

Convection over North America as Shown by GPM

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Categories of Contiguous Echo Objects Based on their 3D Structure

See Houze et al. (2015, *Rev. Geoph.*)

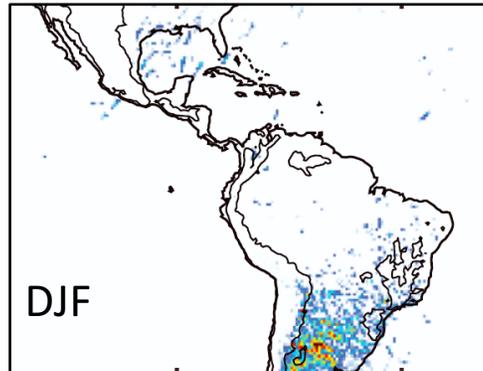
<http://trmm.atmos.washington.edu>

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Object	Echo Characteristic	Height	Area
Isolated Shallow Echoes	> min detectable	< 4 km	2 pixels
Deep Convective Cores	> 40 dBZ (<u>strong</u>)	> 10 km	N/A
	> 30 dBZ (<u>moderate</u>)	> 8 km	N/A
Wide Convective Cores	> 40 dBZ (<u>strong</u>)		> 1000 km ² at some altitude
	> 30 dBZ (<u>moderate</u>)		> 800 km ² at some altitude
Broad Stratiform Regions	Contiguous stratiform		> 50,000 km ² (<u>strong</u>)
			> 30,000 km ² (<u>moderate</u>)
			30-50,000 km ² (<u>filtered</u>)

Recall TRMM South America Results

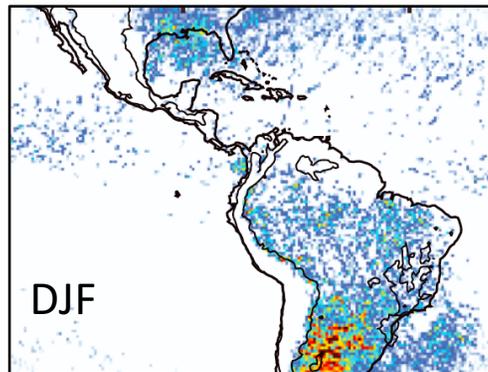
Deep Convective Cores
(strong)



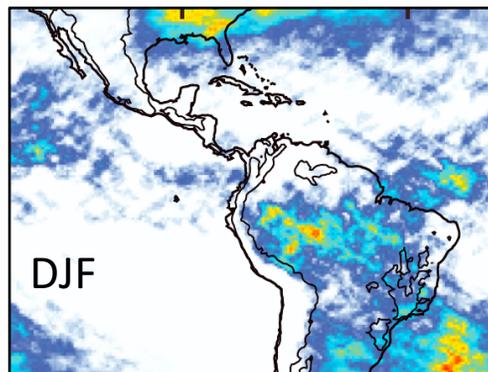
Frequencies of occurrence

See Houze et al. 2015 for
full low-latitude patterns
of these features

Wide Convective Cores
(strong)

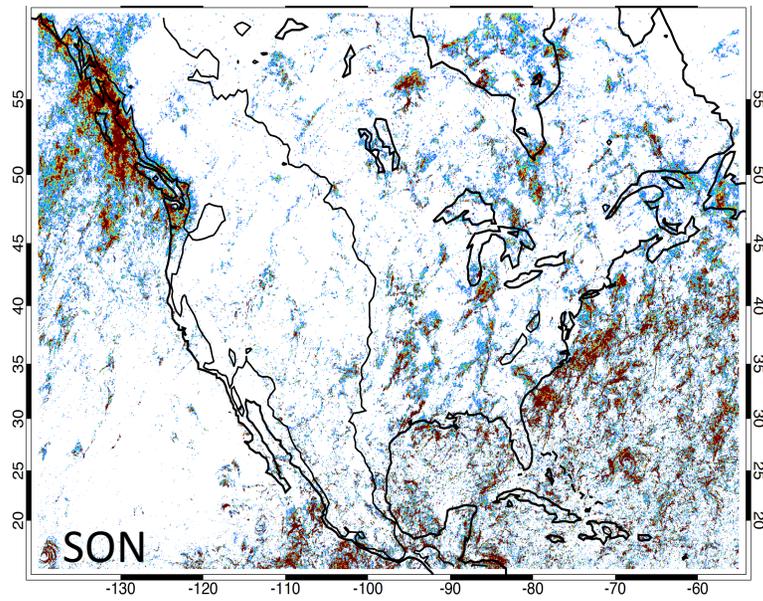
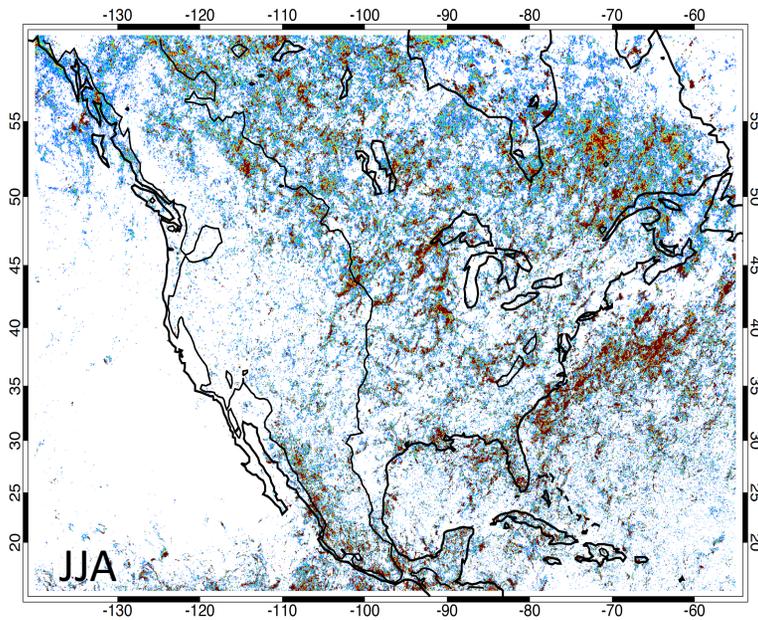
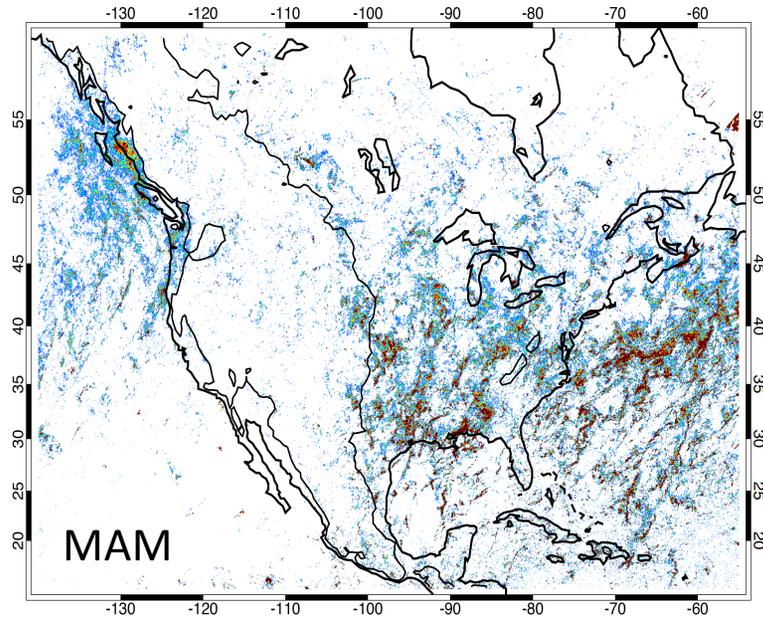
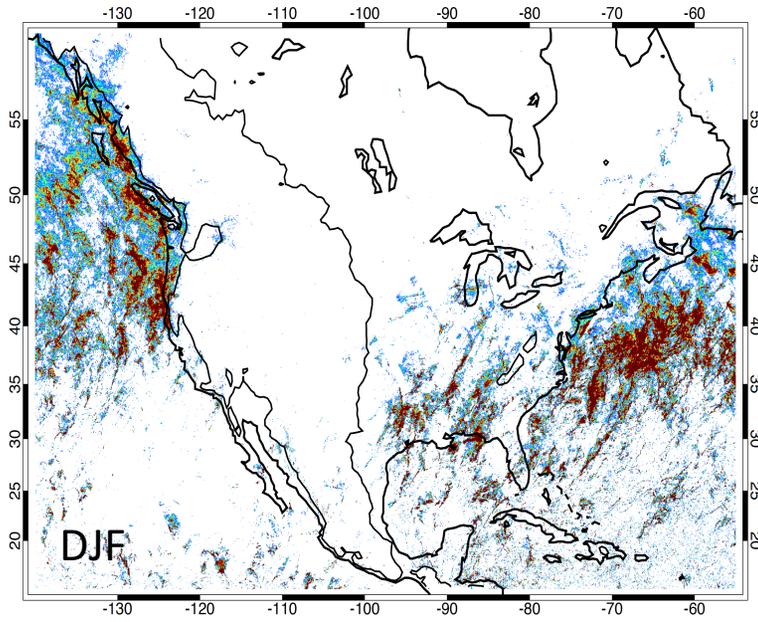


