Log N-log S studies of EGRET sources

...but it's not about: luminosity functions, redshift distributions

Why should we care about number-flux relations?

A standard tool in observational astronomy:

$$S = \frac{L_0}{4\pi R^2} \qquad N(>S) = \frac{4\pi}{3}\rho R^3 = kS^{-3/2}$$

Euklidean distribution
no evolution

- diagnosis of known source populations:
  spatial distributions, completeness/deficits
- assessment of unidentified and unresolved sources;
  unresolved sources -> background contributions
- cosmological evolution studies

and before all that: detectabilty studies

The scarce use of logN - logS for EGRET data:

Application for high-latitude unidentified sources (Özel & Thompson 1996)

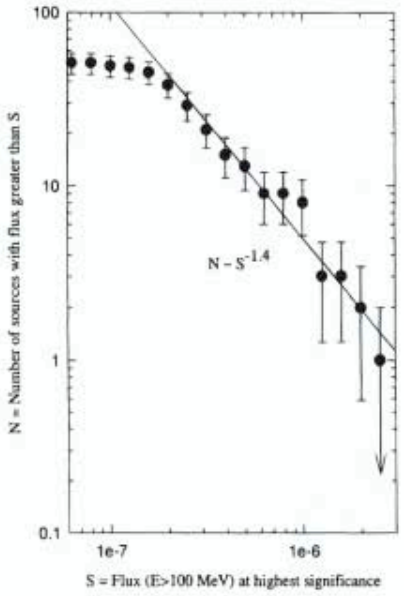


FIG. 5.—Plot of log N vs. log S for EGRET-detected AGNs.

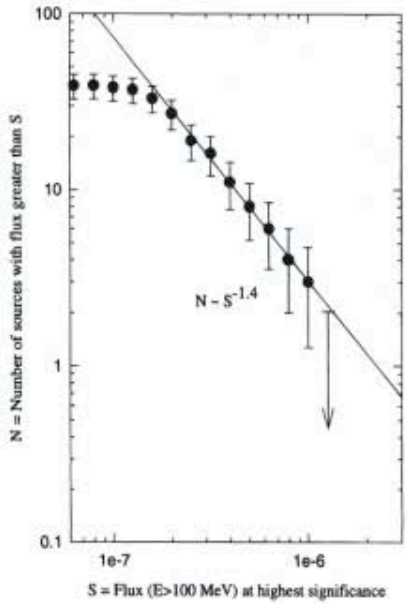


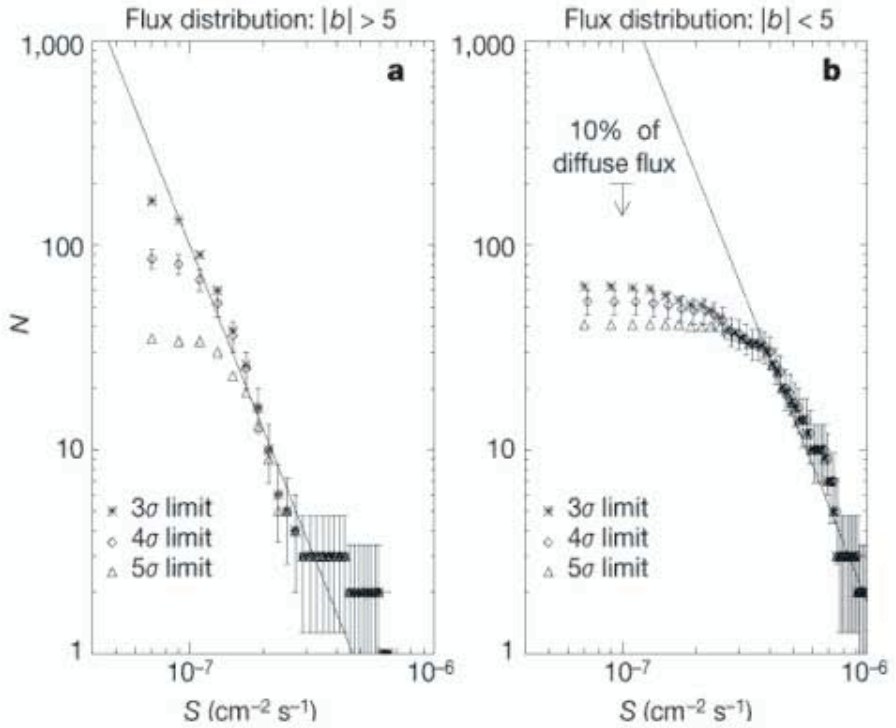
FIG. 6.—Plot of log N vs. log S for unidentified EGRET sources with $|b| > 10°$.

