24+Radio Catalog Manual

(GOODS-North)

January 11, 2016

Contents

1 Abstract

This is the manual for the 24+radio catalog. We select sources from the GOODS-Spitzer IRAC catalog in GOODS-North field using 24 and radio images.

We use Monte-Carlo simulation to validate and correct measurements. The output is a catalog contains IRAC, Ks, 24 and radio band flux and uncertainties. Additional, we measure 16um based on this catalog, and append 16um flux and uncertainty to our final 24+radio catalog.

With the final 24+radio catalog, we do a panchromatic SED fitting to derive SFR, dust mass, and to predict the far-infrared band fluxes, which will be used for the next step "super-deblending" photometry.

Hints: black text are our method and procedures, blue text are notes, and red text are unsolved issues.

2 Band 24

2.1 Galfit at band 24

We use these commands to run the galfit photometry at band 24:

```
# run first-pass without varying source position
./do_Galfit 24 201500 -catalog irac_mips_fluxes_hdfn.dat
cd boxgalfit; do_GalfitRunqsub; cd ..
./do_Galfit 24 201500 -catalog irac_mips_fluxes_hdfn.dat -postparallel
# then second-pass varying source position
./do_Galfit 24 201500 -catalog irac_mips_fluxes_hdfn.dat -vary
cd boxgalfit_vary; do_GalfitRunqsub; cd ..
./do_Galfit 24 201500 -catalog irac_mips_fluxes_hdfn.dat -vary -postparallel
```

2.2 Galsim at band 24

We use these commands to run the Monte-Carlo simulation at band 24:

```
# first estimate magnitude range
convert_flux2mag goodsn 24 $(0.0044*01) 1 # (mBias -0.2036 fBias -0.000553)
convert_flux2mag goodsn 24 $(0.0044*25) 1 # (mBias -0.2036 fBias -0.000553)
# then do the simulation
# ./do_Galsim 24 201500 -mag0 -2.8416 -mag1 0.530157 -number 6000 -vary \
-catalog RadioOwenMIPS24_priors_April18_2014.txt
./do_Galsim 24 201500 -mag0 -2.8416 -mag1 0.530157 -number 6000 -vary \
-catalog irac_mips_fluxes_hdfn.dat
cd boxgalsim; do_GalsimRunqsub; cd ..
./do_Galsim 24 201500 -mag0 -2.8416 -mag1 0.530157 -number 6000 -vary \
-catalog irac_mips_fluxes_hdfn.dat -postparallel
```

2.3 Galsim Analysis at band 24

We use these commands to run the simulation analysis at band 24:

```
sm
macro read run_simu_stats_v7.sm run_simu_stats_v7 24 201500
```

Below are our statistical analyses:

