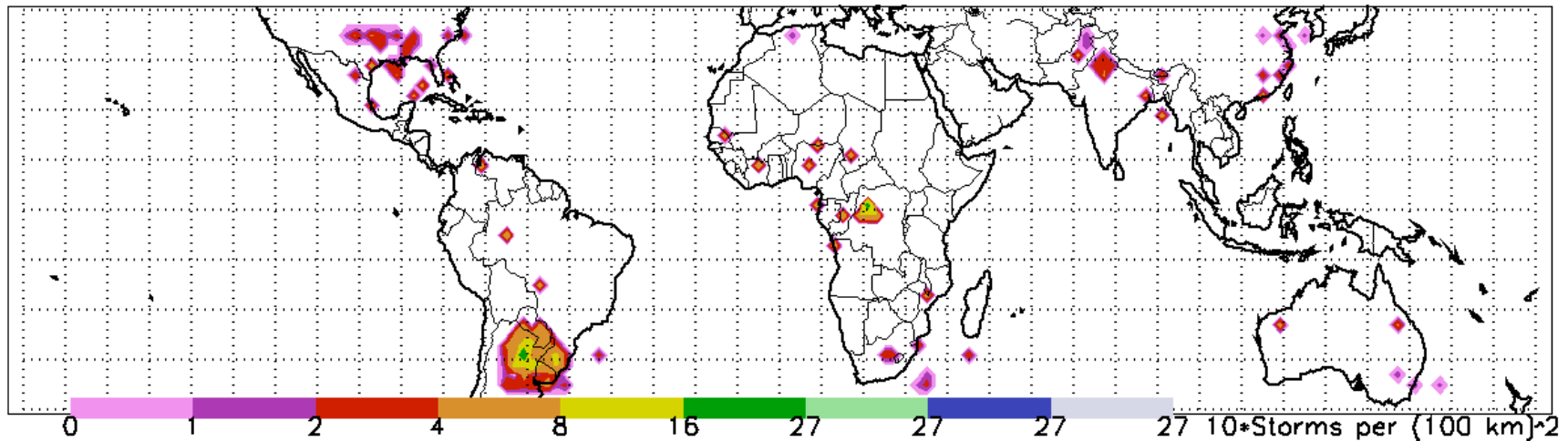
Some more discrete (right) - This case had 40 dBZ at 19 km



