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:

```
1  # run first-pass without varying source position
2  ./do_Galfit 24 201500 -catalog irac_mips_fluxes_hdfn.dat
3  cd boxgalfit; do_GalfitRunqsub; cd ..
4  ./do_Galfit 24 201500 -catalog irac_mips_fluxes_hdfn.dat -postparallel
5  # then second-pass varying source position
6  ./do_Galfit 24 201500 -catalog irac_mips_fluxes_hdfn.dat -vary
7  cd boxgalfit_vary; do_GalfitRunqsub; cd ..
8  ./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:

```
1   # first estimate magnitude range
2   convert_flux2mag goodsn 24 $(0.0044*01) 1 # (mBias -0.2036 fBias -0.000553)
3   convert_flux2mag goodsn 24 $(0.0044*25) 1 # (mBias -0.2036 fBias -0.000553)
4   # then do the simulation
5   # ./do_Galsim 24 201500 -mag0 -2.8416 -mag1 0.530157 -number 6000 -vary \
6   -catalog RadioOwenMIPS24_priors_April18_2014.txt
7   ./do_Galsim 24 201500 -mag0 -2.8416 -mag1 0.530157 -number 6000 -vary \
8   -catalog irac_mips_fluxes_hdfn.dat
9   cd boxgalsim; do_GalsimRunqsub; cd ..
10  ./do_Galsim 24 201500 -mag0 -2.8416 -mag1 0.530157 -number 6000 -vary \
11  -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:

```
1  sm
2  macro read run_simu_stats_v7.sm run_simu_stats_v7 24 201500
```
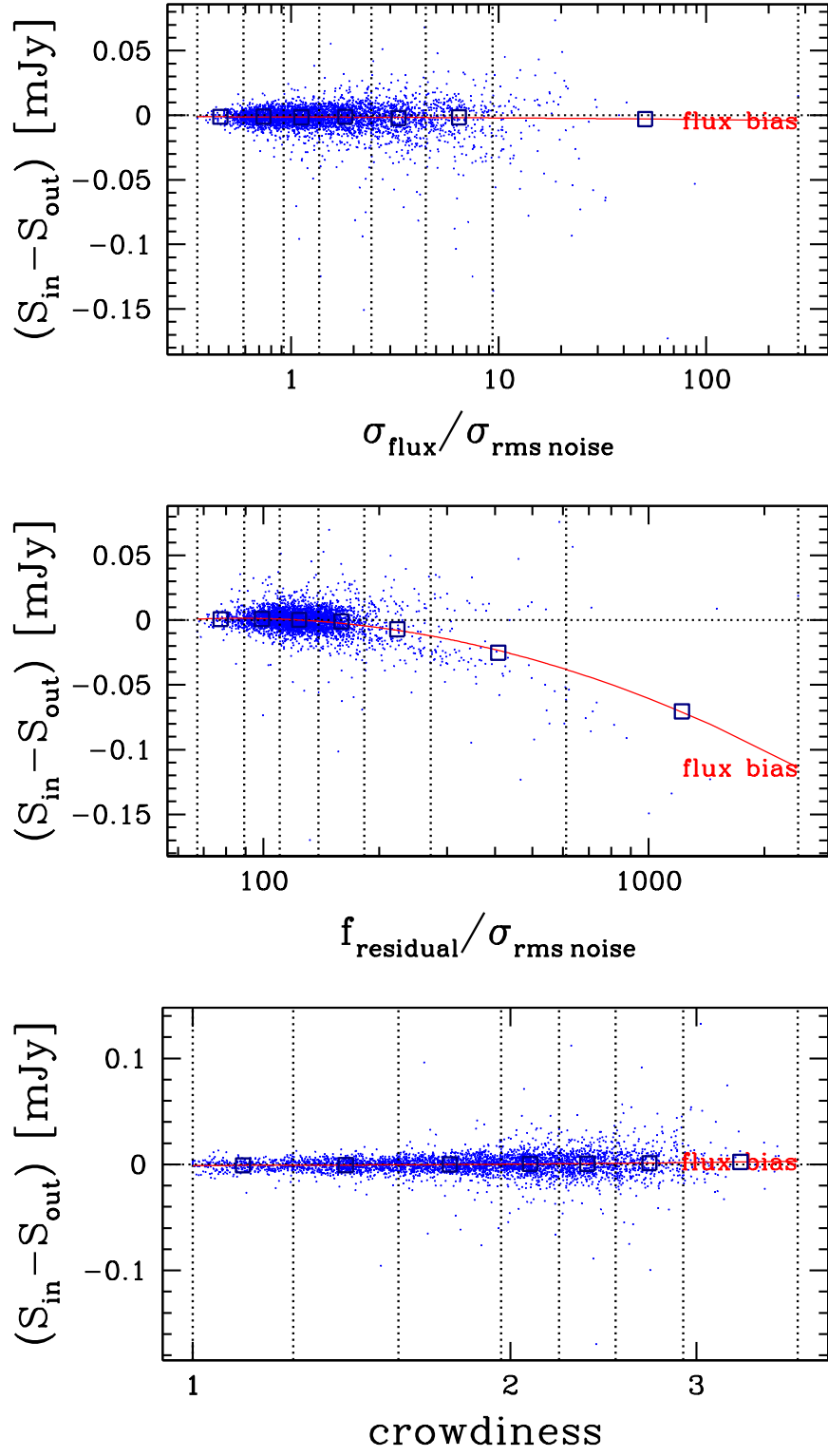
Below are our statistical analyses:

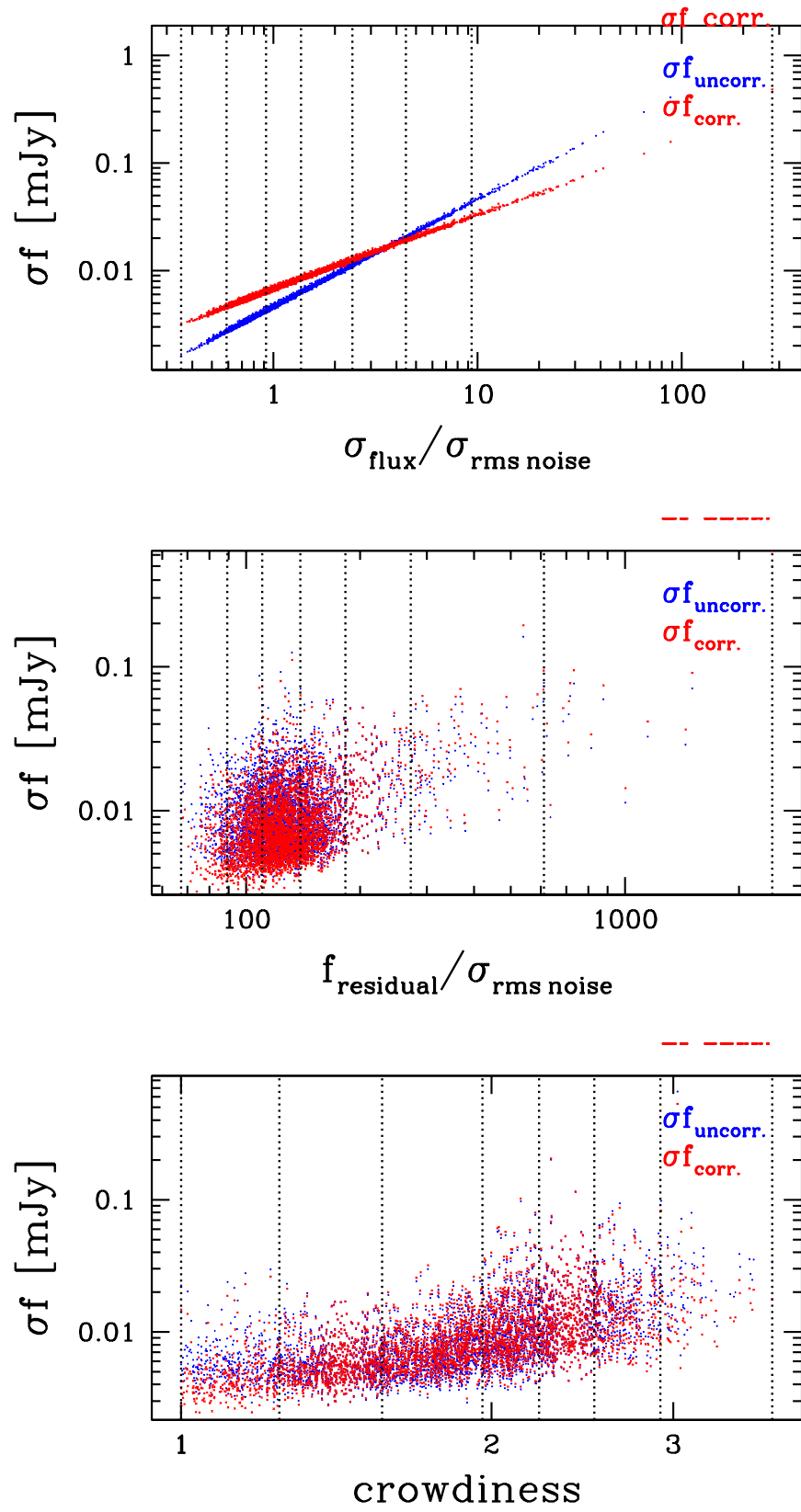Figure 1: Flux bias analysis from simulation.