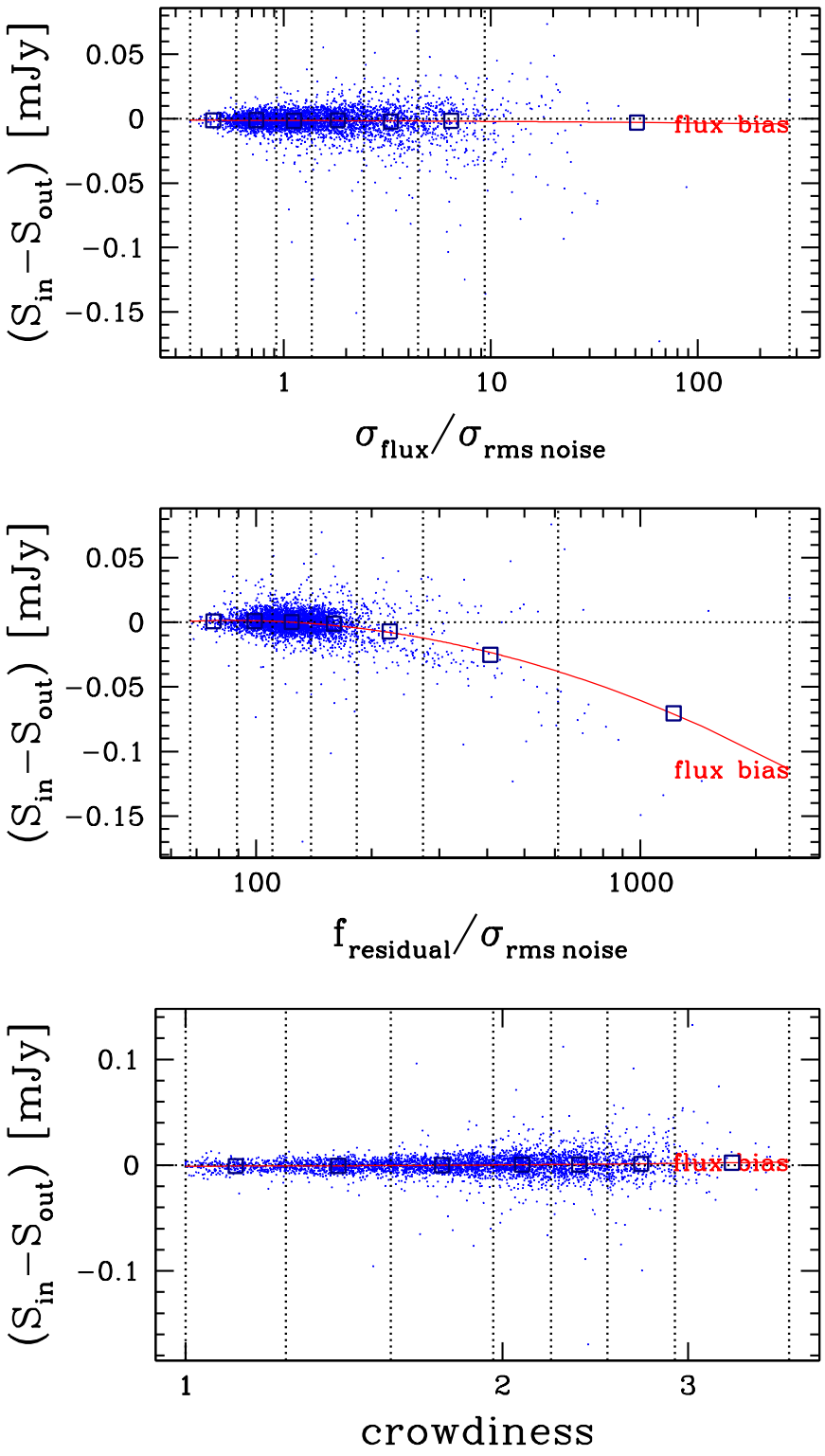

Figure 1: Flux bias analysis from simulation.