The plot is completely consistent with that of the AGNs, indicating that the source population is largely drawn from an isotropic distribution. The only difference between the AGNs and the unidentified sources is that the AGN distribution extends to higher flux levels, although the number of sources involved is small enough that the difference is not significant.

Application for blazar contribution (FSRQ, BL Lac) to EGRB (Mücke & Pohl 2000)

The scarce use of logN -logS for EGRET data:

Application for galactic unidentified sources (Gehrels et al. 2000)



unidentified steady EGRET sources (3σ, 4σ and 5σ)

(a) 5° < |b| < 30° Galactic latitude
(b) |b| < 5°

best-fit power law (index = -2.9± 0.7) to the |b| > 5° data

The upper limit in b gives the approximate maximum number of unresolved point sources that could be hidden in the diffuse flux from the region.

The |b| < 5° sources have a logN–logS function shape that is clearly different from those at |b| > 5°.

Where's that coming from?

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ICRC 2001

LogN–LogS Studies of EGRET Sources

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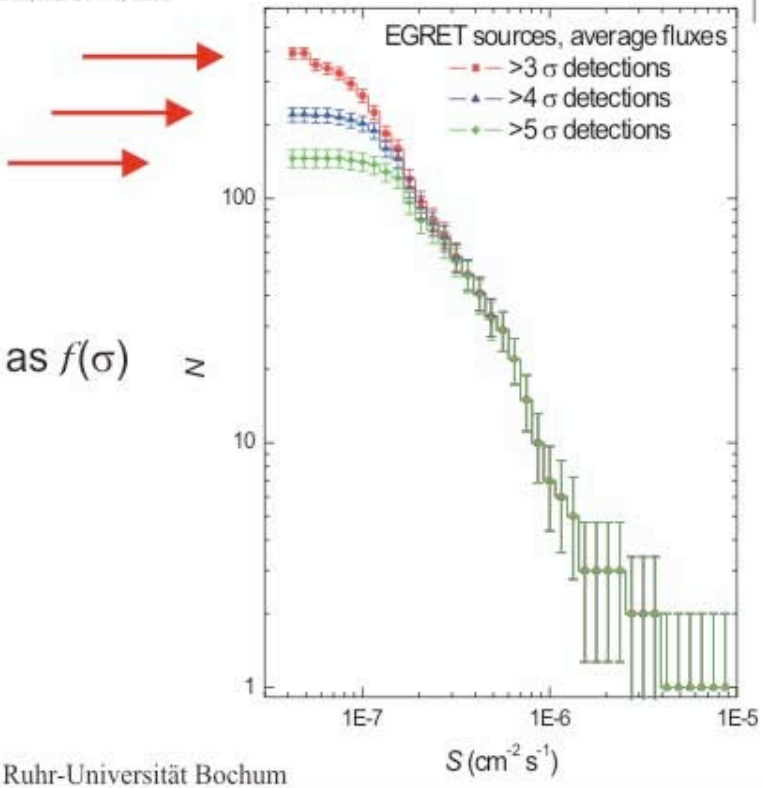
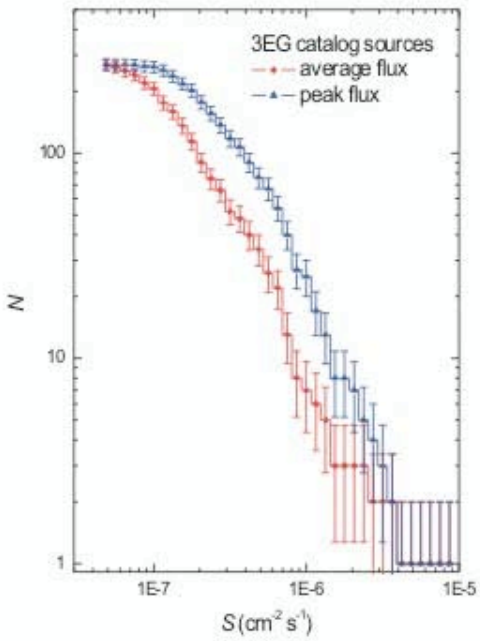
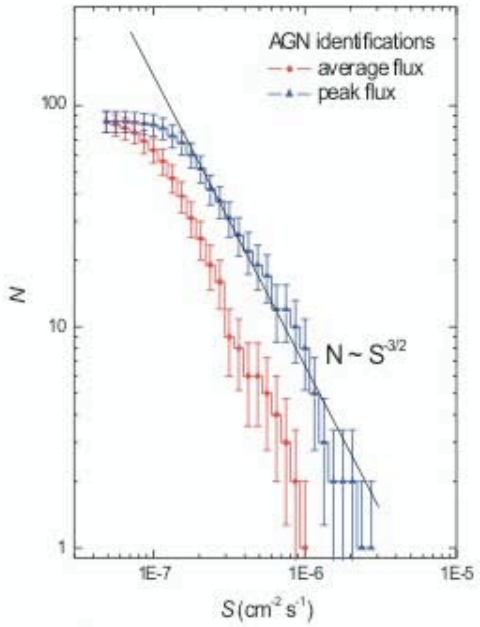
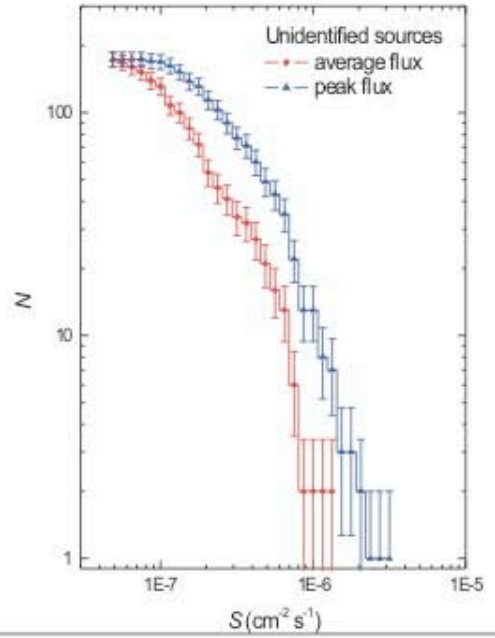
EGRET:
completeness as $f(\sigma)$



