Characteristics of extremely bright TGFs and short TGFs from *RHESSI,* and Stacked search for subluminous TGFs

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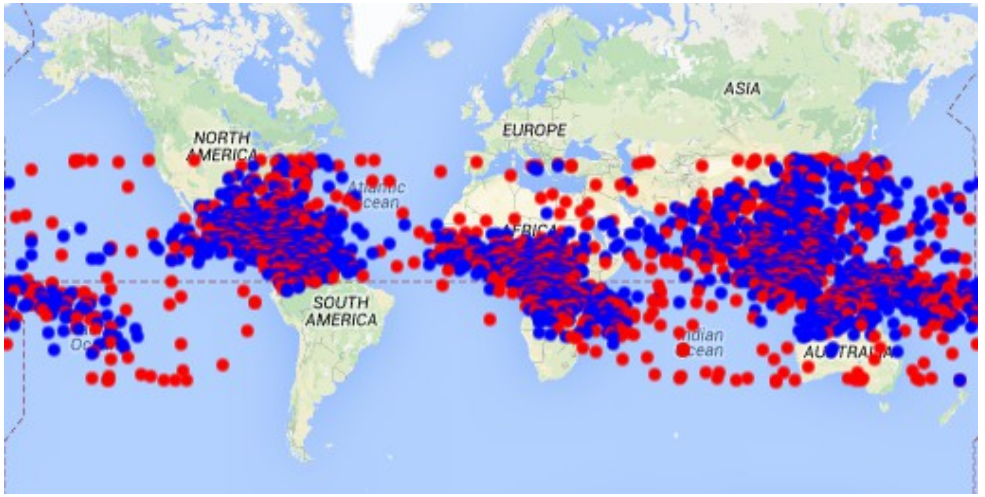
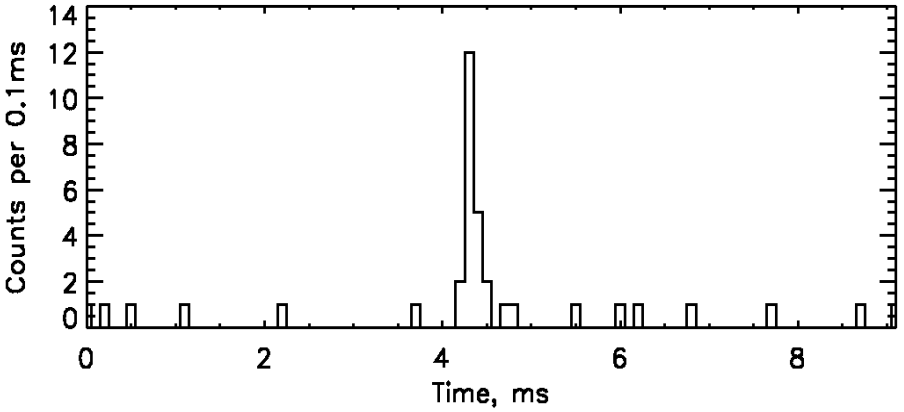
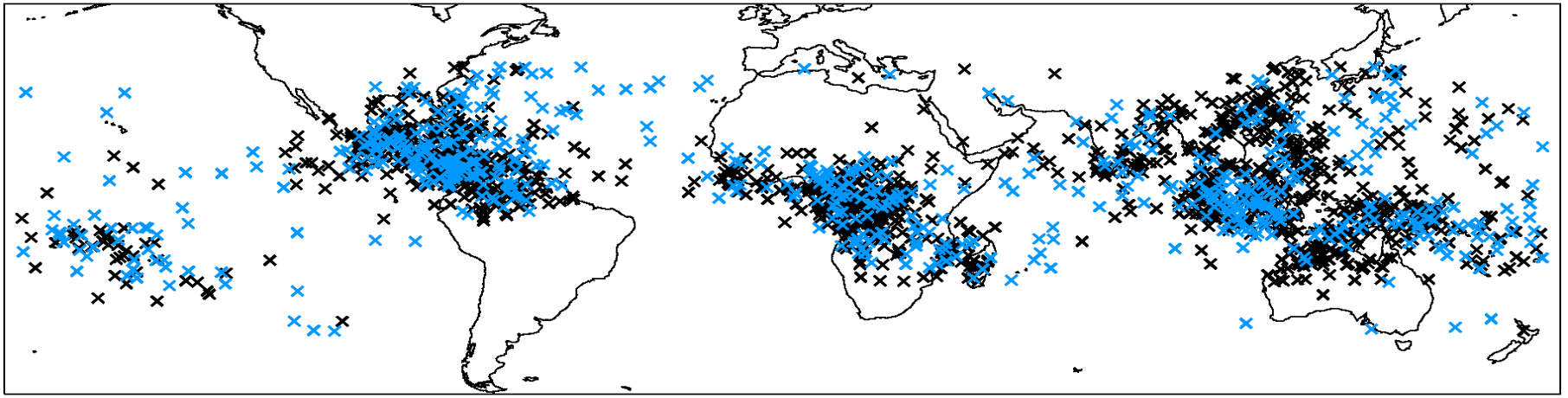
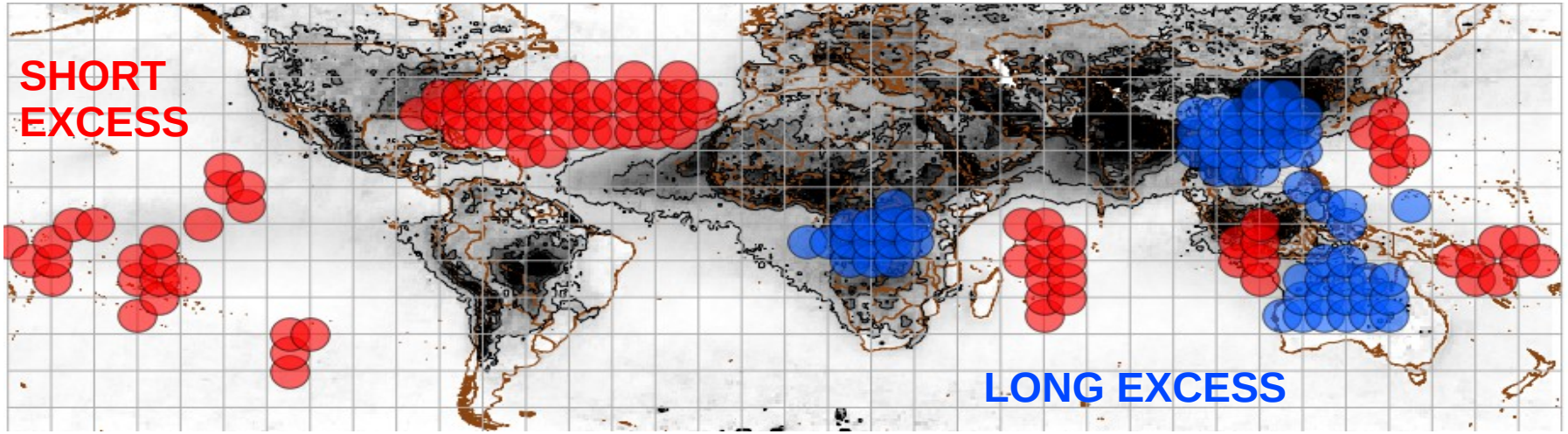




