Some remarks about calibrator counts around 100 GHz

The ATNF recently published a nearly complete southern-sky (dec < 0d) survey at 20GHz

http://www.atnf.csiro.au/research/AT20G/

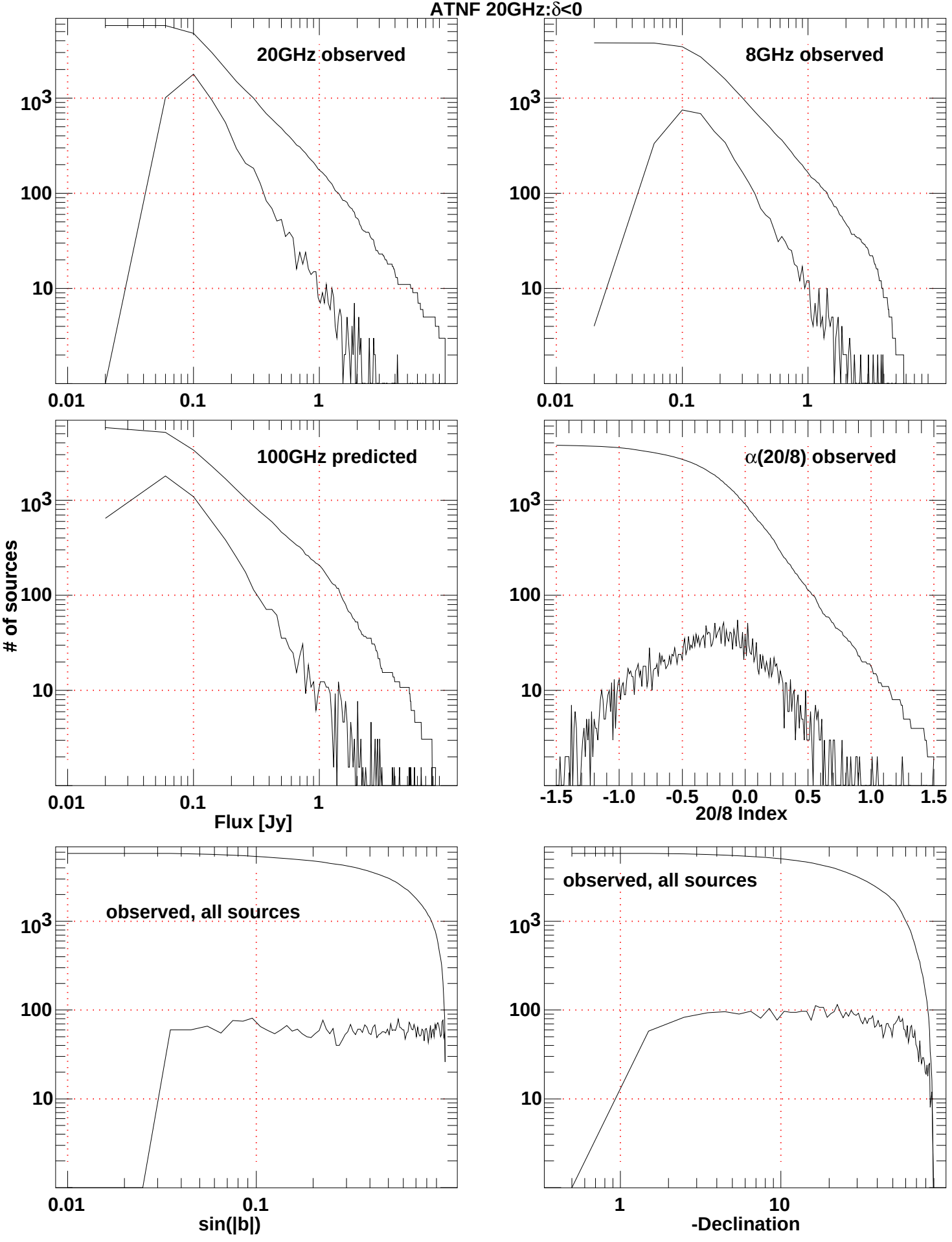
The survey comprises some 5900 compact sources observed at 20 GHz, of which about half were also observed at 8 GHz. There are some caveats: the full survey at dec < 0 d is limited to |b| > 1.5d and lacks complete coverage above -15d. Below that the 20GHz survey is estimated by its authors to be 91% complete at 100 mJy and 75% at 50 mJy. Given my previous experience at finding northern 100 GHz sources in the Ku band (14.5GHz) VLA calibrator list circa 1990 (for the absorption studies that Robert Lucas and I made at the PdBI), it is likely that the great majority of 100 GHz ALMA calibrator sources are represented in the ATNF's 20 GHz survey.