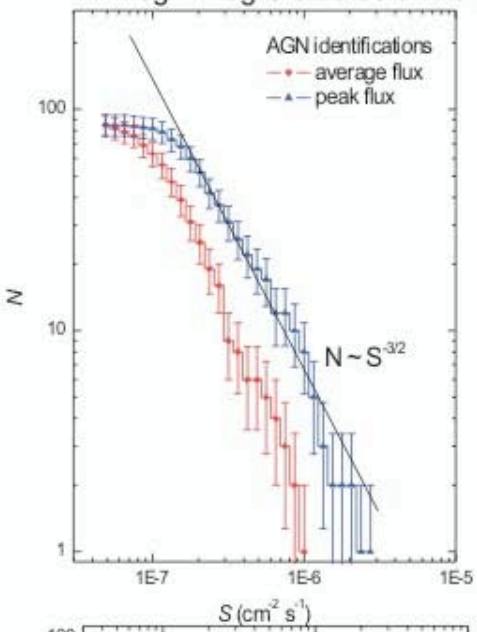
... which flux ?

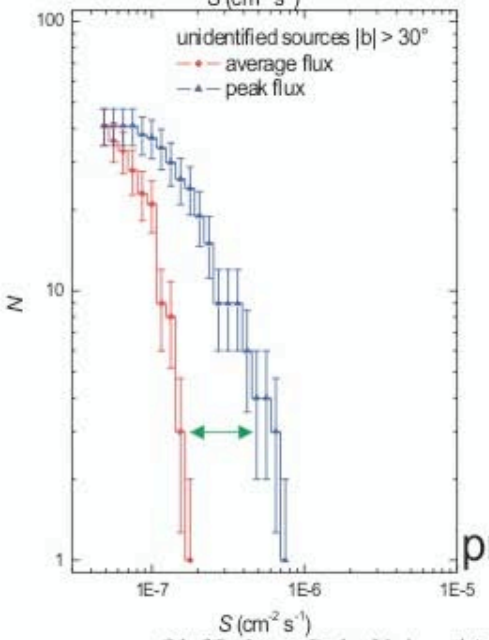

3EG catalog sources
average flux
peak flux
100
10
1
N
1E-7
1E-6
1E-5
S(cm-2 s-1)


AGN identifications
average flux
peak flux
100
10
1
N
N ~ S-3/2
1E-7
1E-6
1E-5
S(cm-2 s-1)