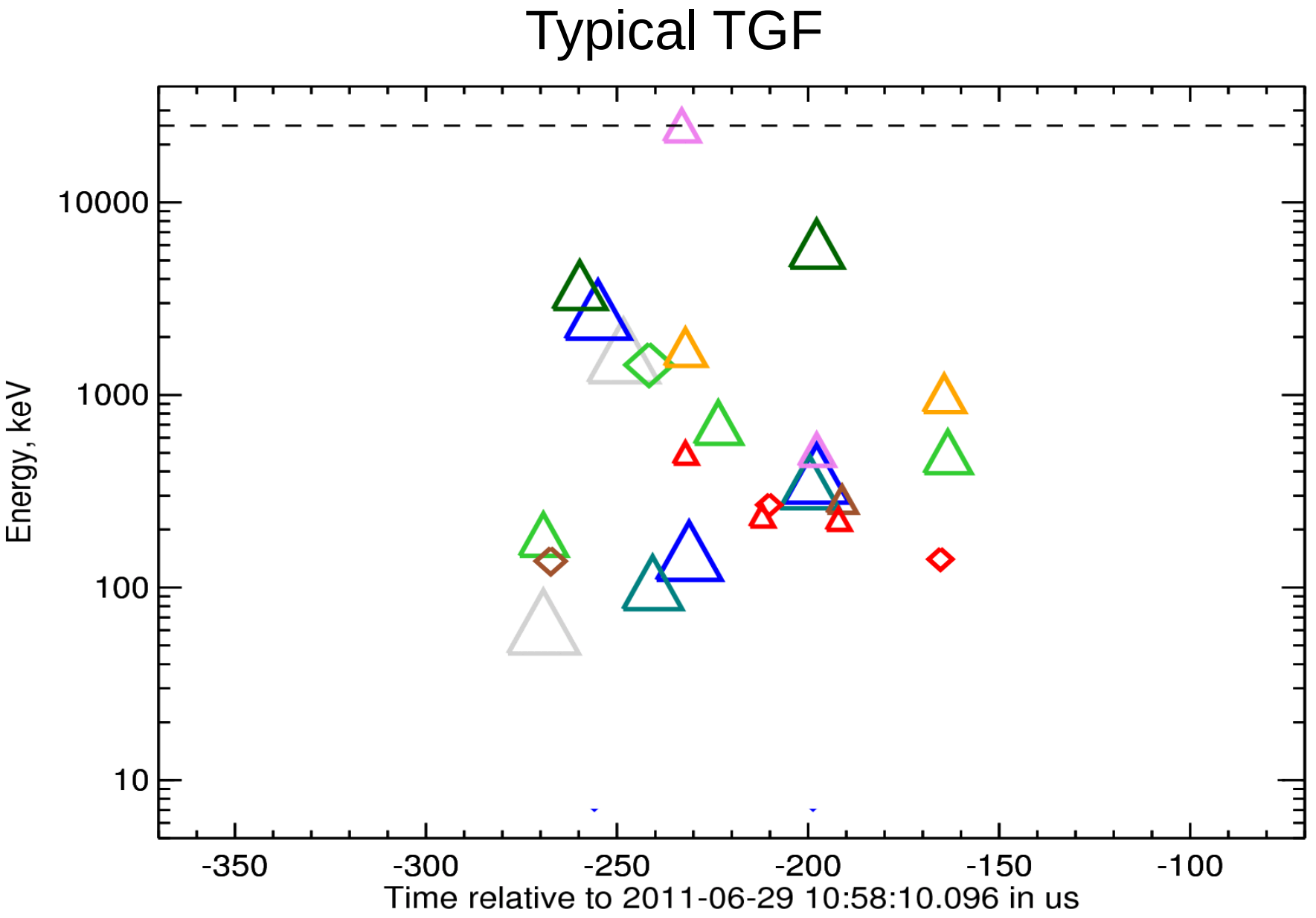
Short TGFs (T_{68} < 50 us) show a population with oceanic bias relative to (T_{68} > 100 us). Is there any connection to higher lightning peak currents of oceanic -CG lightning?