Some statistics derived from the AT20G are shown here. The first page of figures shows the partial and cumulative source count, spectral index and galactic latitude distributions for the full survey: the 100 GHz source count distributions were created by extrapolating the observed 20GHz/8GHz spectral indices (in detail: what is plotted for 100 GHz is the extrapolation for the smaller number of sources observed at 20GHz and 8GHz, scaled up in number to the total 20 GHz source count). The second page of figures is a slightly different version. On that page, only the more complete survey data at dec < -15d are used and the source counts etc are scaled up by the fraction of southern sky at dec < -15d. Overlaying the two pages shows slightly higher source counts on the second page because it nominally includes the entire southern sky at b < 0d including the narrow band at around the galactic equator that is absent from the whole survey. Neither page contains any explicit correction for completeness in flux.

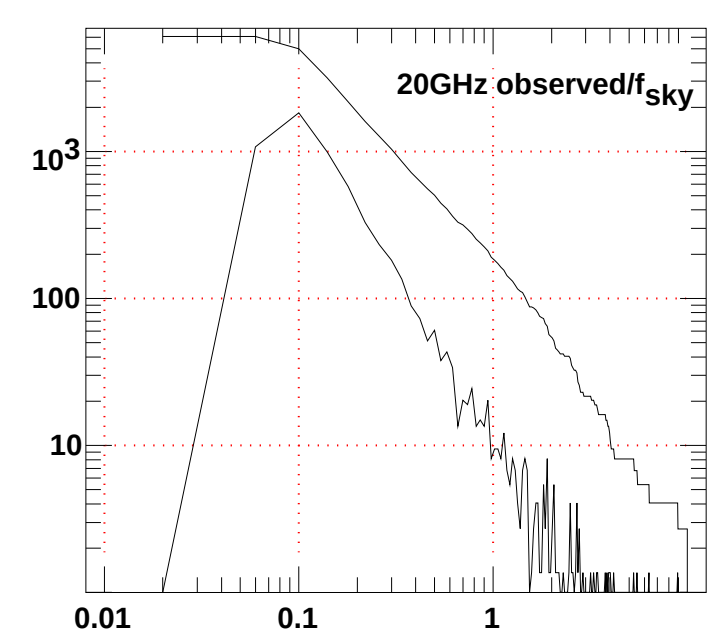
The 20 GHz source counts above 100 mJy are slightly steeper than 1/flux^2 and only slightly steeper than at 8 GHz. As a result the extrapolated 100 GHz source counts also vary approximately as 1/flux^2. On the whole, the source counts agree pretty well with the size of the strong source lists that currently exist in the North. For instance, about 200 sources are predicted to have S>1Jy in the southern sky; at 100 mJy, there should be about 4000 sources. About ¼ of the observed sources have flat or rising 20 GHz/8 GHz spectral indices.

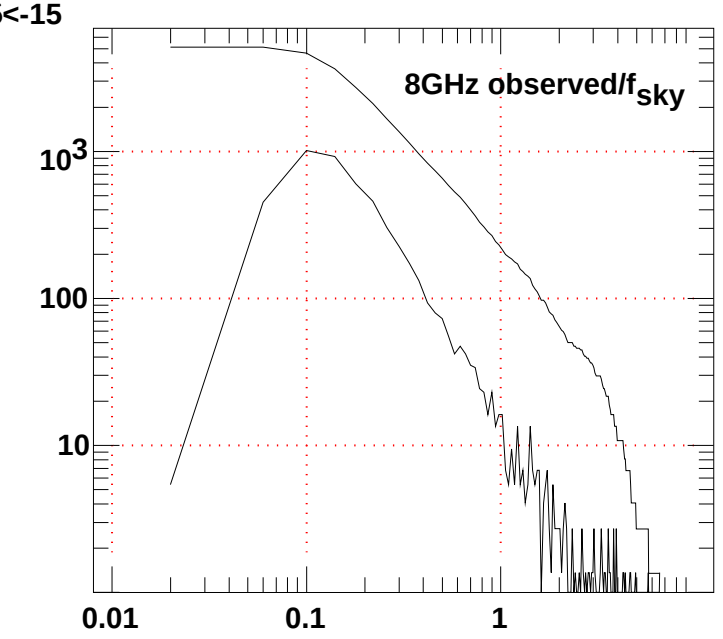
A third page of figures shows some statistics for southern (dec < 0d) sources in the ALMA calibrator list in sourceCatalog.py. That has about 70 southern sources with > 1 Jy flux, perhaps 1/3 of the expected total, but only a very small fraction of the source count expected for 0.3 Jy. Two-thirds of all the ALMA calibrators can be found among the sources predicted to be above 300 mJy at 100 GHz in the ATNF survey. Curiously, the ratio of predicted and tabulated ALMA fluxes for common sources is 1.0 +/- 0.6. The ATNF and ALMA positions differ by up to nearly 1".