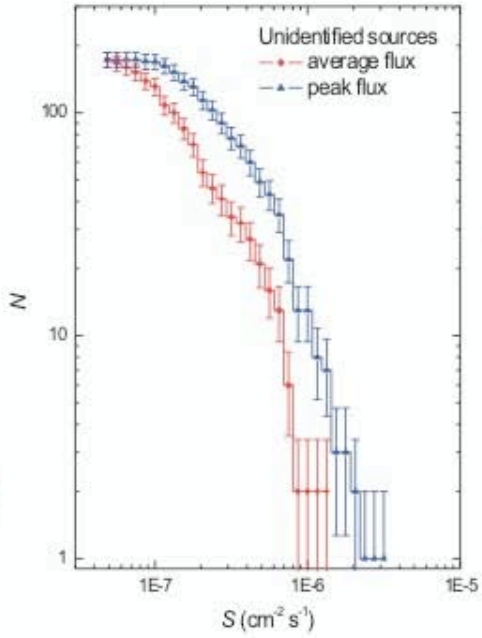

Unidentified sources
average flux
peak flux
100
10
1
N
1E-7
1E-6
1E-5
S(cm-2 s-1)

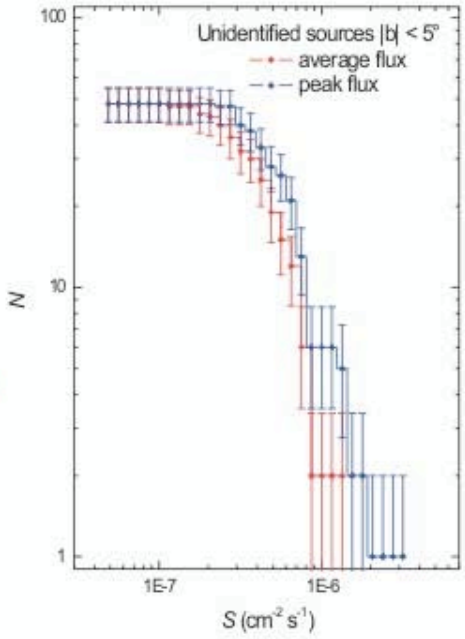
Log N- log S studies of EGRET sources





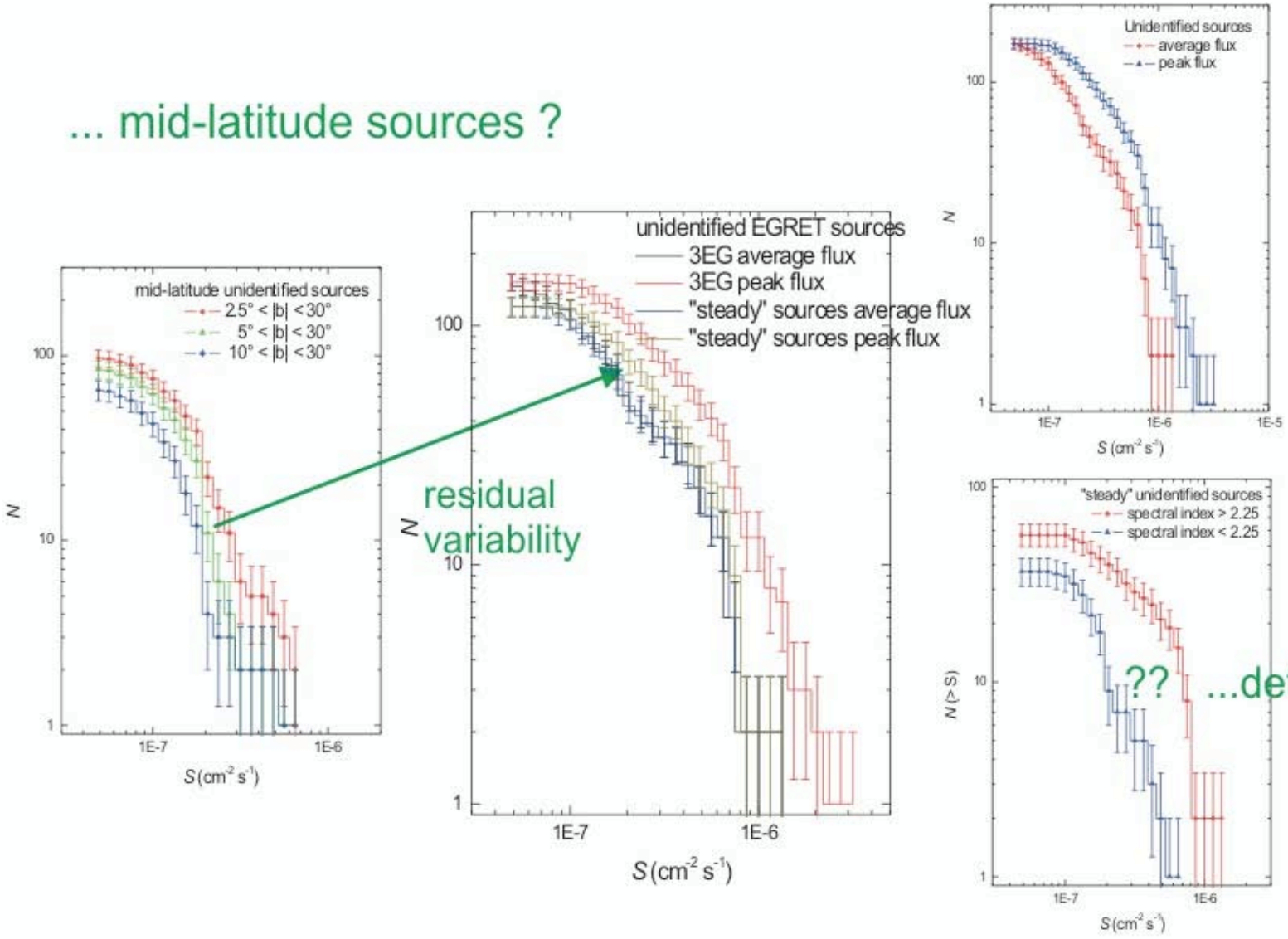
AGN <-> high latitude unid ?