Broad Stratiform
(strong)

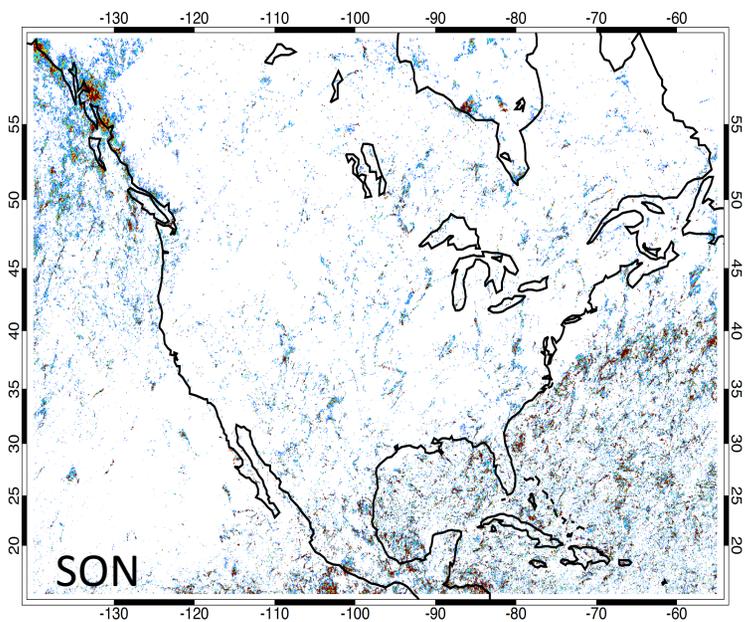
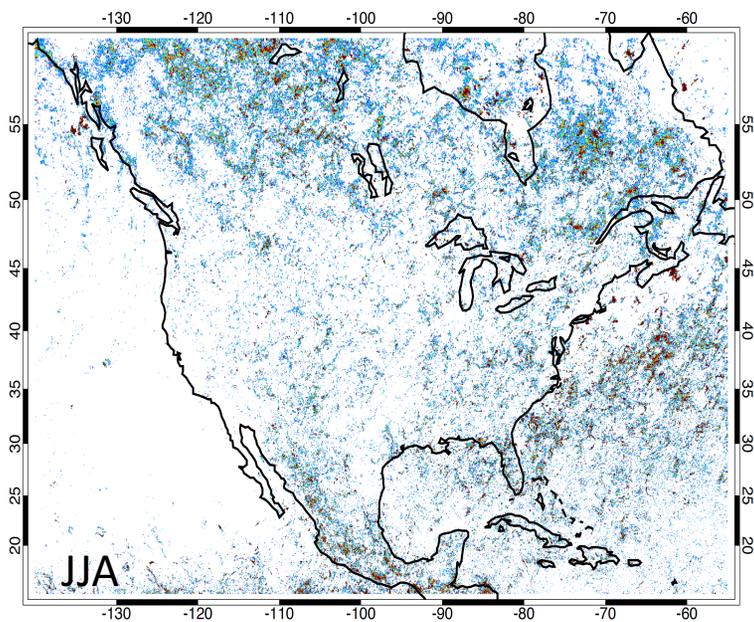
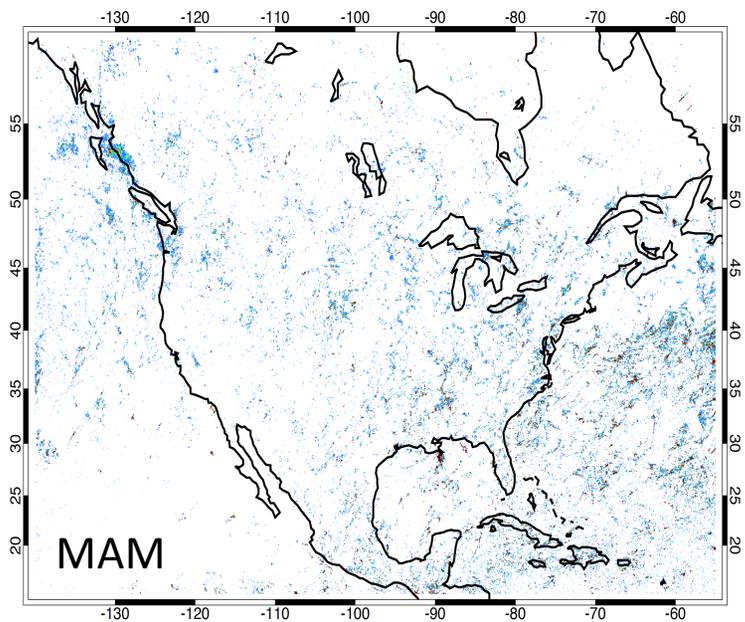
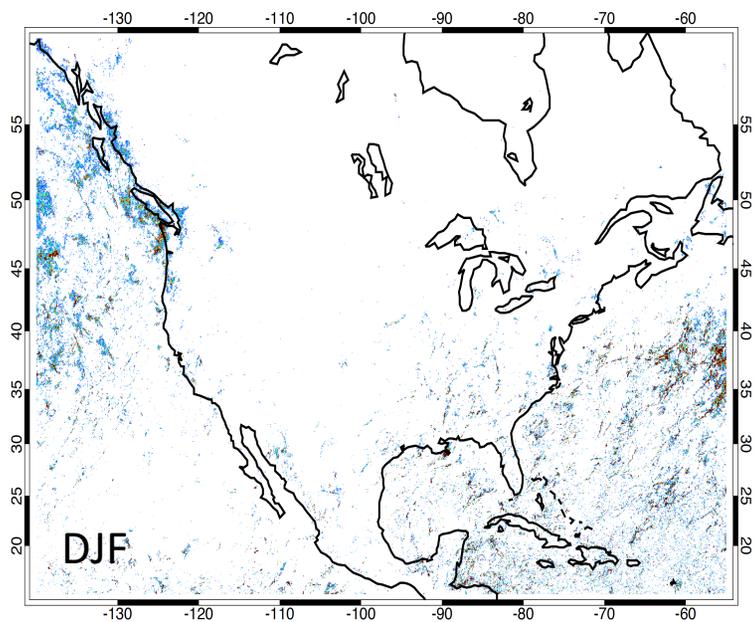


Using GPM Over N. America
How Much Rain is Explained by Storms
Containing Extreme Categories?