Lightning Flash Rates

By some measures, the strongest tstms are in SE S. America

Top 0,001% Lightning, 317+ FI/min, 1998–2007
2x2 grid, Annual, 6-hourly sampling

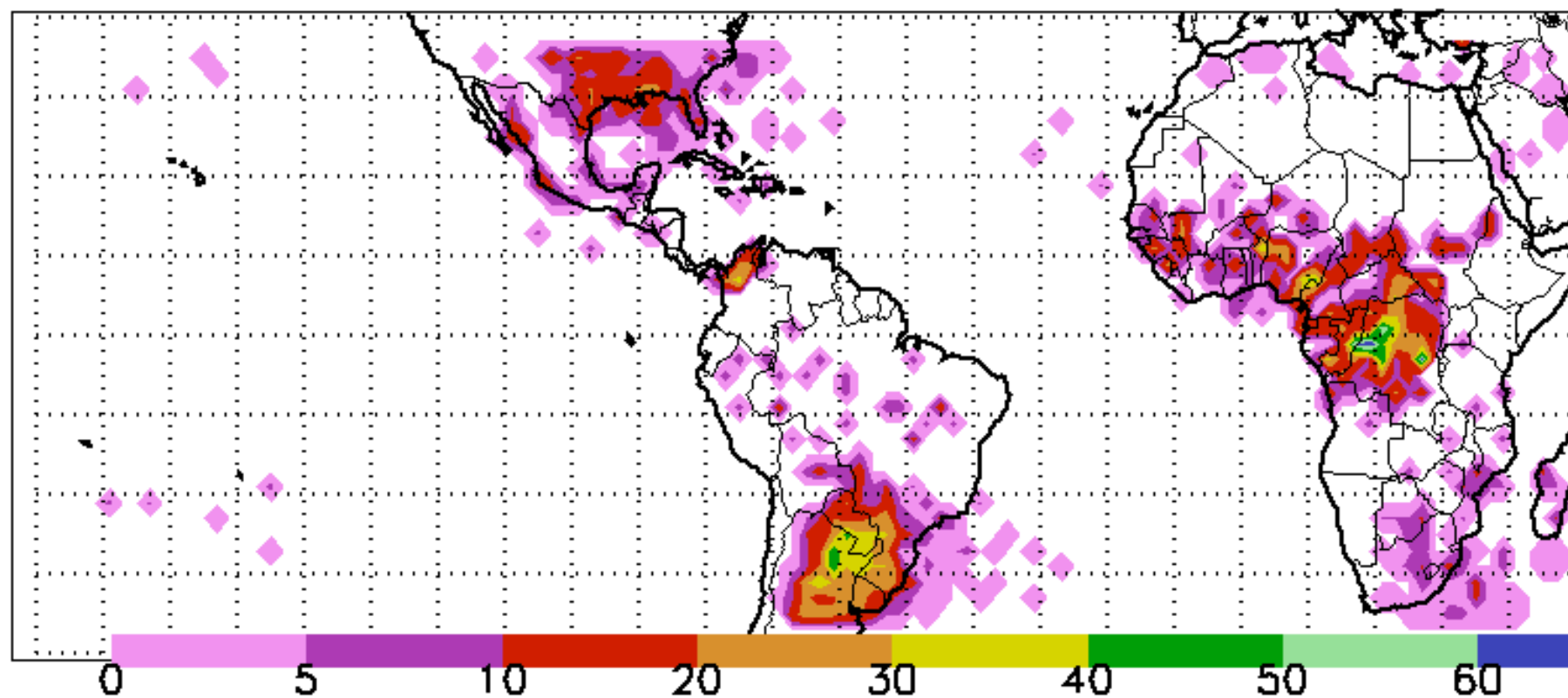


21 of the 22 highest storm flash rates seen by TRMM are from same region.

There is over-sampling at high latitudes, but not enough to account for the SA maximum.

Some cases *may* have up to 25% over-estimate due to SAA, but this is not enough to account for the SA maximum.