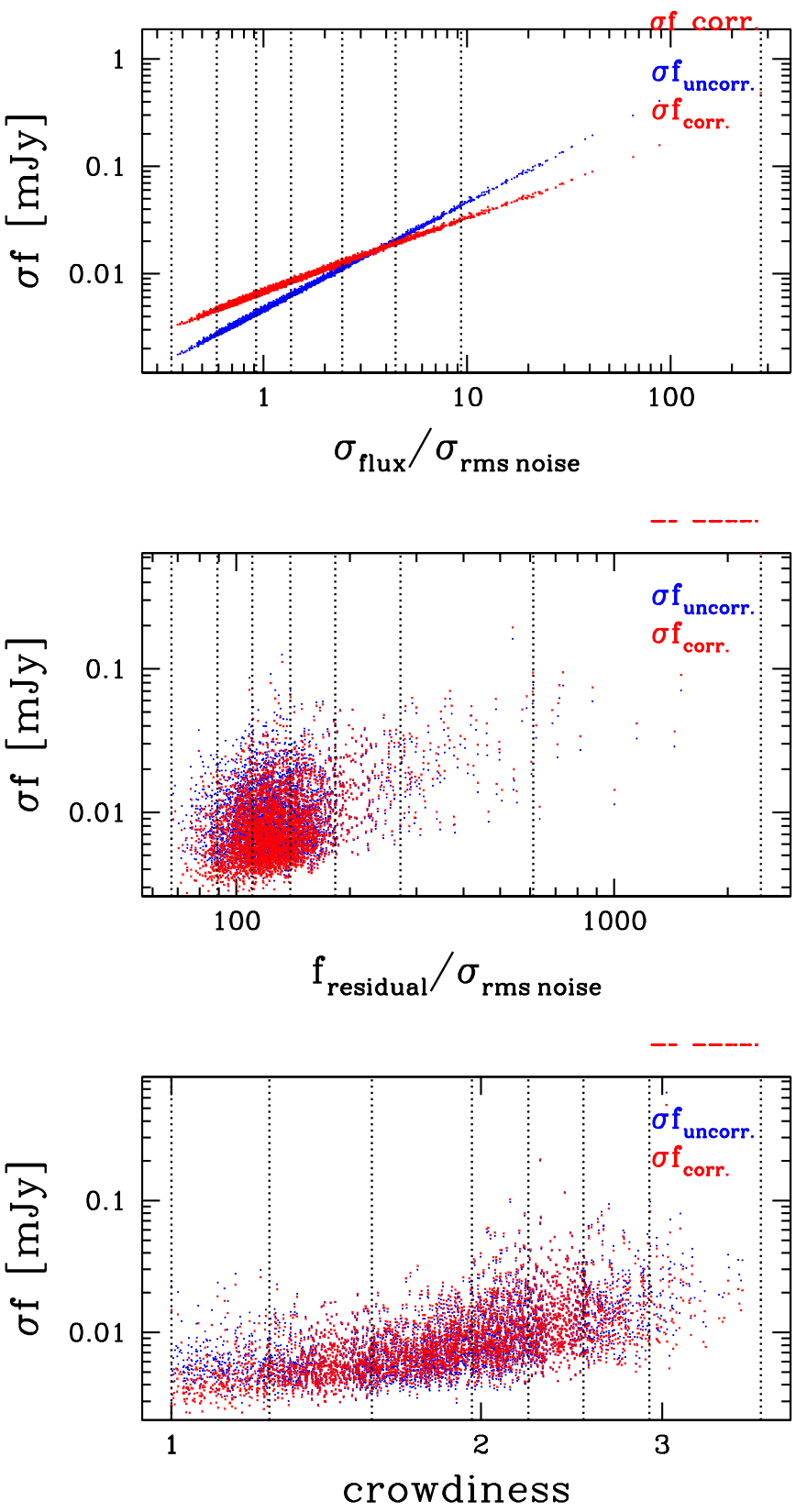

Figure 2: Flux uncertainty analysis from simulation.