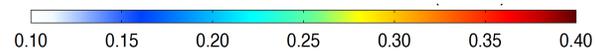
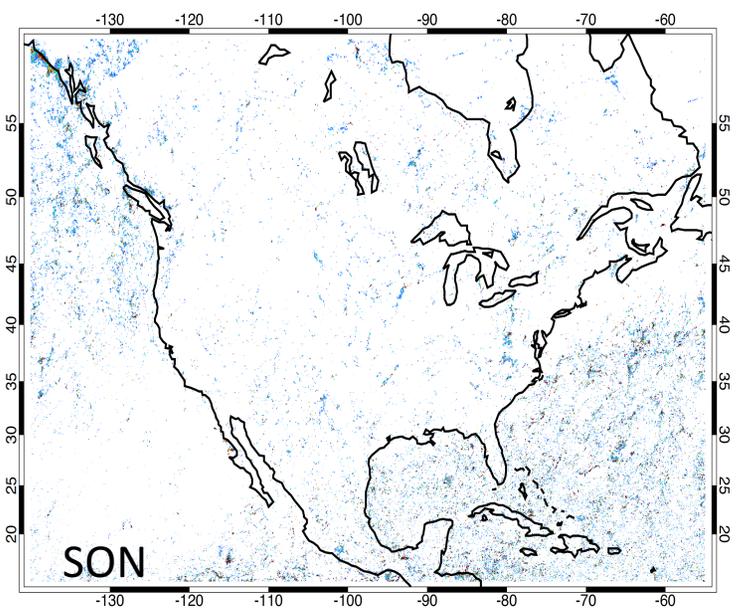
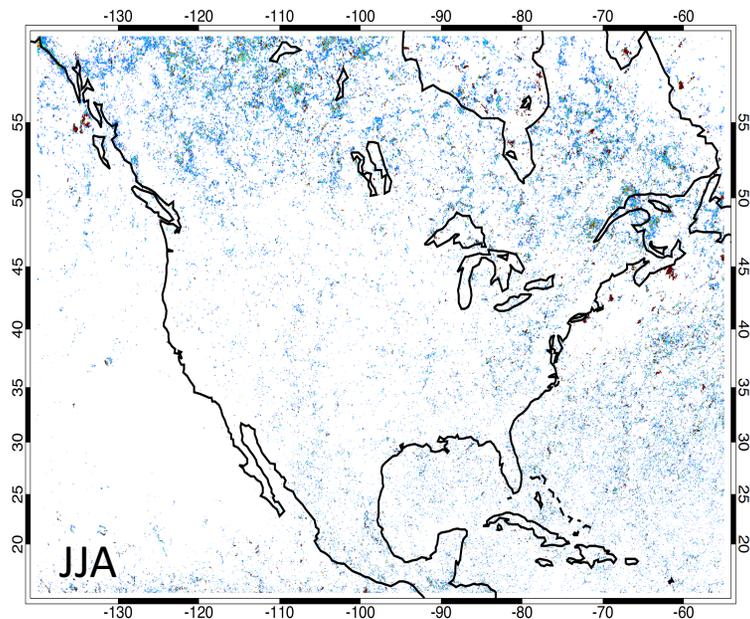
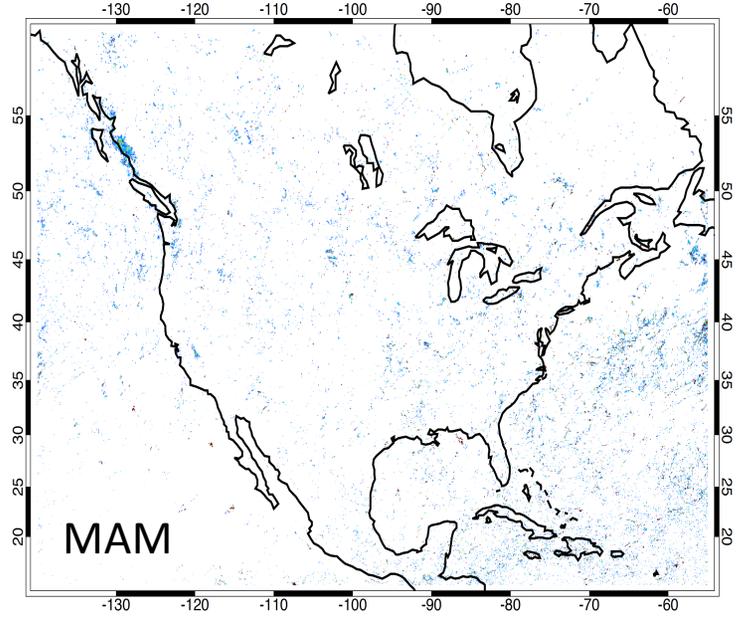
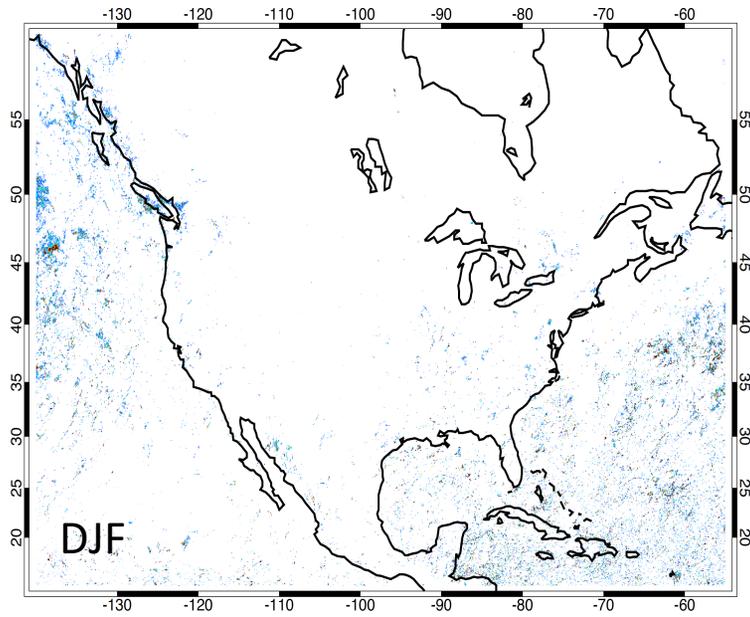
Overall Mean Rain Rate (mm/h)