Connaughton et al 2013: Short TGFs have more WWLLN matches Here: (21% +/ 2%) versus (7.6% +/ 0.8%)

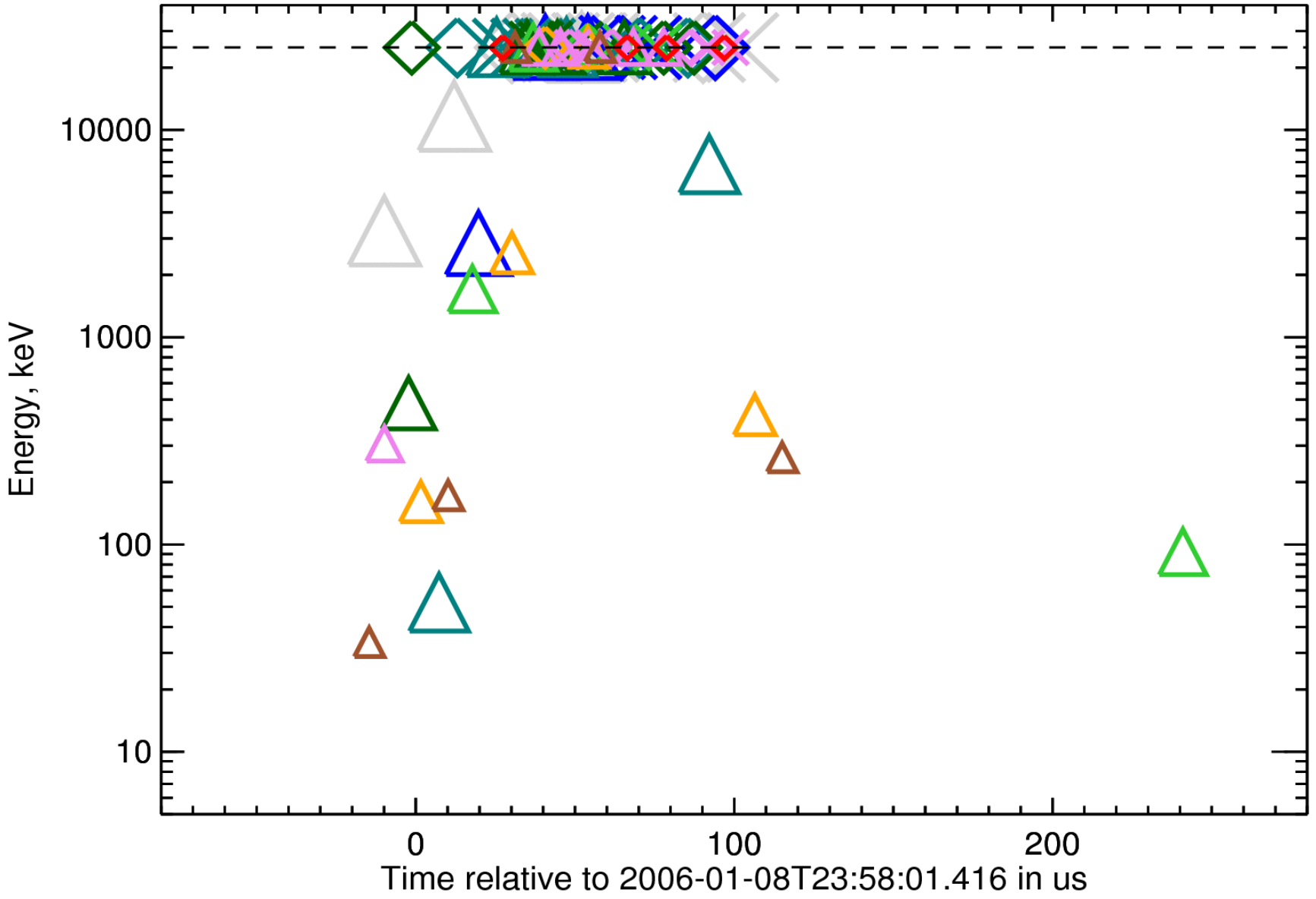