preferential source detection by peak flux -> variability -> source IDs

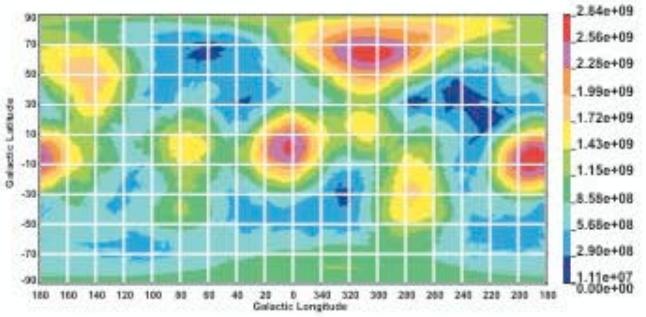
... mid-latitude sources ?



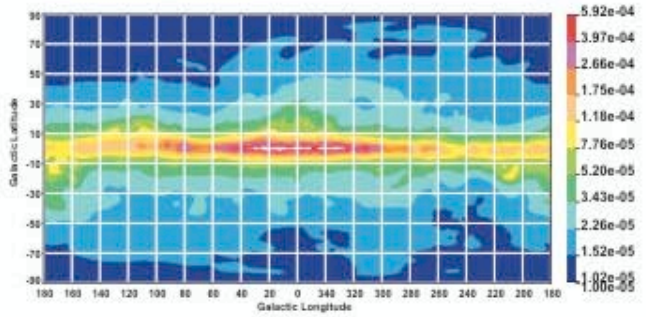
significance of detection for an isolated source (Mattox et al.1996)

$$S \propto F\, E^{1/2}\, B^{-1/2}$$

Exposure: P1-4, <30° off-axis angle

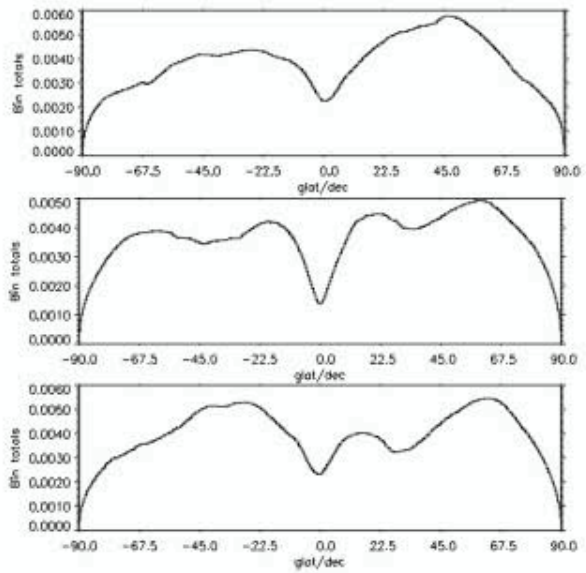


Diffuse background:
EGRET: (Hunter et al. 1997)



"detectability"