Top 0.01% Lightning, 128+ FI/min,
2x2 grid, Annual, 6-hourly scan



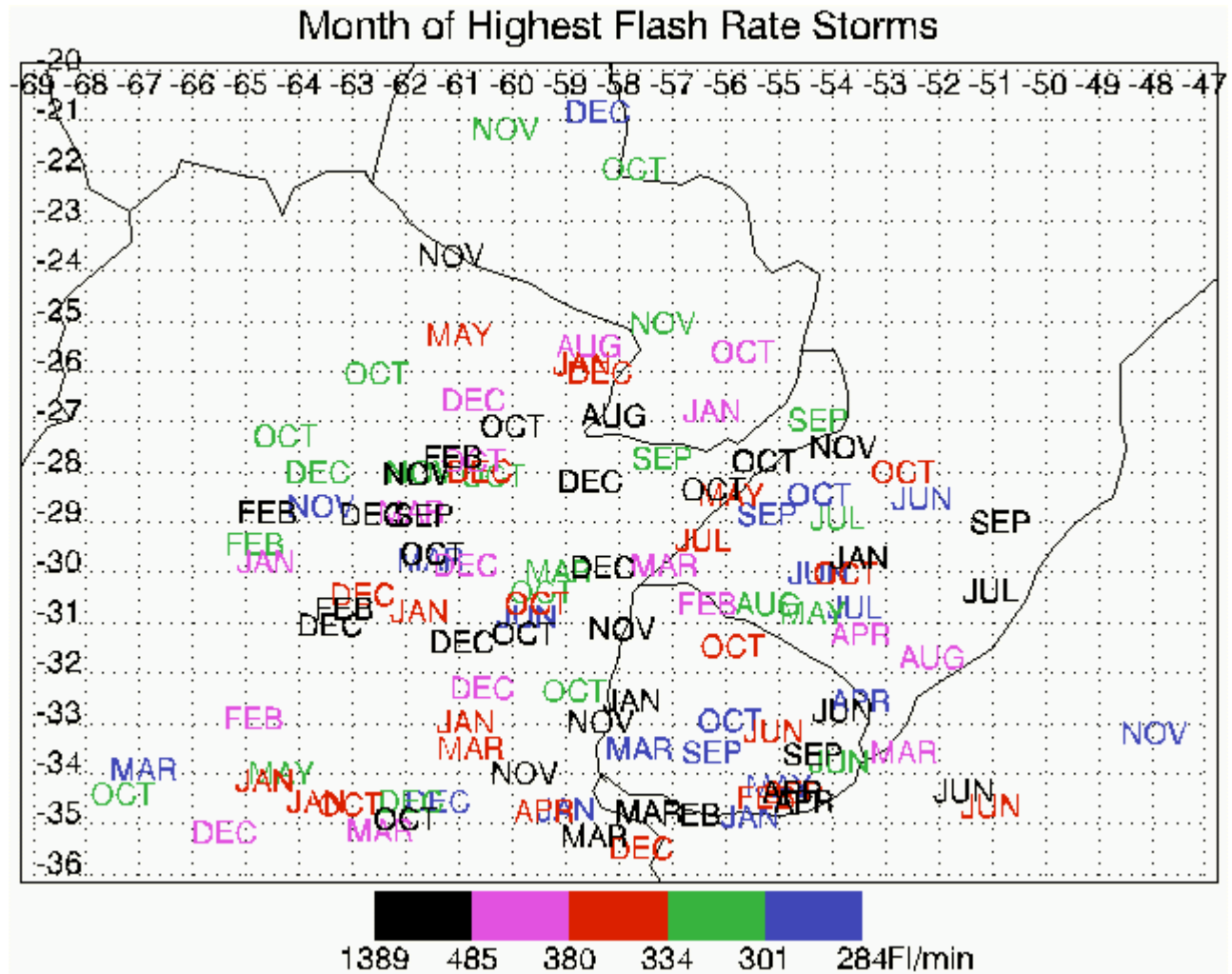
Lightning Flash Rates

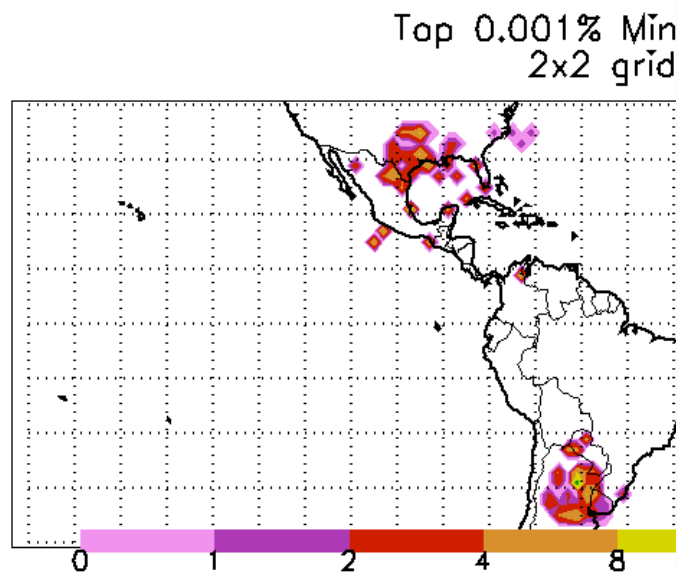
Black letters are among the 50 highest flash rate storms (globally) seen by TRMM;

Purple are among 51-100th highest flash rates; etc.