Minus Storms Containing Strong Threshold Features



Minus Storms Containing Moderate Threshold Features

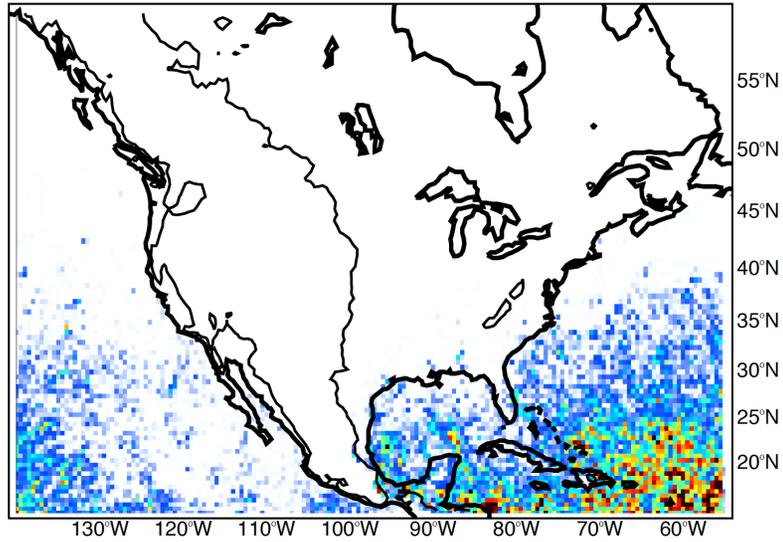


Now Look at Probability of Occurrence of

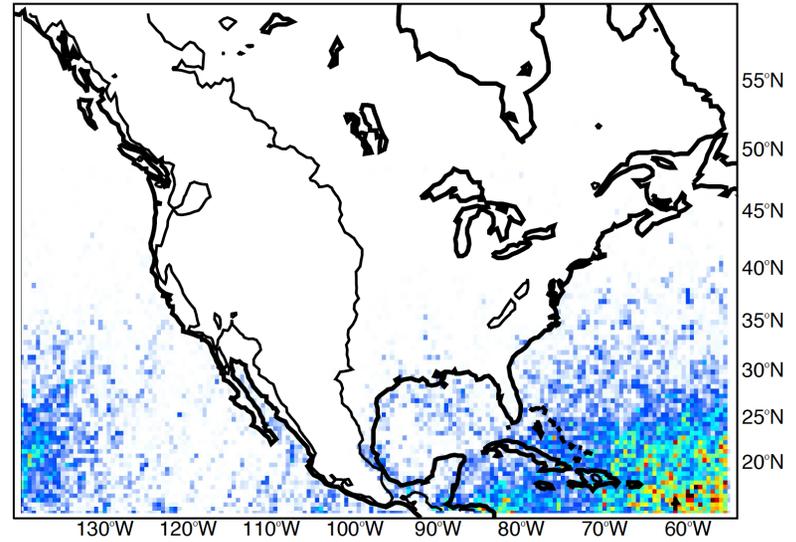
- Isolated Shallow Echoes
- Deep Cores
- Wide Cores
- Deep and Wide Cores
- Broad Stratiform Regions

Probability of Shallow Isolated

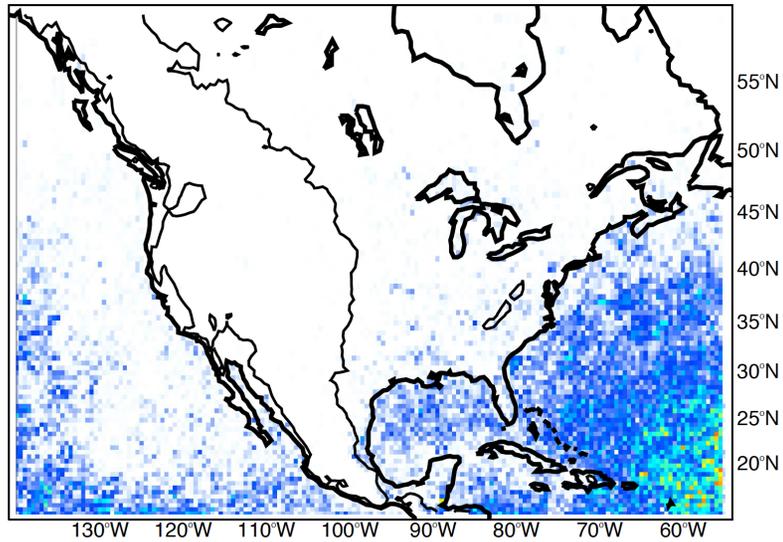
a) DJF



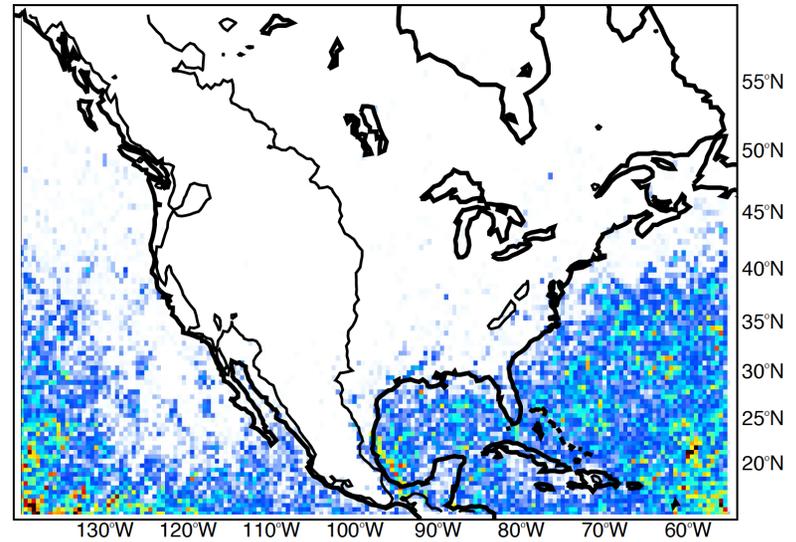
b) MAM



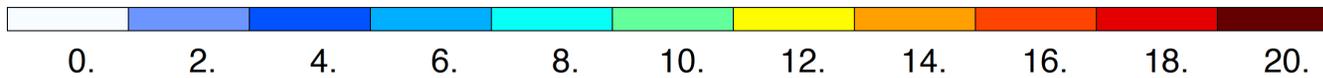
c) JJA



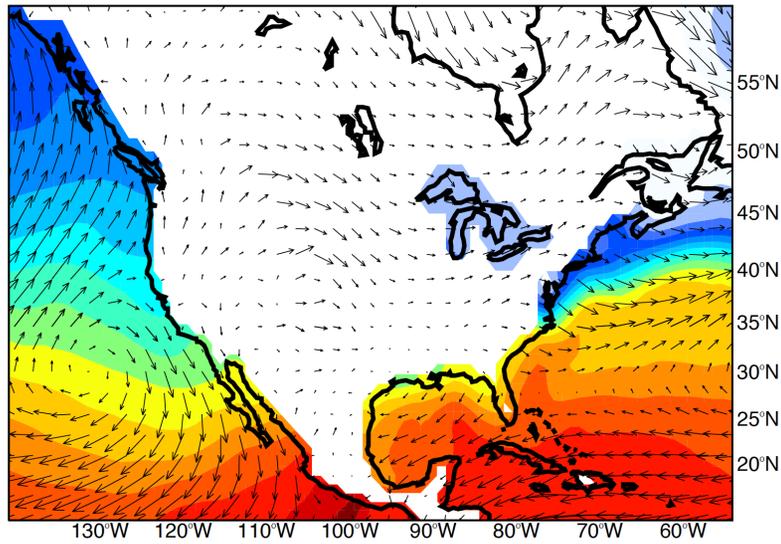
d) SON



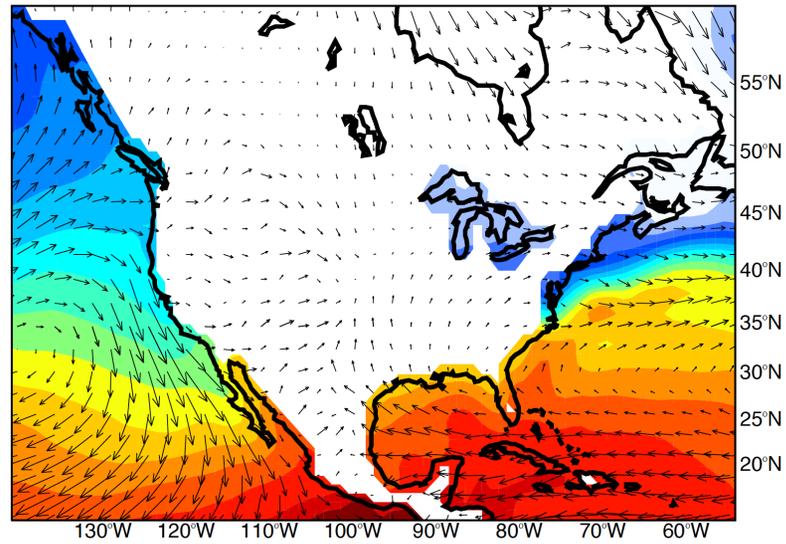
Probability of shallow isolated cores ($1e-3$)