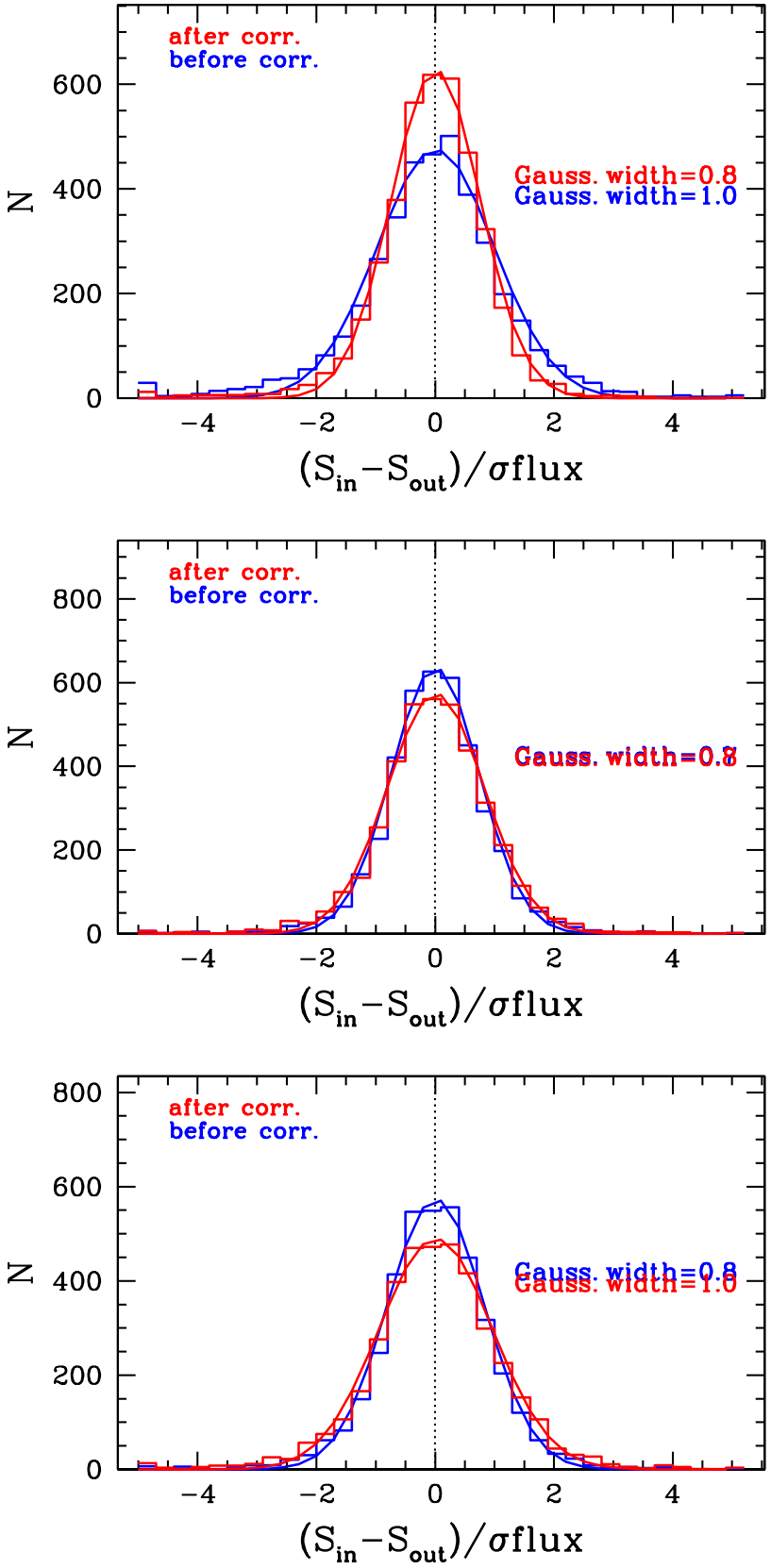

Figure 3: Statistical behavior of input minus output differences before and after correction.

3 Band 20cm

3.1 Galfit at band 20cm

We use these commands to run the galfit photometry at band 20cm:

```
# run first-pass without varying source position
./do_Galfit 20cm 201500 -catalog irac_mips_fluxes_hdfn.dat
cd boxgalfit; do_GalfitRunqsub; cd ..
./do_Galfit 20cm 201500 -catalog irac_mips_fluxes_hdfn.dat -postparallel
# then second-pass varying source position
./do_Galfit 20cm 201500 -catalog irac_mips_fluxes_hdfn.dat -vary
cd boxgalfit_vary; do_GalfitRunqsub; cd ..
./do_Galfit 20cm 201500 -catalog irac_mips_fluxes_hdfn.dat -vary -postparallel
```

3.2 Galsim at band 20cm

We use these commands to run the Monte-Carlo simulation at band 20cm:

```
# first estimate magnitude range
# note that 20cm 3-sigma is about 7.5uJy (Owen's map)
load astroPhot.sm
convert_flux2mag goodsn 20cm $(0.0022*01) 1 # (mBias 0 fBias -5e-05) # => 10.5112
convert_flux2mag goodsn 20cm $(0.0022*25) 1 # (mBias 0 fBias -5e-05) # => 7.03979
# then do the simulation
./do_Galsim 20cm 201500 -mag0 7.03979 -mag1 10.5112 -number 6000 -vary \
-catalog irac_mips_fluxes_hdfn.dat
cd boxgalsim; do_GalsimRunqsub; cd ..
./do_Galsim 20cm 201500 -mag0 7.03979 -mag1 10.5112 -number 6000 -vary \
-catalog irac_mips_fluxes_hdfn.dat -postparallel
```

```
# first estimate magnitude range
# In Morrison et al. 2010 catalog, 1230 radio sources were detected.
# Their median df20cm is ~10uJy, while minimum df20cm is ~3uJy.
# Their minimum f20cm is ~21uJy, and maximum f20cm is ~263uJy.
# Therefore we do simulation with f20cm from 10uJy to 263uJy.
load astroPhot.sm
convert_flux2mag goodsn 20cm_Morrison 0.010 1 # (mBias 0 fBias 0) # => 9.6961
convert_flux2mag goodsn 20cm_Morrison 0.263 1 # (mBias 0 fBias 0) # => 6.14621
# then do the simulation
./do_Galsim 20cm_Glenn 201500 -mag0 6.14621 -mag1 9.6961 -number 6000 -vary \
-catalog irac_mips_fluxes_hdfn.dat
cd boxgalsim; do_GalsimRunqsub; cd ..
./do_Galsim 20cm_Glenn 201500 -mag0 6.14621 -mag1 9.6961 -number 6000 -vary \
-catalog irac_mips_fluxes_hdfn.dat -postparallel
```