Highest flash rate storms mostly October through December

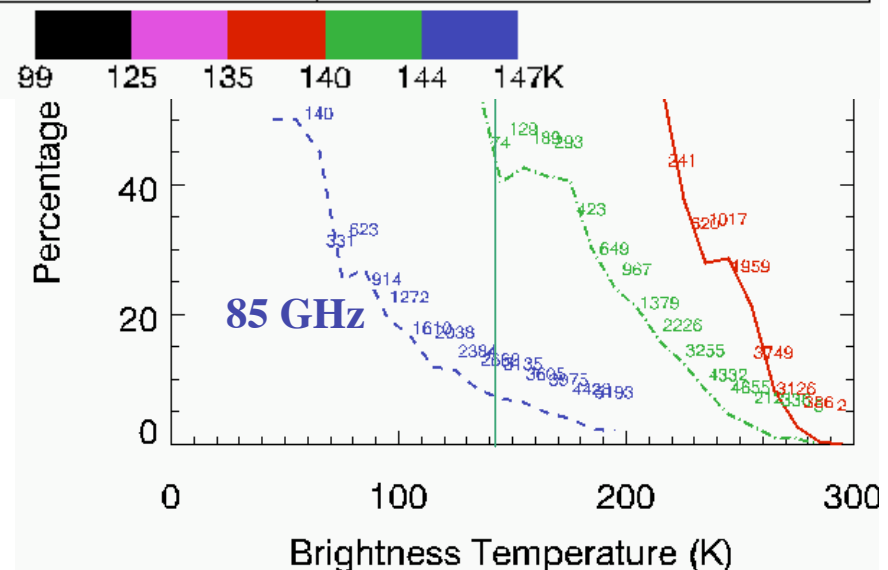
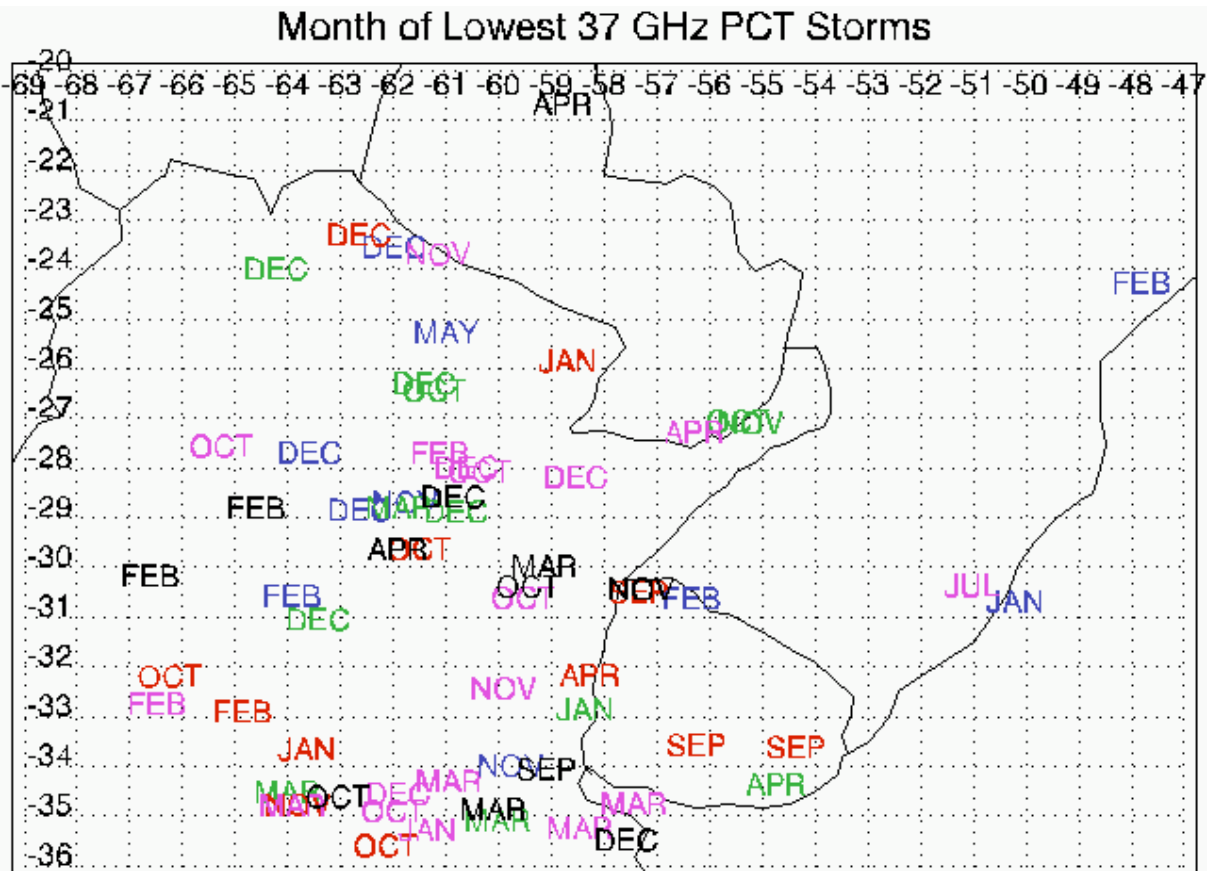
Some significant storms throughout the year, even in winter