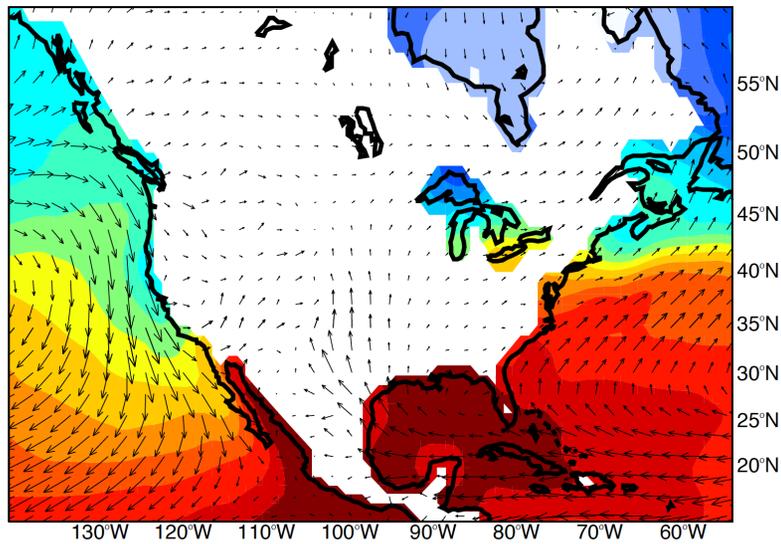
a) DJF



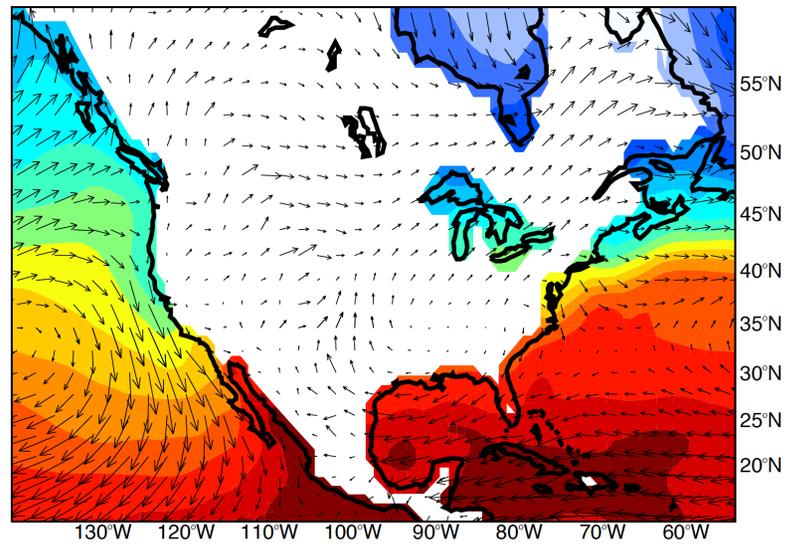
b) MAM



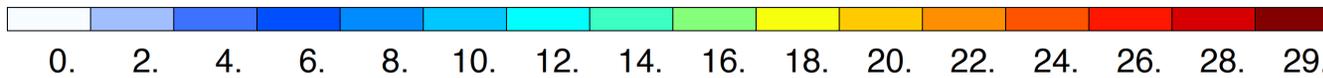
c) JJA



d) SON



sea surface temperature (deg C)

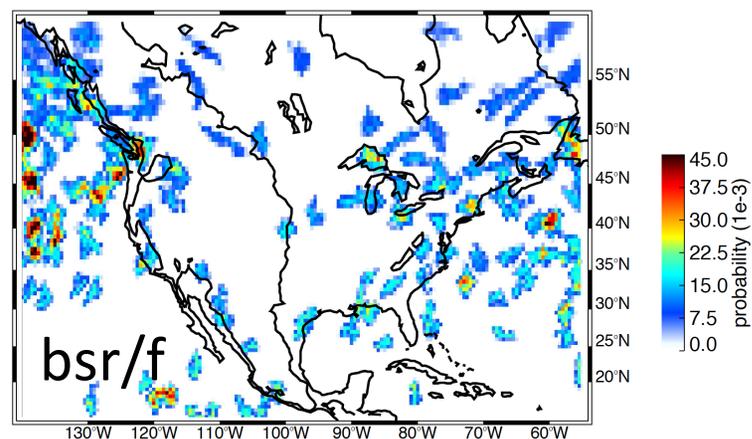
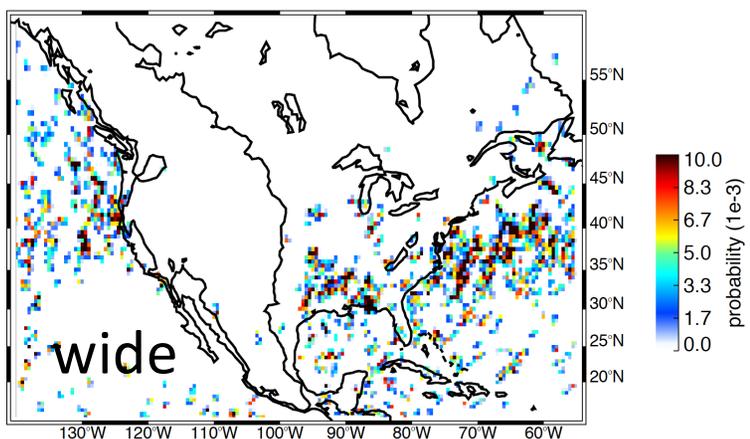
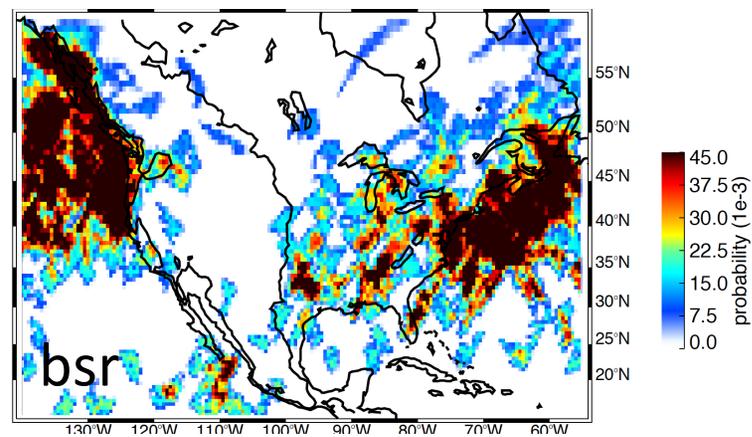
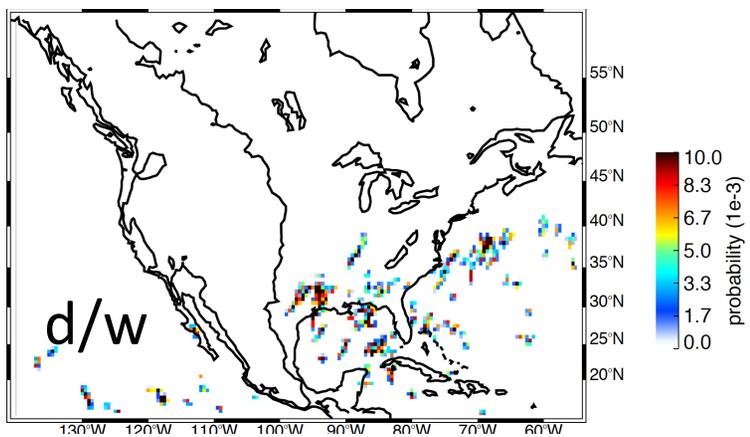
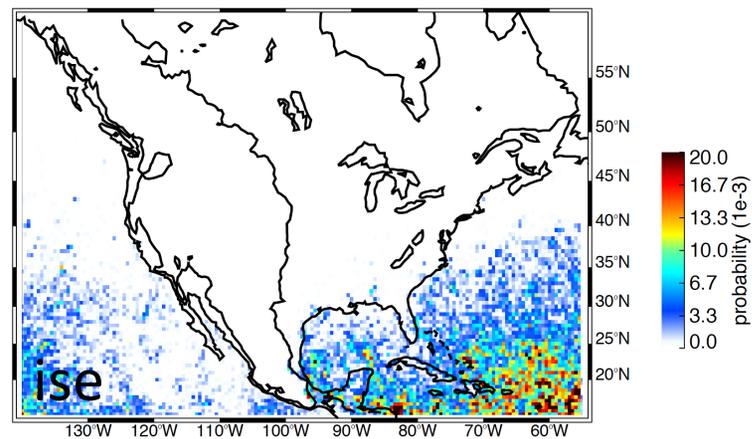
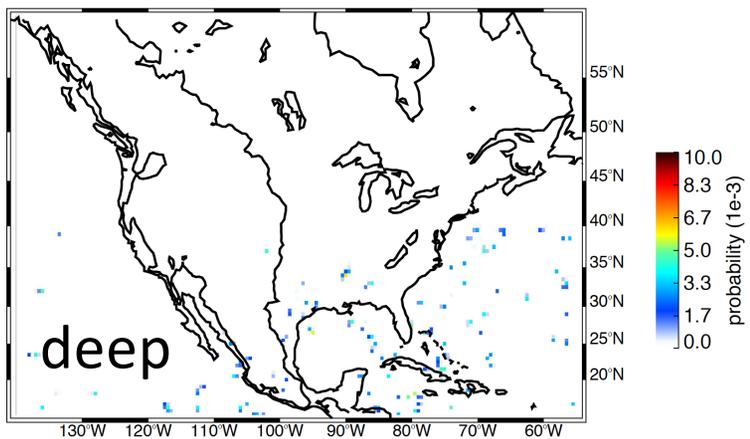