3.3 Galsim Analysis at band 20cm

We use these commands to run the simulation analysis at band 20cm:

```
sm
macro read run_simu_stats_v7.sm run_simu_stats_v7 20cm 201500
```

Below are our statistical analyses:

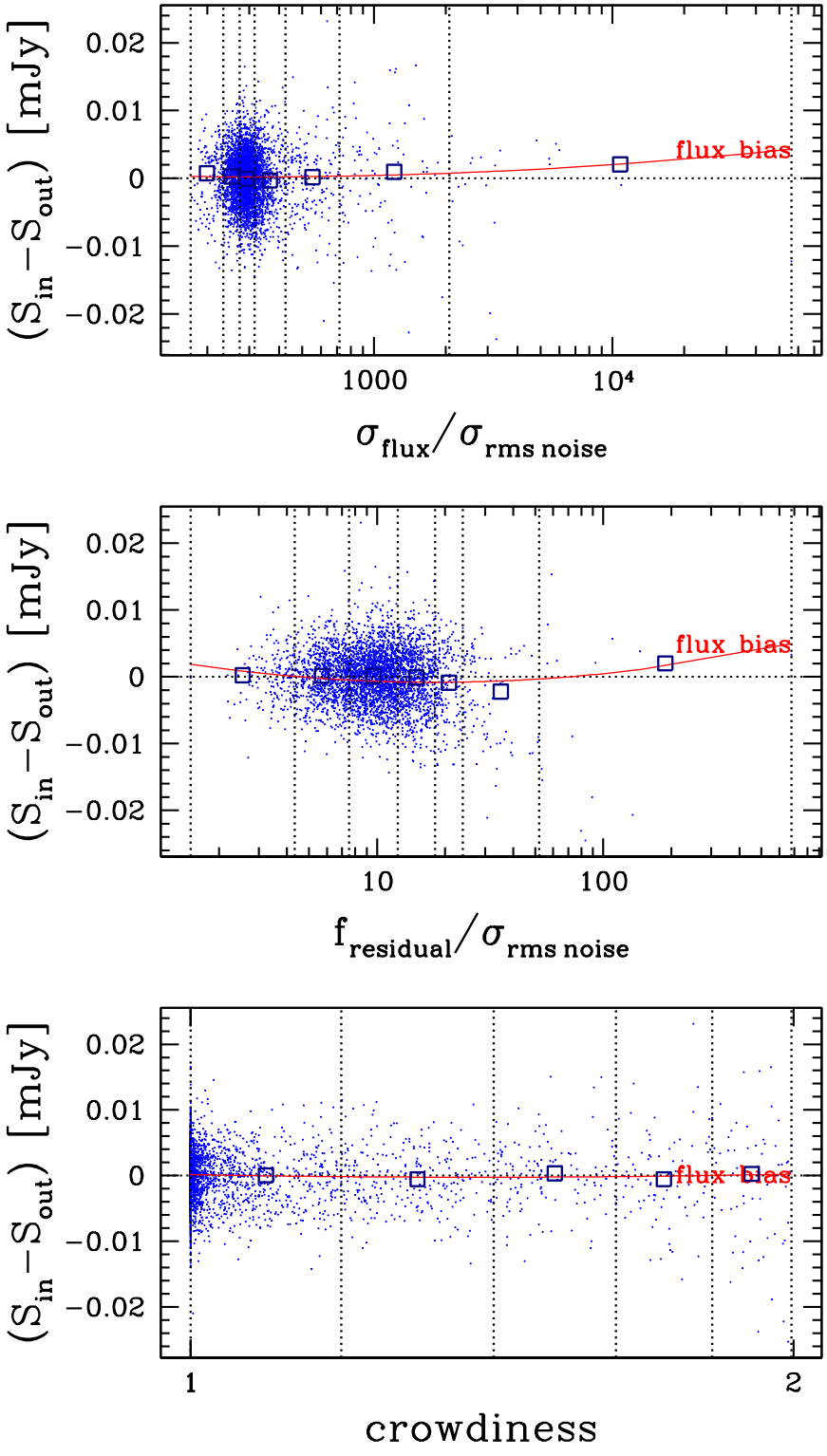

Figure 4: Flux bias analysis from simulation.