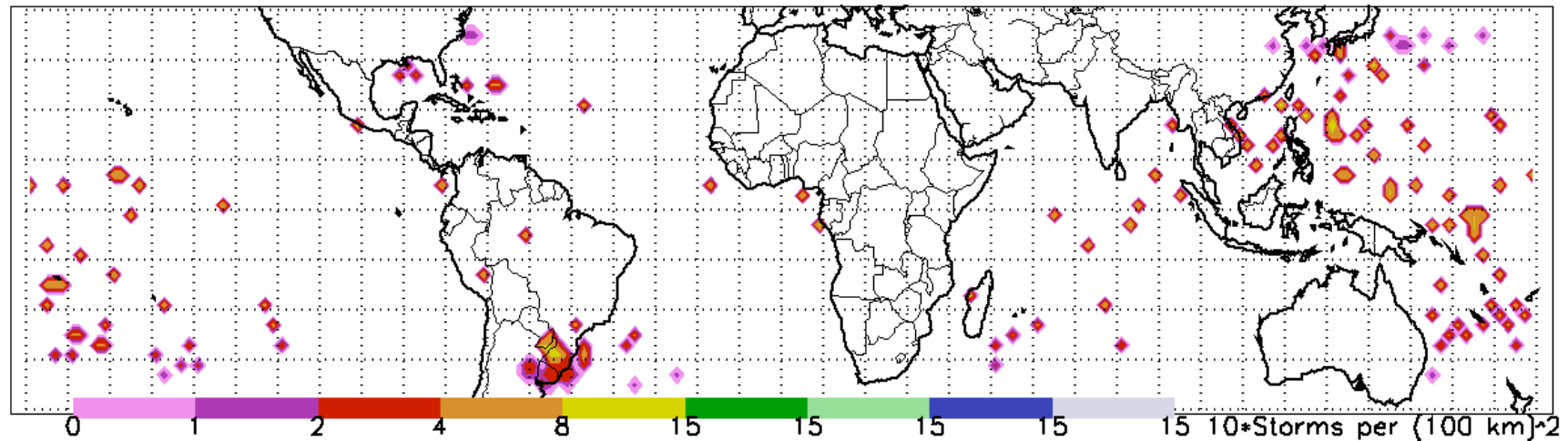
37 GHz ~ Ha

37 GHz PCT < ~140
land is very likely to
large hail, based on
comparison with U.S. storm
reports

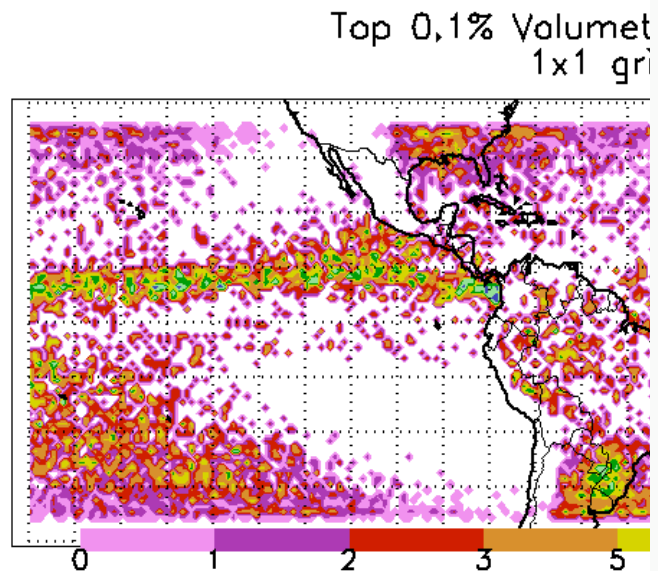


Volumetric Rain

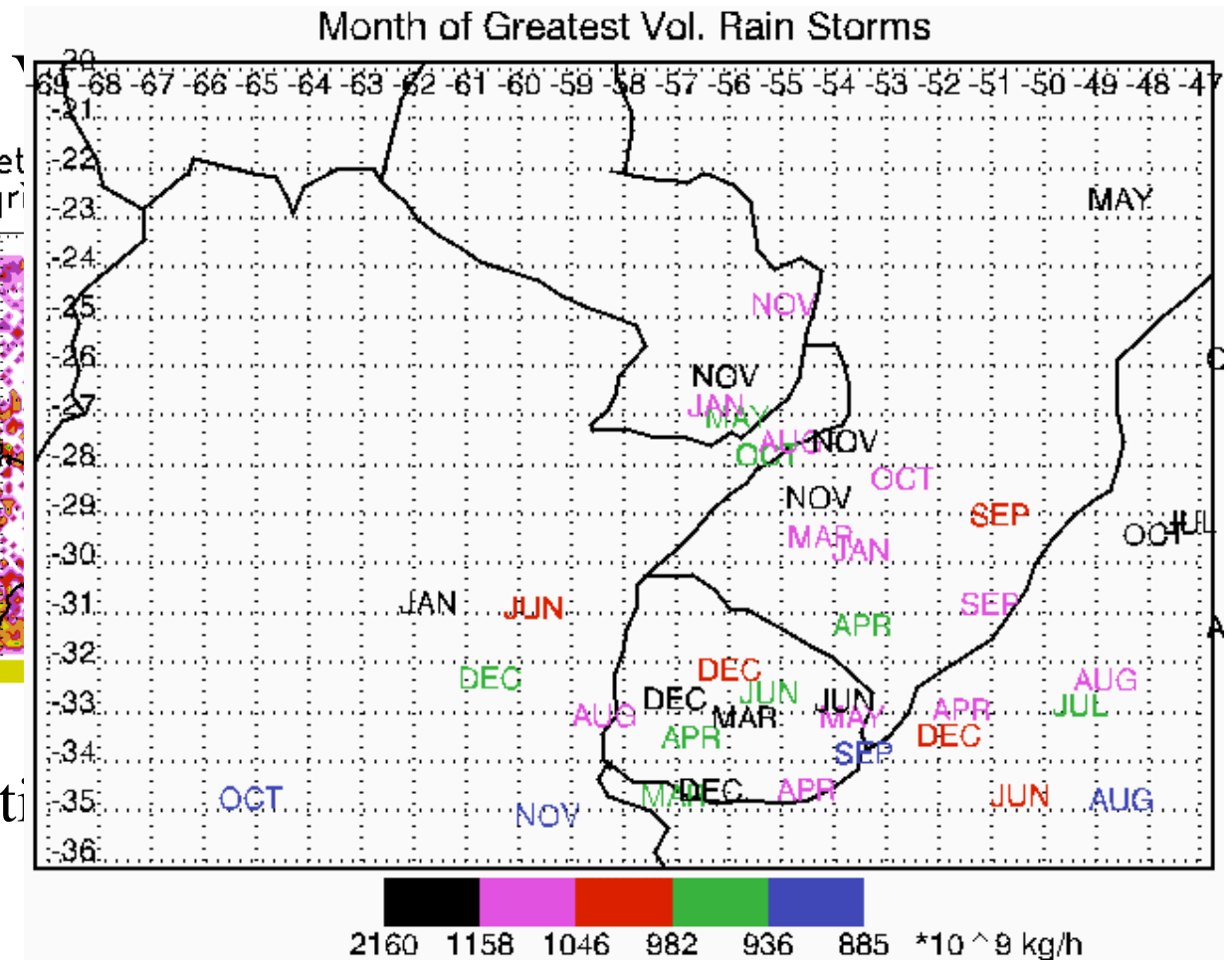
Top 0.001% Volumetric Rain , $>958 \times 10^9 \text{ kg/h}$, 1998–2007
2x2 grid, Annual, 6-hourly sampling



For the “biggest rainmakers”, SE S. America is the only bullseye over land.



Maximum concentration
Basin



Maximum concentration of highest flash rate or lowest TB is
further west, over Northern Argentina.

My Interests in LPB:

What is unique about these MCS, causing them to have disproportionately the largest flash rates and rain totals? (MCS structure and composition)

What is unique about the environment to favor these MCS?

Does damaging weather (particularly hail) at the surface coincide with the satellite-indicated strongest storms?

Relevance:

Extreme lightning flash rates --> Power disruptions?

Low TB / Hail storms --> Crop damage?

High Volumetric Rain storms --> Flash flooding;
sustained flooding?