Probability of Intense Convection

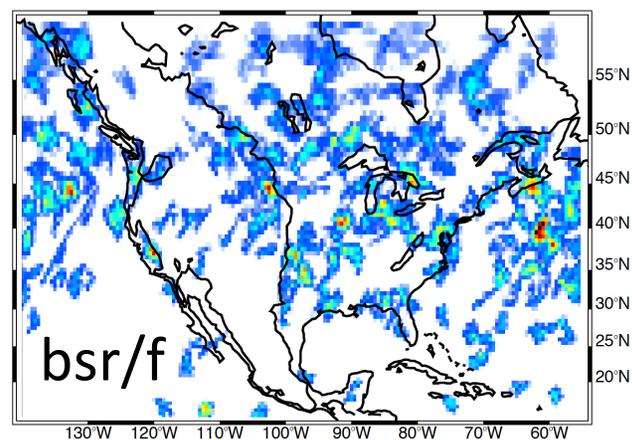
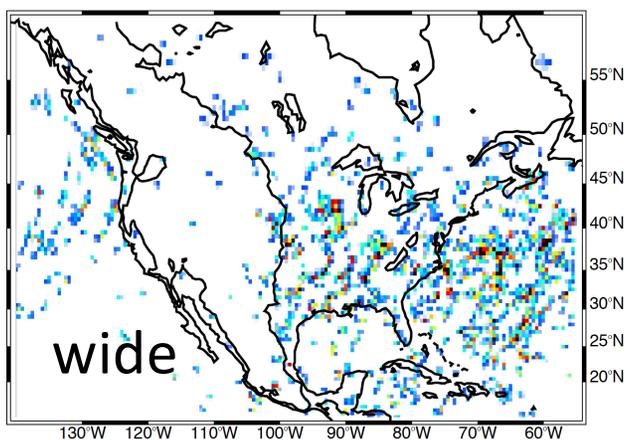
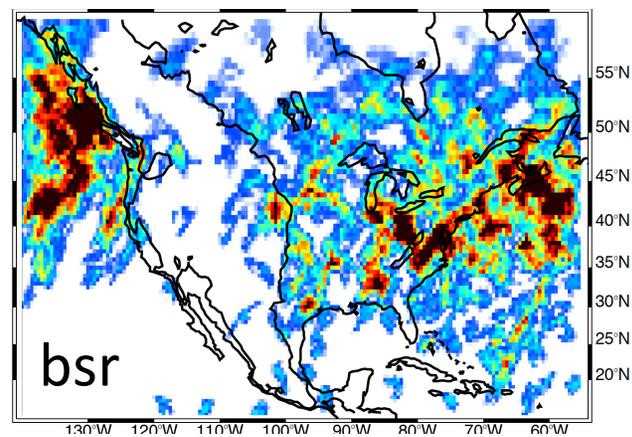
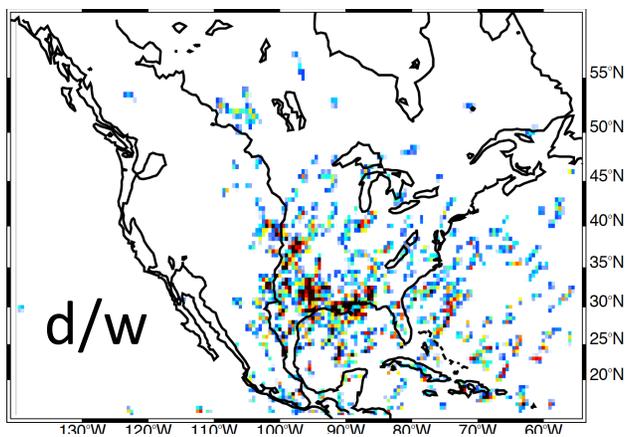
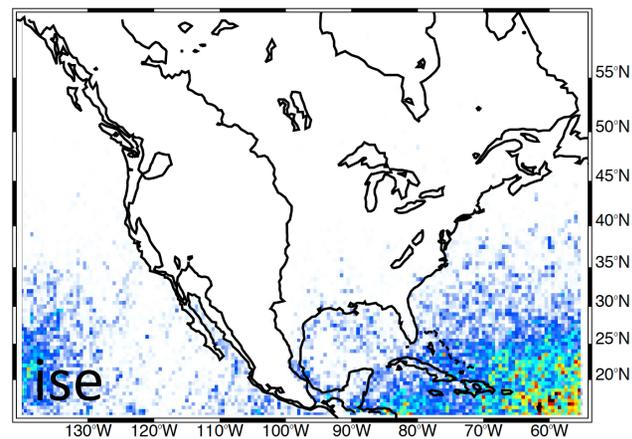
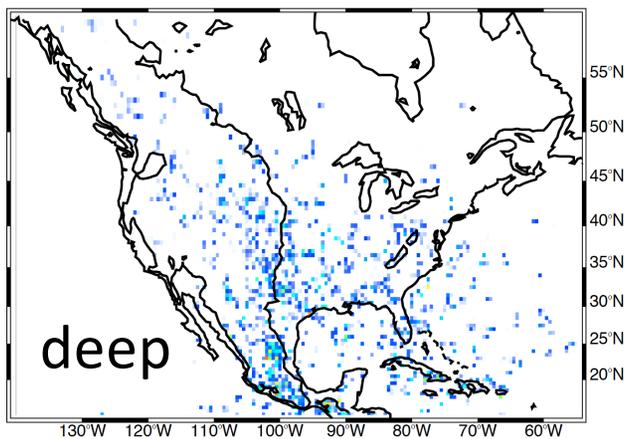
Deep Conv., Wide Conv., & Broad SF

(moderate thresholds)