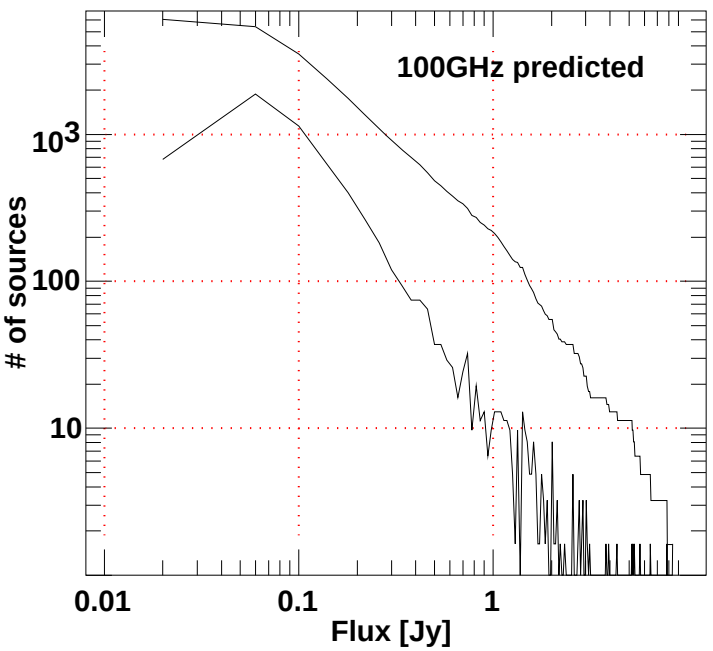
Bottom line: when ALMA needs more calibrators or calibrator positions, the ATNF 20GHz survey will be a useful resource.

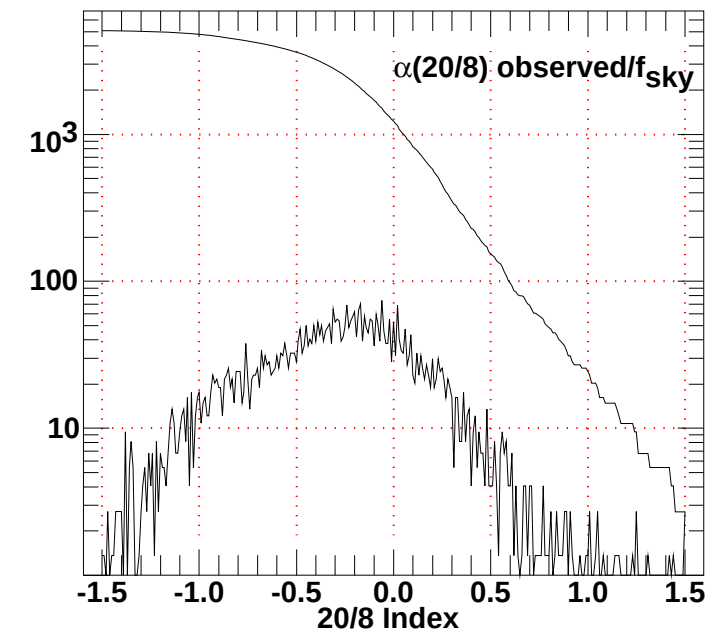

ATNF 20GHz:δ<0
20GHz observed
8GHz observed
100GHz predicted
α(20/8) observed
observed, all sources
observed, all sources
# of sources
Flux [Jy]
20/8 Index
sin(|b|)
-Declination
10
100
10^3
0.01
0.1
1
-1.5
-1.0
-0.5
0.0
0.5
1.0
1.5
10