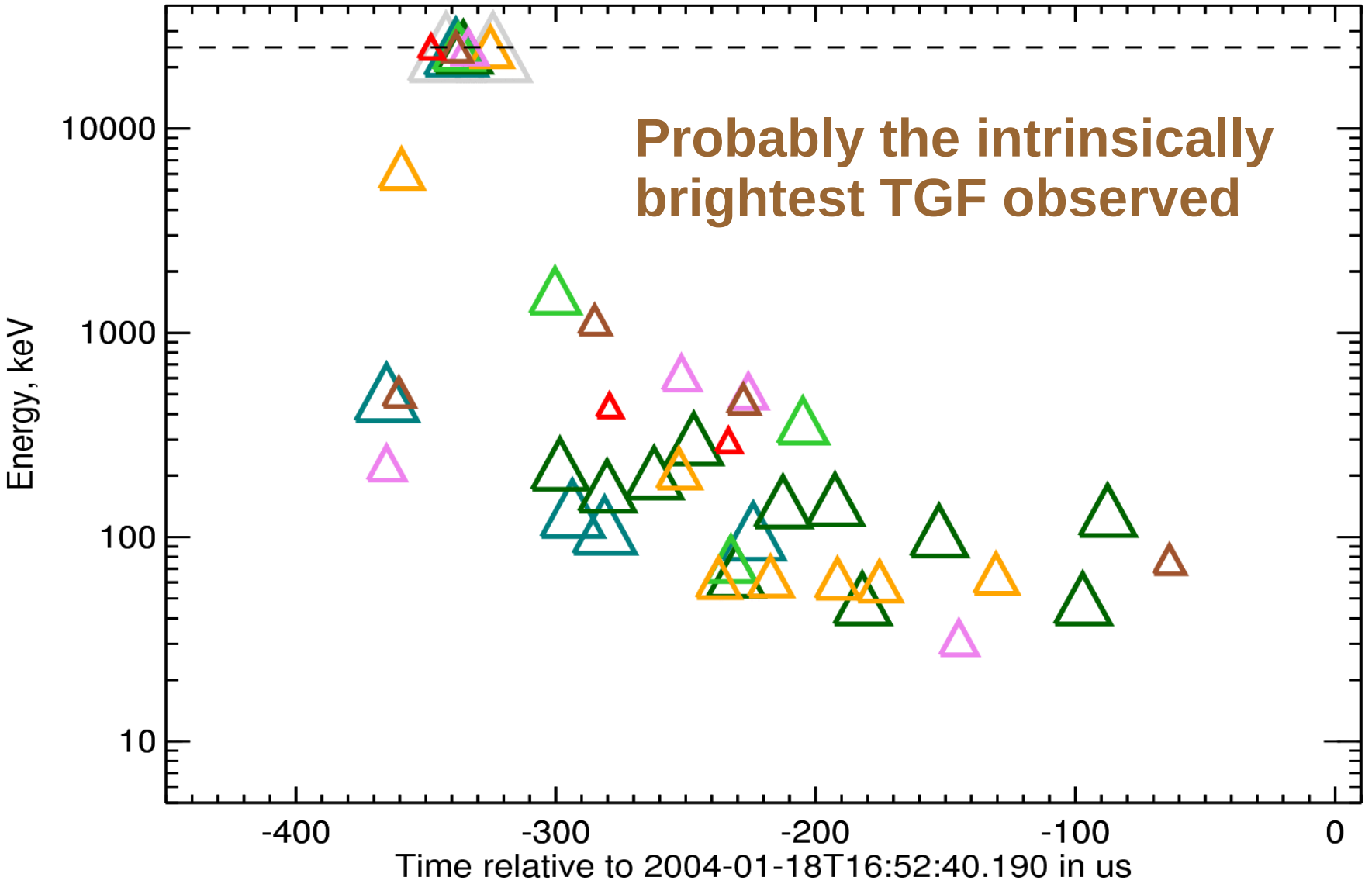
Discovery of (at least) 88 TGFs that saturate *RHESSI*