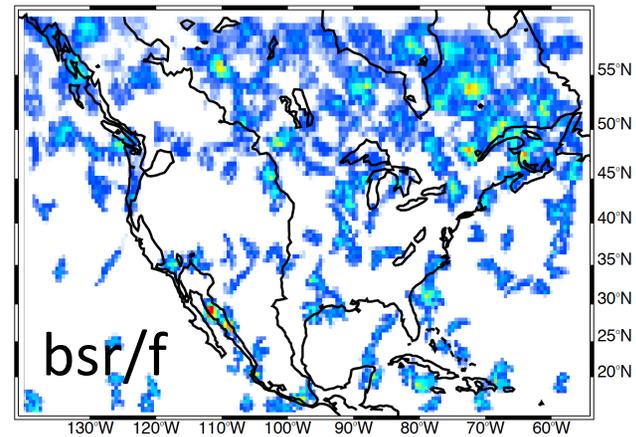
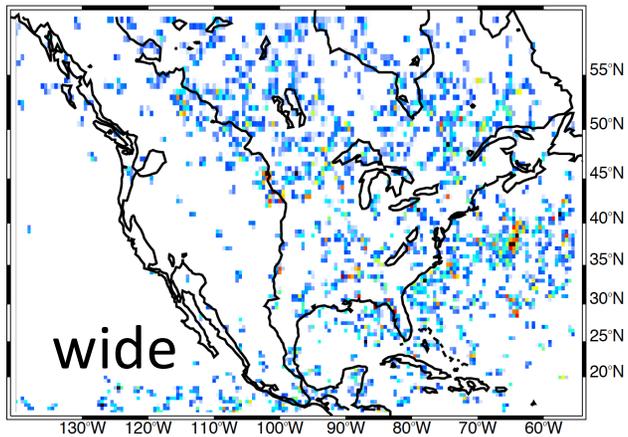
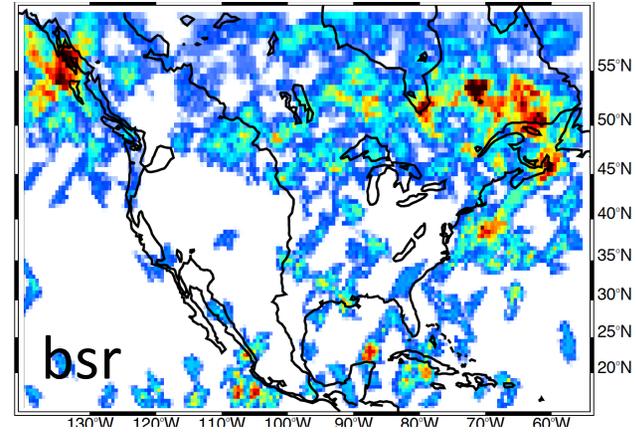
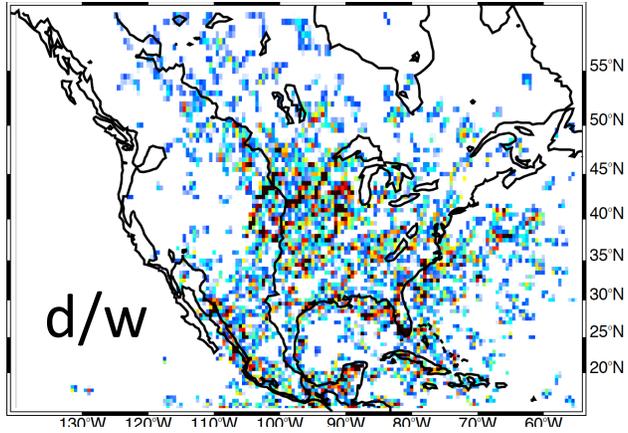
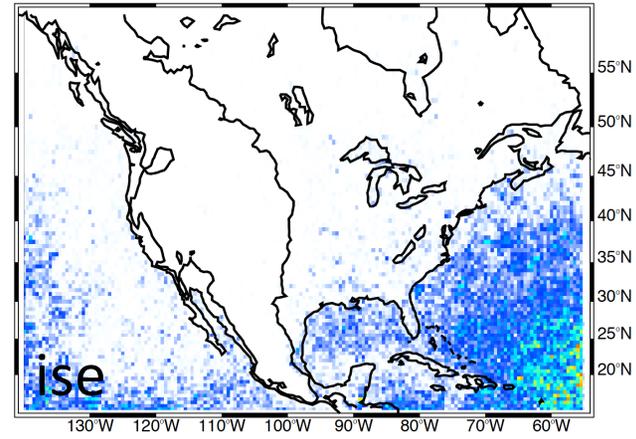
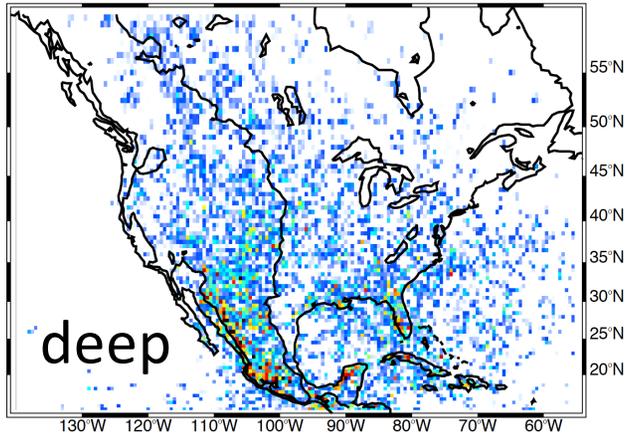
DJF



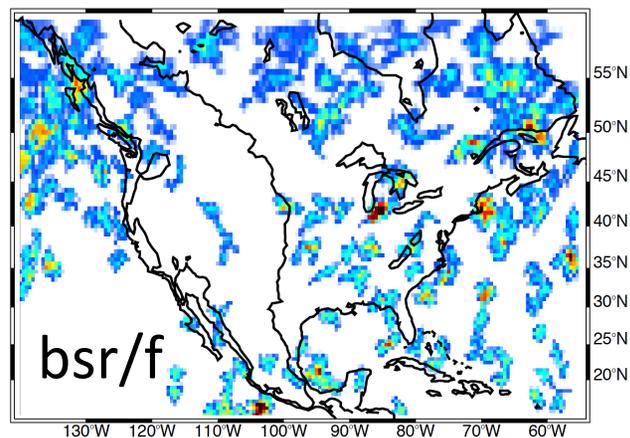
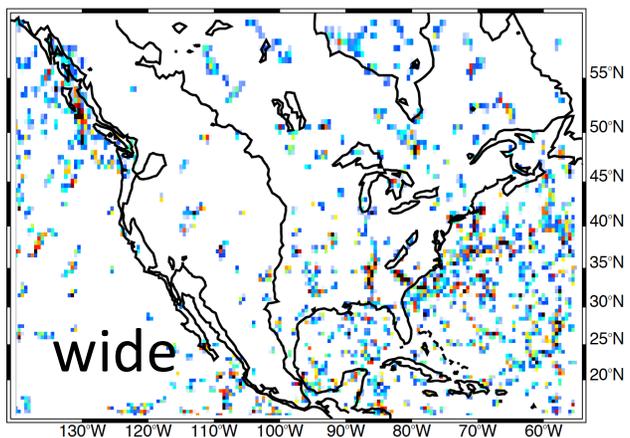
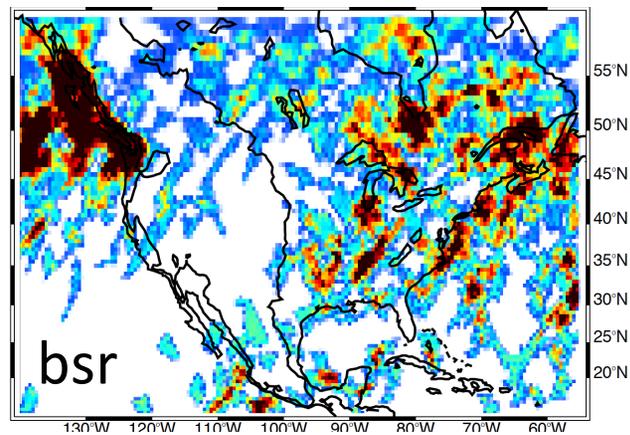
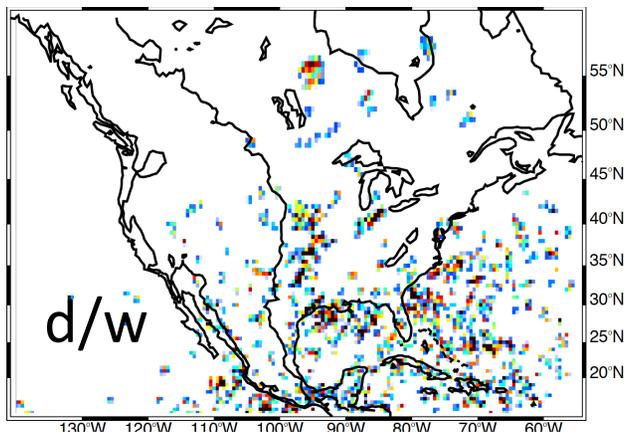
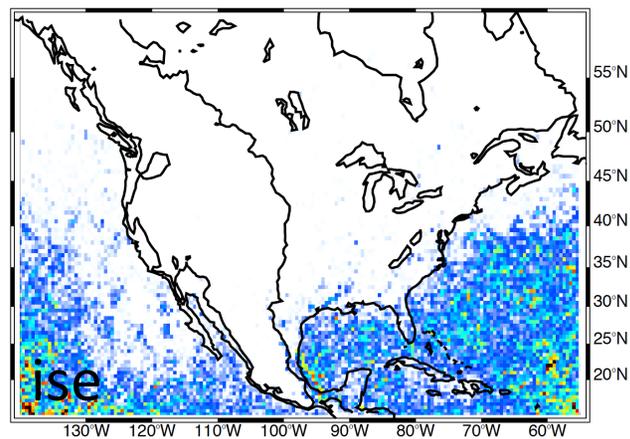
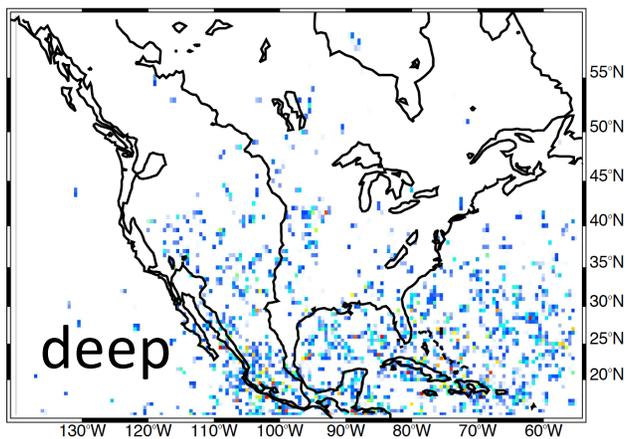
MAM