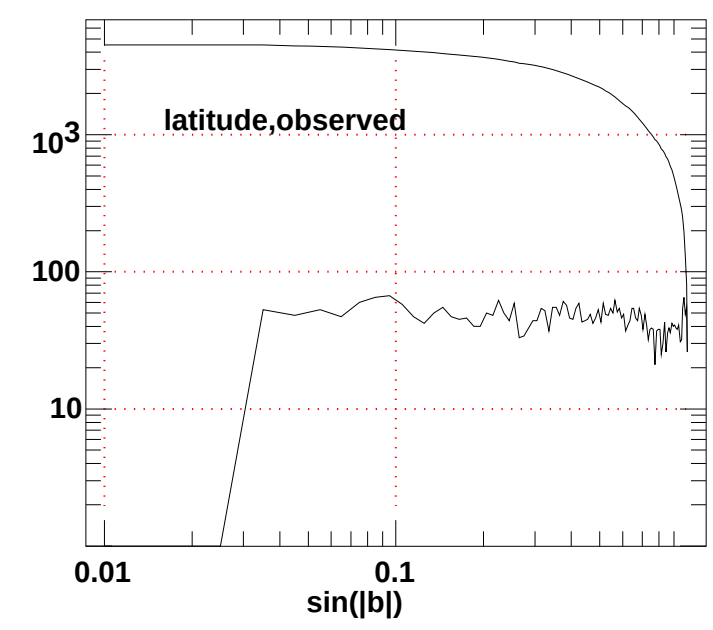
δ<-15

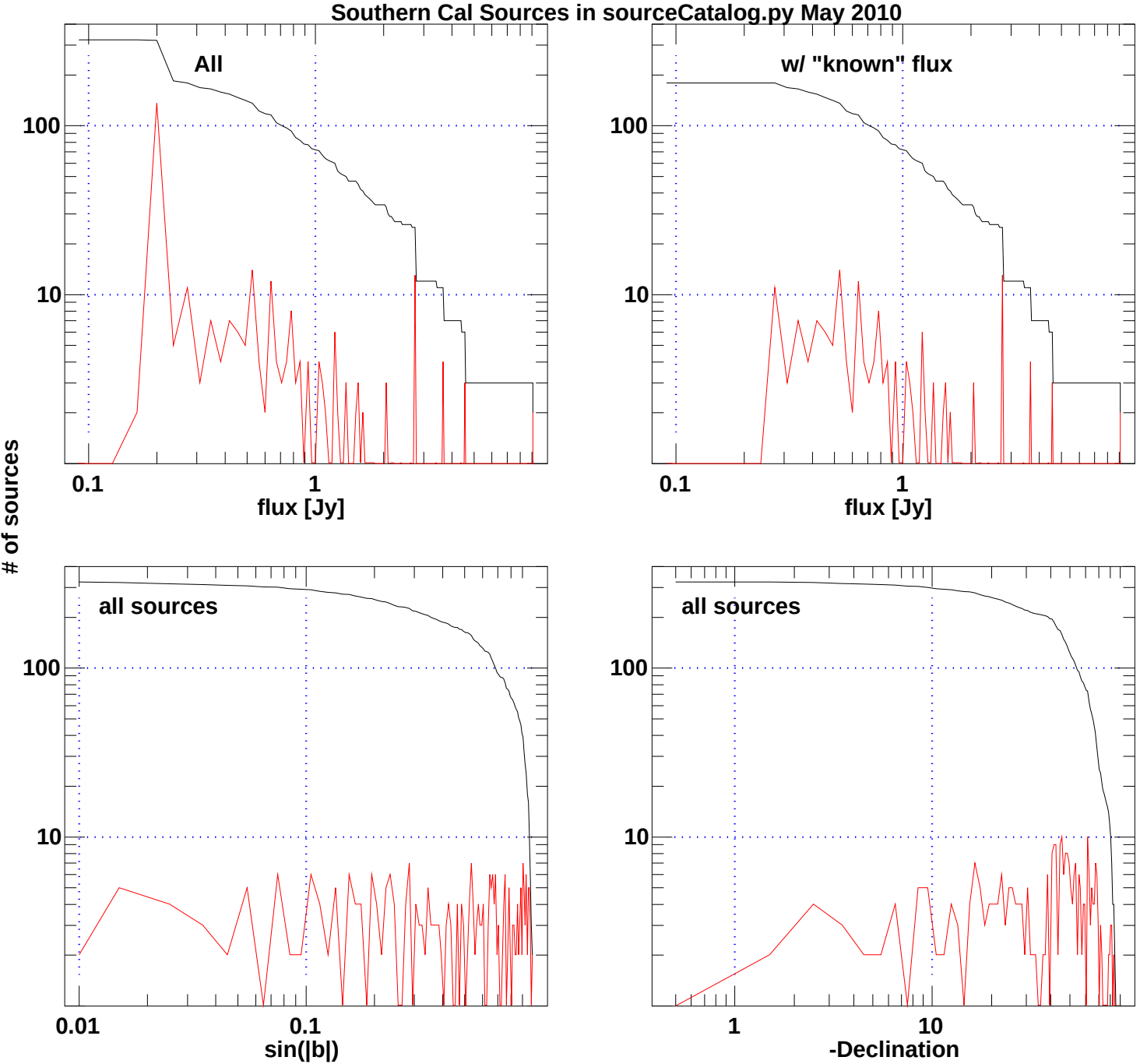

20GHz observed/f_sky
10^3
100
10
0.01
0.1
1


8GHz observed/f_sky
10^3
100
10
0.01
0.1
1


100GHz predicted
# of sources
10^3
100
10
0.01
0.1
1
Flux [Jy]


α(20/8) observed/f_sky
10^3
100
10
-1.5
-1.0
-0.5
0.0
0.5
1.0
1.5
20/8 Index


latitude,observed
10^3
100
10
0.01
0.1
sin(|b|)


Southern Cal Sources in sourceCatalog.py May 2010
All
w/ "known" flux
all sources
all sources
# of sources
100
10
0.1
1
flux [Jy]
0.01
sin(|b|)
-Declination