Longest period of saturation

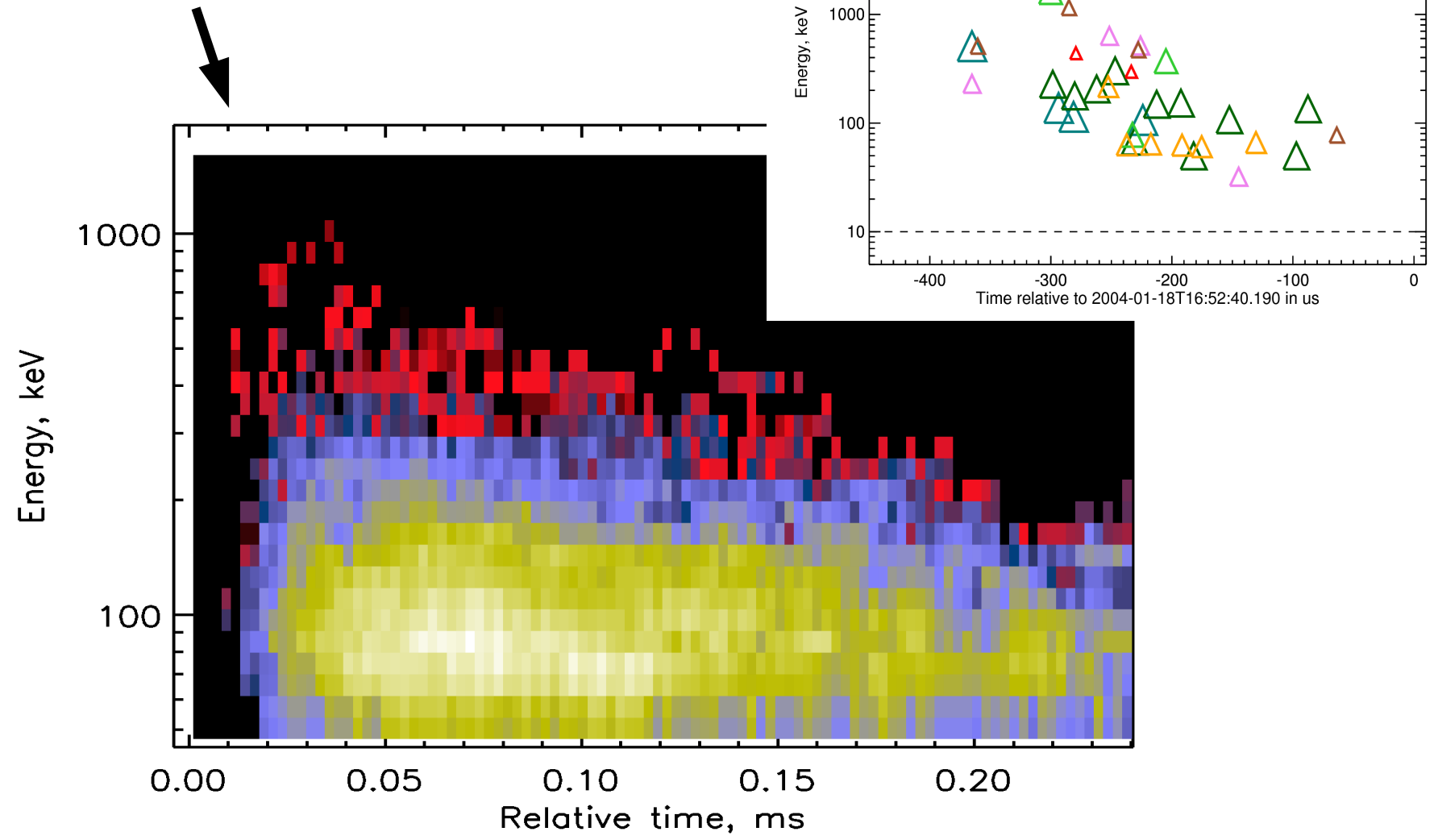


Typical short saturation ----- brightest Compton tail



Deduce brightness from tail

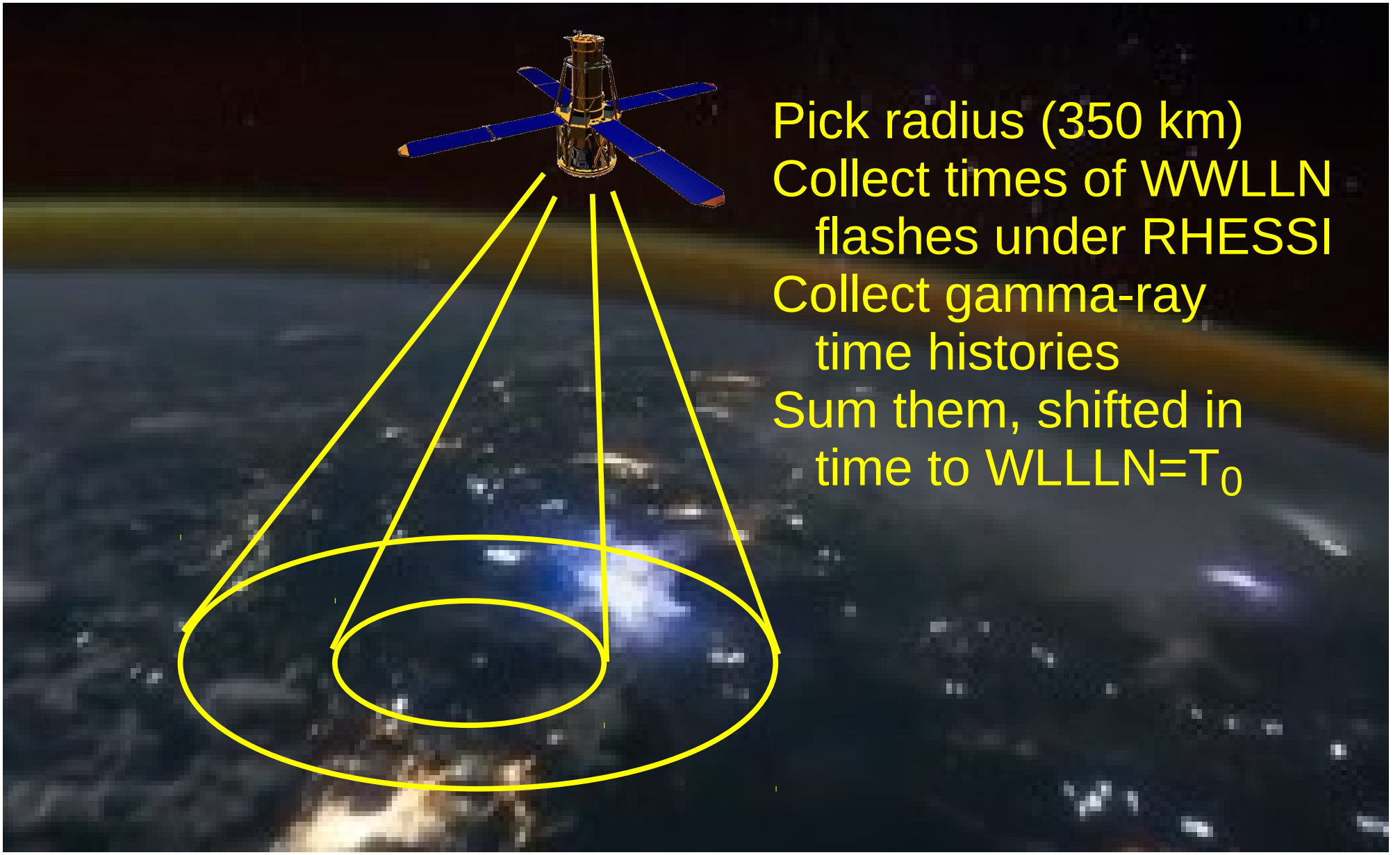
Using simulations of atmospheric scattering and instrument response