Desired Measurements

MCS structure / evolution as seen by radar (preferably airborne radar in order to go to the best storms, instead of hoping they'll come to us)

Enhanced upper air soundings to characterize environment

Lightning mapping

Dual-Pol radar to distinguish hail from rain

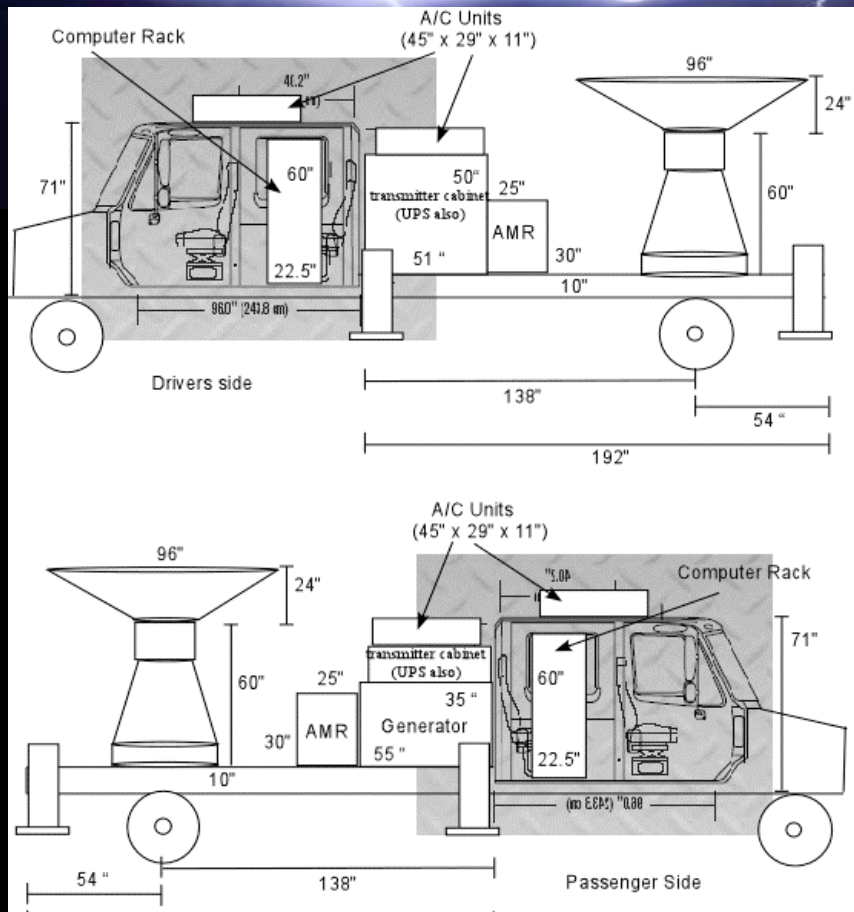
Ground-truth severe storm reports - effort to seek out verification of hail (or lack of hail)

Possible observing system additions

MAX - Mobile Alabama X-band dual-pol, truck-mounted radar (UAH)

LMA - deployable Lightning Mapping Array (NASA MSFC)

MAX: Mobile **A**labama **X**-band dual polarimetric Doppler Radar



Oct. 2006: Initial procurement of hardware

Nov. 2006- Spring: Construction

Summer: 2008: Shakedown/field ready

- Transmit frequency: 9450 MHz (H+V, H)
- Peak Power: 250 kW
- Pulse width: 0.4 – 2.0 μ s
- Min/Max PRF: 250 / 2000 s^{-1}
- Antenna Diameter: 2.4 m (8 ft)
- Antenna Gain: 44.5 dB
- Antenna Beam width: 1°
- Scanning: 0-360 Az., 0.5-90 Deg. El.
- First side-lobe: -31 dB
- Cross-pol isolation: <-36 dB
- Receiver polarization: RVP/8
- Variables: Z, V, W, ZDR, ϕ_{DP} , KDP, ρ_{HV} , LDR

Radar Development

- Tx/Rx/Ant. Design/Integration: Baron Services, Huntsville
- MP-61 Pedestal (Radio Research): UAH with prep. work and checkout by Mr. Bob Bowie, CSU-CHILL
- Truck/generator/navigation/leveling/data system: UAH