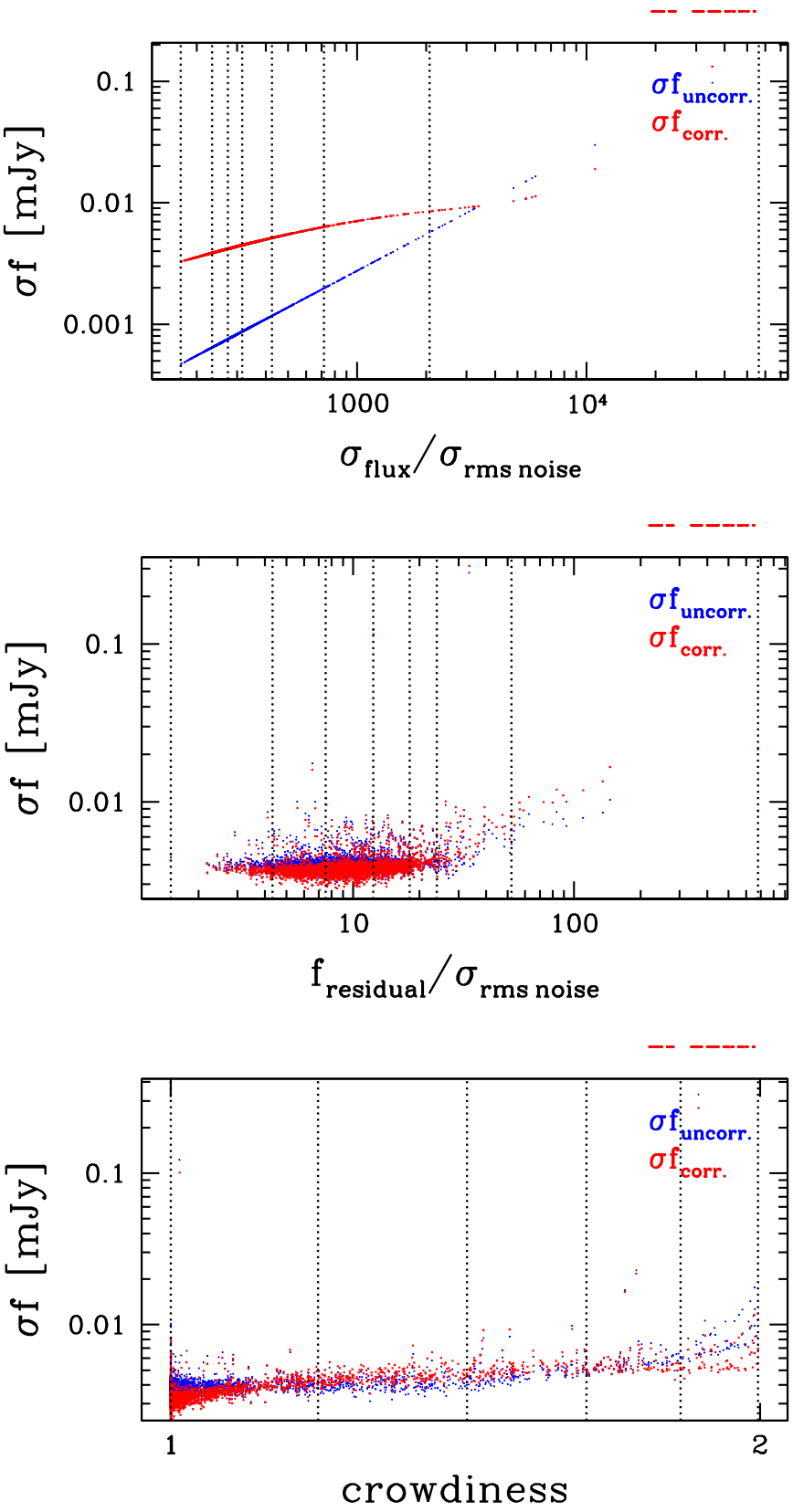

Figure 5: Flux uncertainty analysis from simulation.