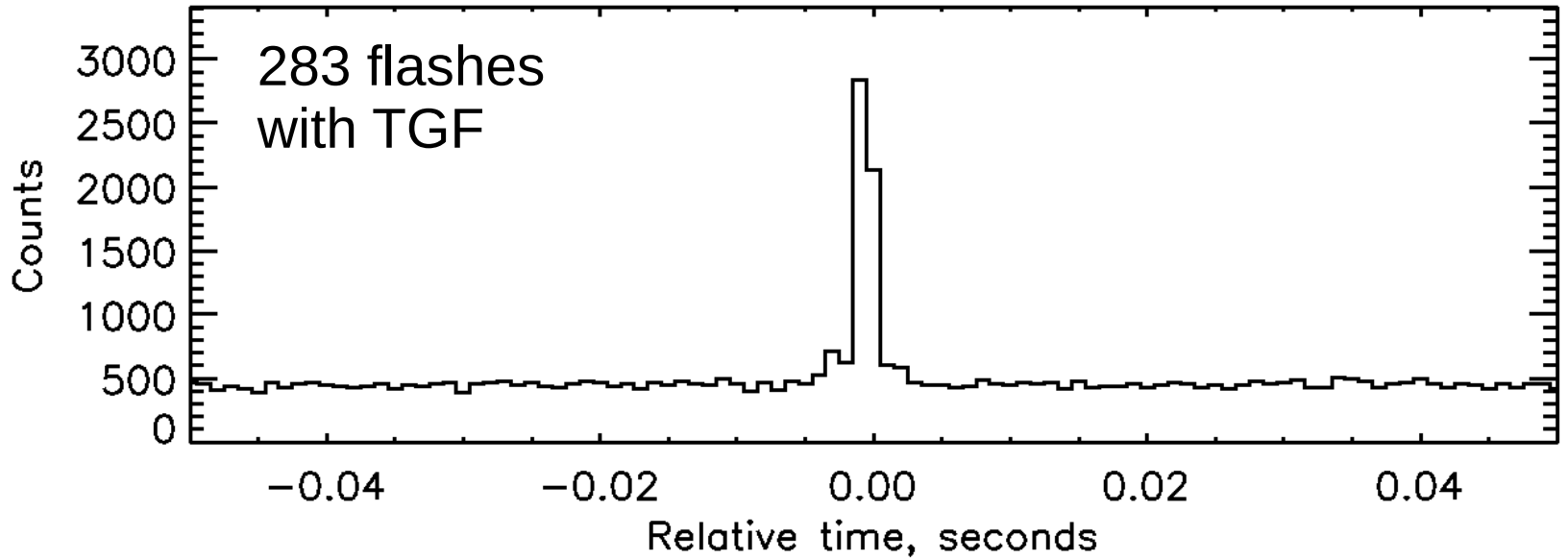
Summary of saturating TGFs

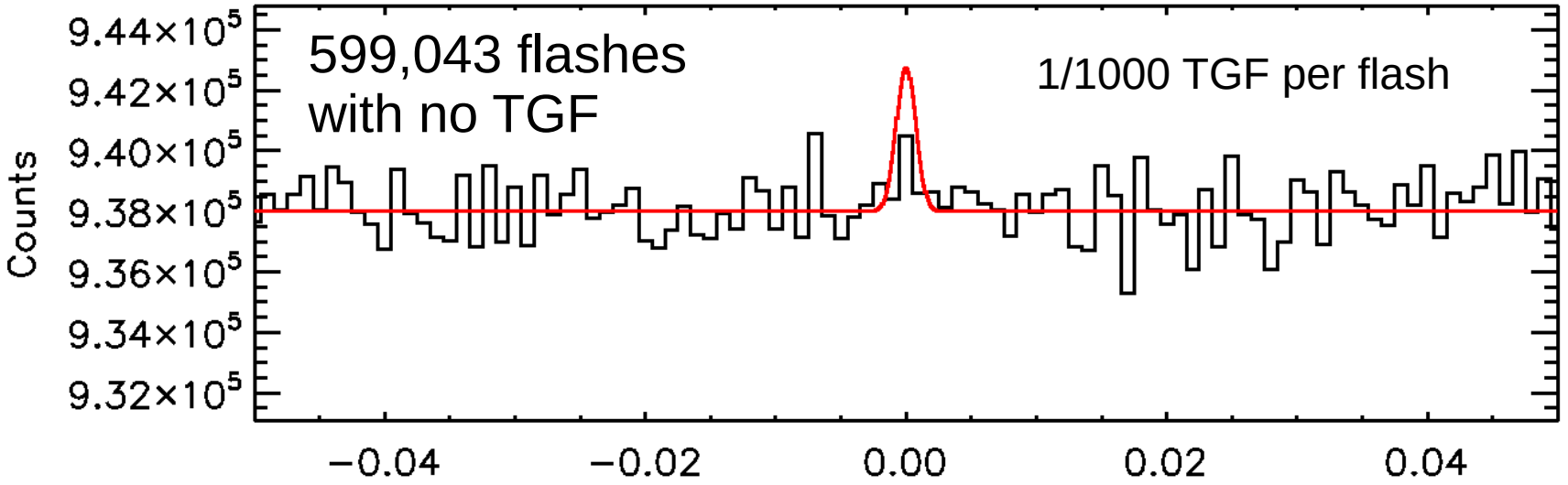
- Compton tail most reliable way to constrain luminosity
- Up to a few x10^{18} runaway electrons (a few MJ)
- A subset of short TGFs
- Hint of oceanic bias as well (to be quantified):