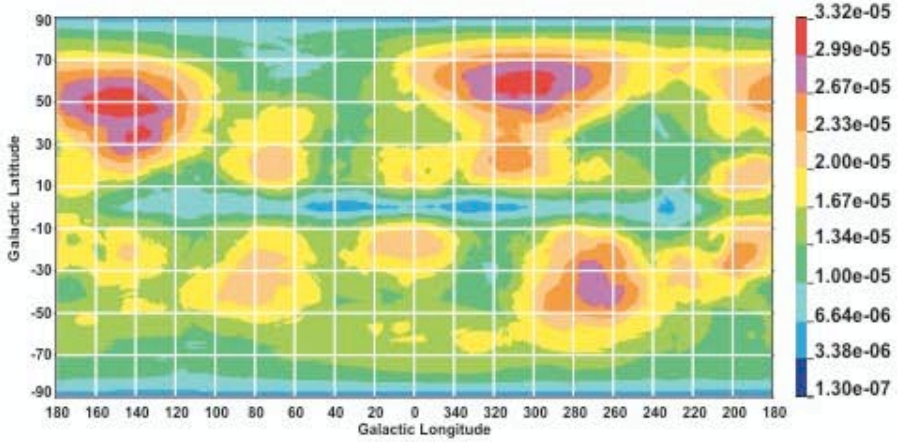
(E > 100 MeV, P1-4)
-> for 3EG catalog

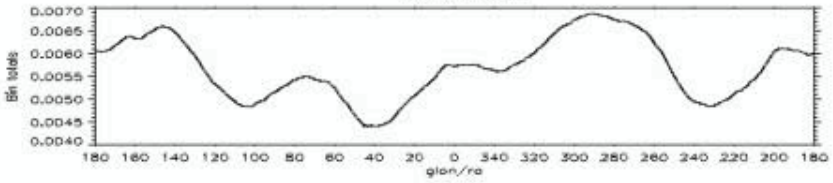


60° ... 180°:

-60°... 60°:

-60° ... -180°:





DETECTABILITY ISSUES DOMINATE logN-logS results!

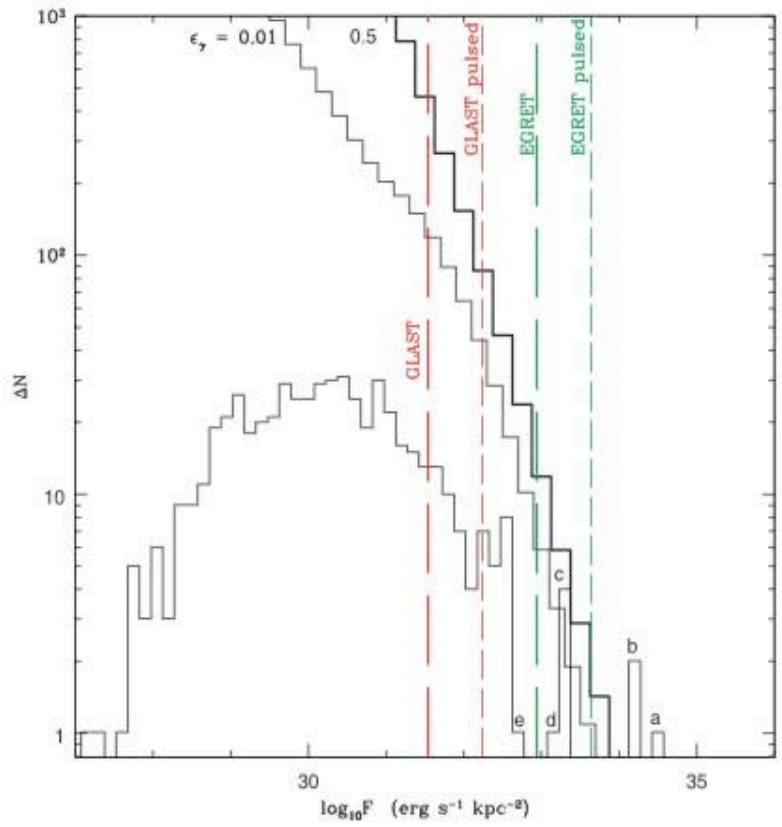
a factor of **TEN** in detectability as f(l,b)

-> logN-logS studies: determination at levels of comparable detectabilty necessary
-> especially inconclusive for comparison of populations at contrary detectabilty,
i.e. high-lat vs. low-lat source, hard spectrum sources vs. soft spectrum sources

what's left ?

predictions utilizing logN-logS

McLaughlin 2000



Tom Willis, PhD thesis ...