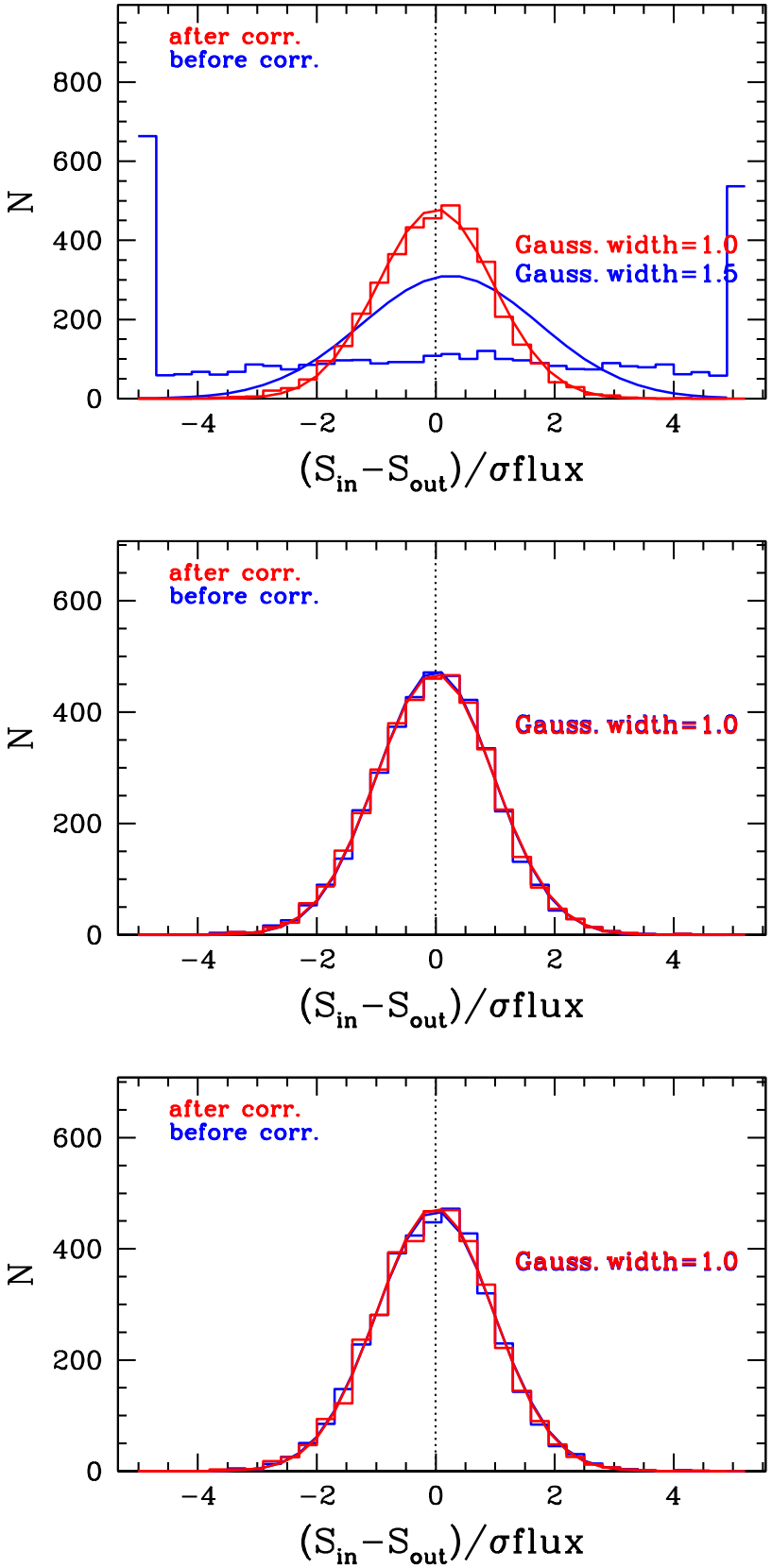

Figure 6: Statistical behavior of input minus output differences before and after correction.