Instead of looking for lightning from triggered TGFs, look for gamma-ray signature from WWLLN lightning below RHESSI

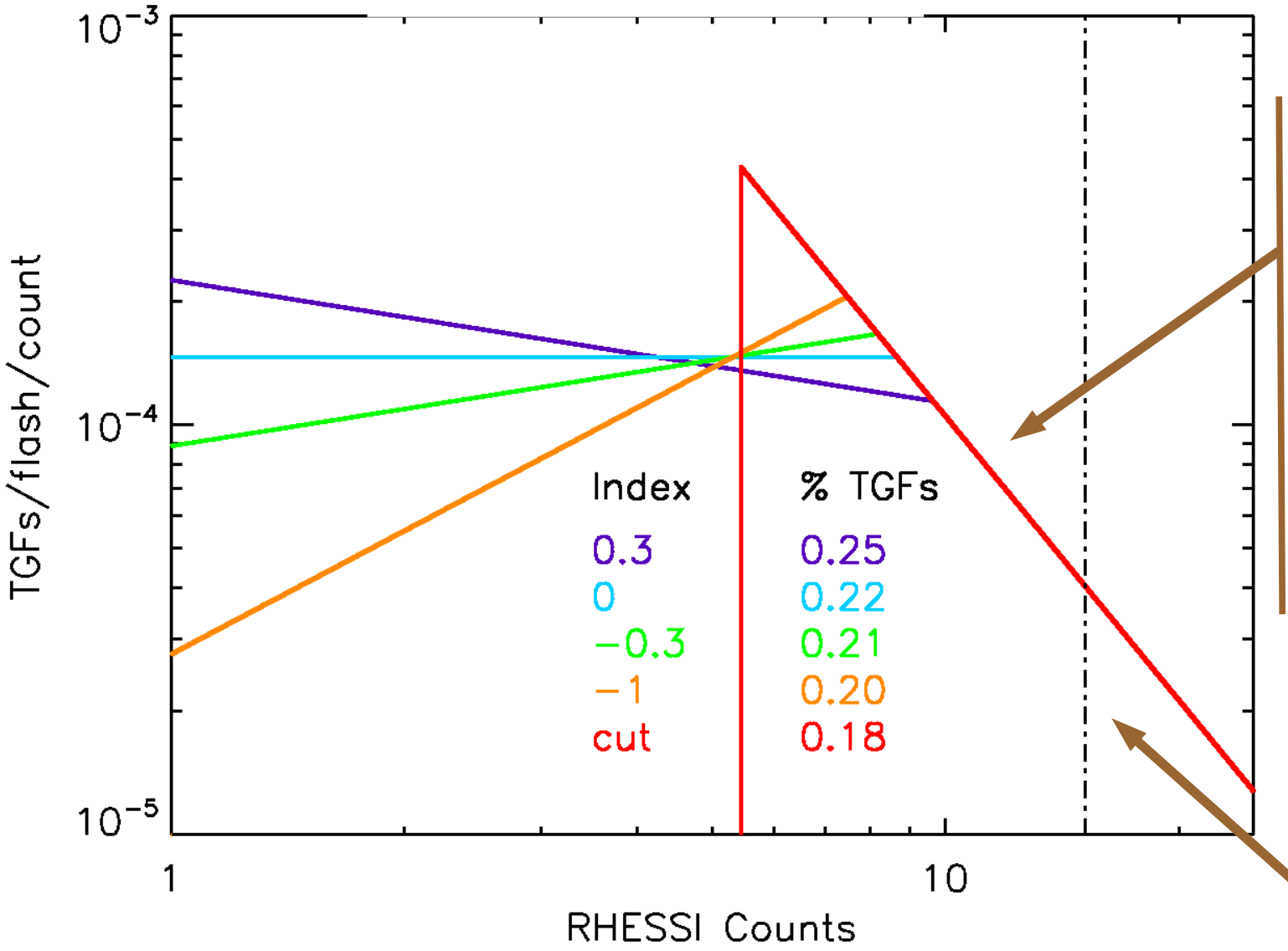


Within 350km





Models of brightness distribution of TGFs



Index -2.3 from Ostgaard et al. (2012)