JJA

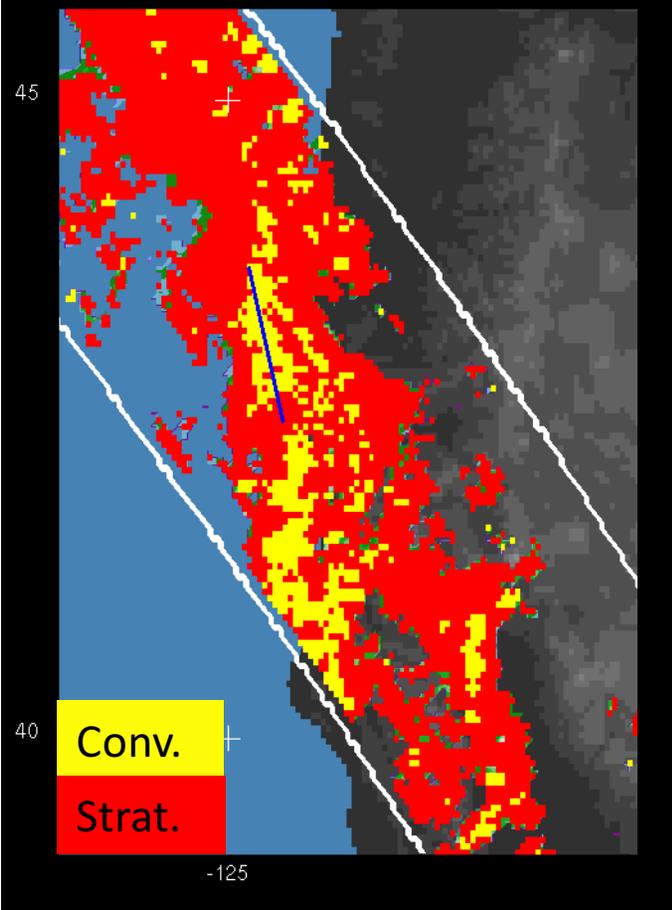


SON

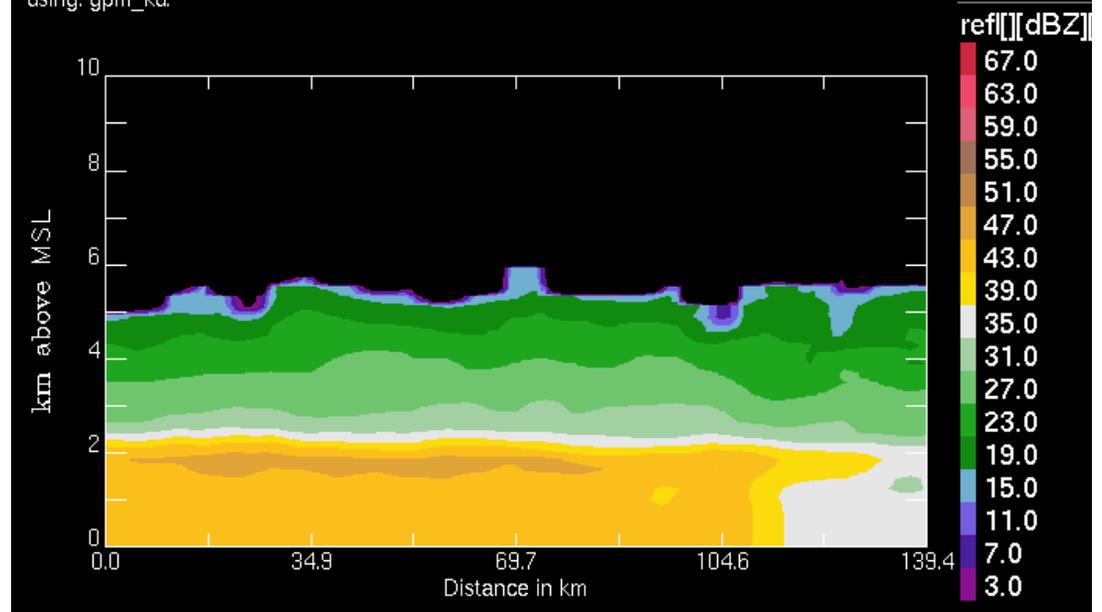


Example of frontal echo identified as convective by GPM algorithm

6-dec-2014,01:47:36 Zebra projection: elev e plot. Gpm_ku swath contour. Gpm_ku refl fi contour. gpm_ku Rain Type plot.



6-dec-2014,01:47:36 Planar cross-section plot. Contour of topo using: topo. Contour of GPM-Ku Reflectivity using: gpm_ku.



Conclusions

1. Seasonal shifting of all categories

- Shallow isolated echoes nearly all over ocean and sort of follow SST
- Frontal BSRs show strong seasonal migration
- WCC formation in the westerly belt, shifting N in summer, & coastlines

2. Mountain and near-mountain convection

- Much deep convective activity directly over mountains—unlike Andes and Himalayas
- Mesoscale development occurs slightly west of Rockies but in a less focused pattern than over Argentina

3. Coastal convection

- Prominent coastal patterns, especially near mountains (Mexico)
- Sea/land breeze pronounced along Gulf Coast (30°N)

4. Stratiform regions

- BSR development from convection is generally weak—as over other landmasses
- Dominated by frontal activity
- Some frontal stratiform misidentified as convective

END

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