Normalization from 283 TGFs matching WWLLN flashes

Approx. trigger level

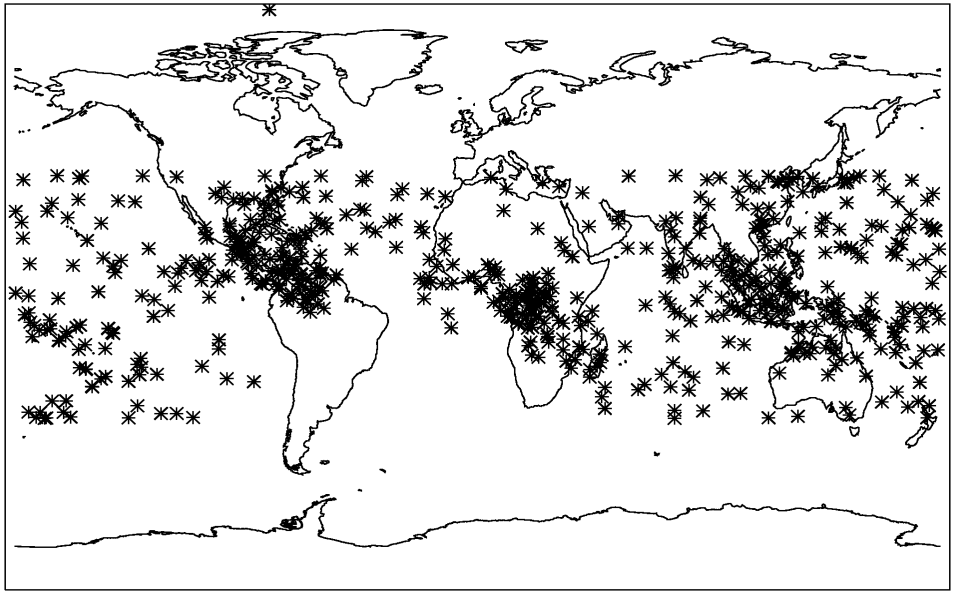
TGF distribution does not extend far below what we already see!

Toward an optimized *RHESSI* TGF Catalog

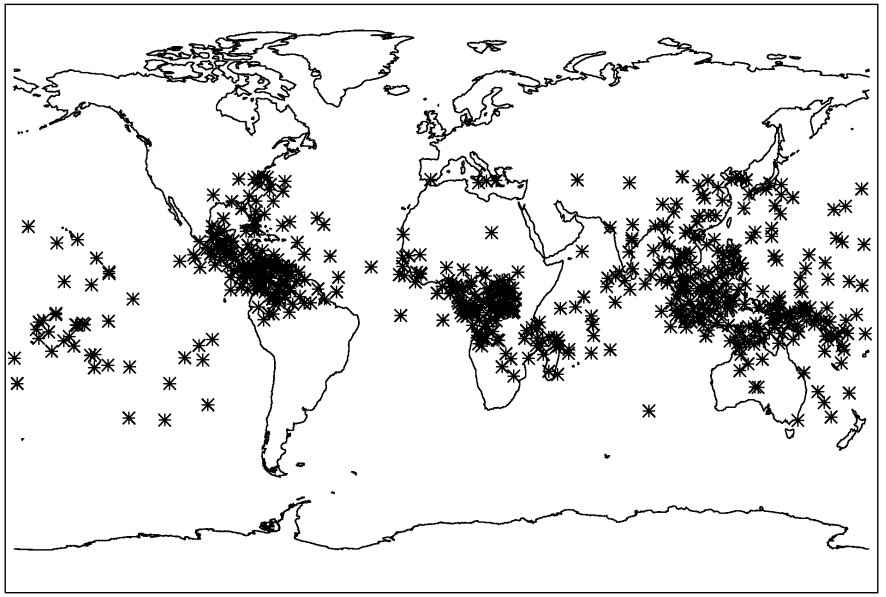
2nd *RHESSI* Catalog (T. Gjesteland, N. Ostgaard, U. Bergen)
3rd Catalog (UCSC)

Goal: > 5000 TGF identifications with < 5% false positives

"Bergen not UCSC"



"UCSC not Bergen"



Conclusions

- Short TGFs favor oceans relative to other TGFs
- Short TGFs are more likely to match WWLLN sferics (confirmation of *Fermi* result, Connaughton et al. 2012)
- The brightest TGFs appear to be members of the short class, and can be several times brighter than previously known (> a few MJ)
- Most lightning does not contain a TGF on the low end of a continuous distribution joining that of known TGFs
- The RHESSI TGF catalog can still be made bigger and remain clean by further reanalysis

Thanks! Please see the “beta” version of the 3rd RHESSI catalog at:
http://scipp.pbsci.ucsc.edu/rhessi/