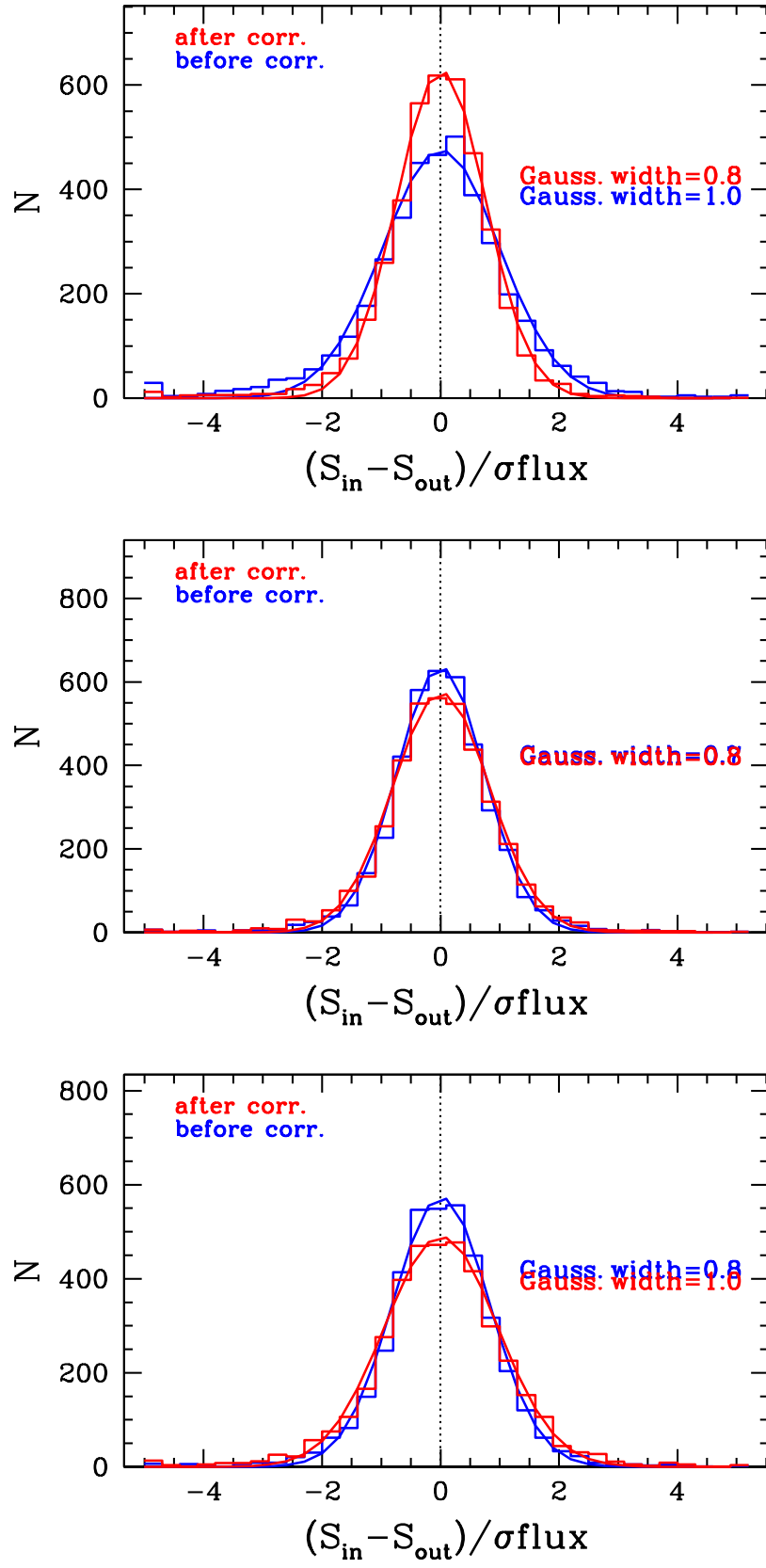Figure 2: Flux uncertainty analysis from simulation.

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

3 Band 20cm (Owen's map)

3.1 Galfit at band 20cm (Owen's map)

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

```
1  # run first-pass without varying source position
2  ./do_Galfit 20cm 201500 -catalog irac_mips_fluxes_hdfn.dat
3  cd boxgalfit; do_GalfitRunqsub; cd ..
4  ./do_Galfit 20cm 201500 -catalog irac_mips_fluxes_hdfn.dat -postparallel
5  # then second-pass varying source position
6  ./do_Galfit 20cm 201500 -catalog irac_mips_fluxes_hdfn.dat -vary
7  cd boxgalfit_vary; do_GalfitRunqsub; cd ..
8  ./do_Galfit 20cm 201500 -catalog irac_mips_fluxes_hdfn.dat -vary -postparallel
```

3.2 Galsim at band 20cm (Owen's map)

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

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

3.3 Galsim Analysis at band 20cm (Owen's map)

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

```
1  cd doing20cm/
2  sm
3  macro read run_simu_stats_v7.sm run_simu_stats_v7 20cm 201500
```
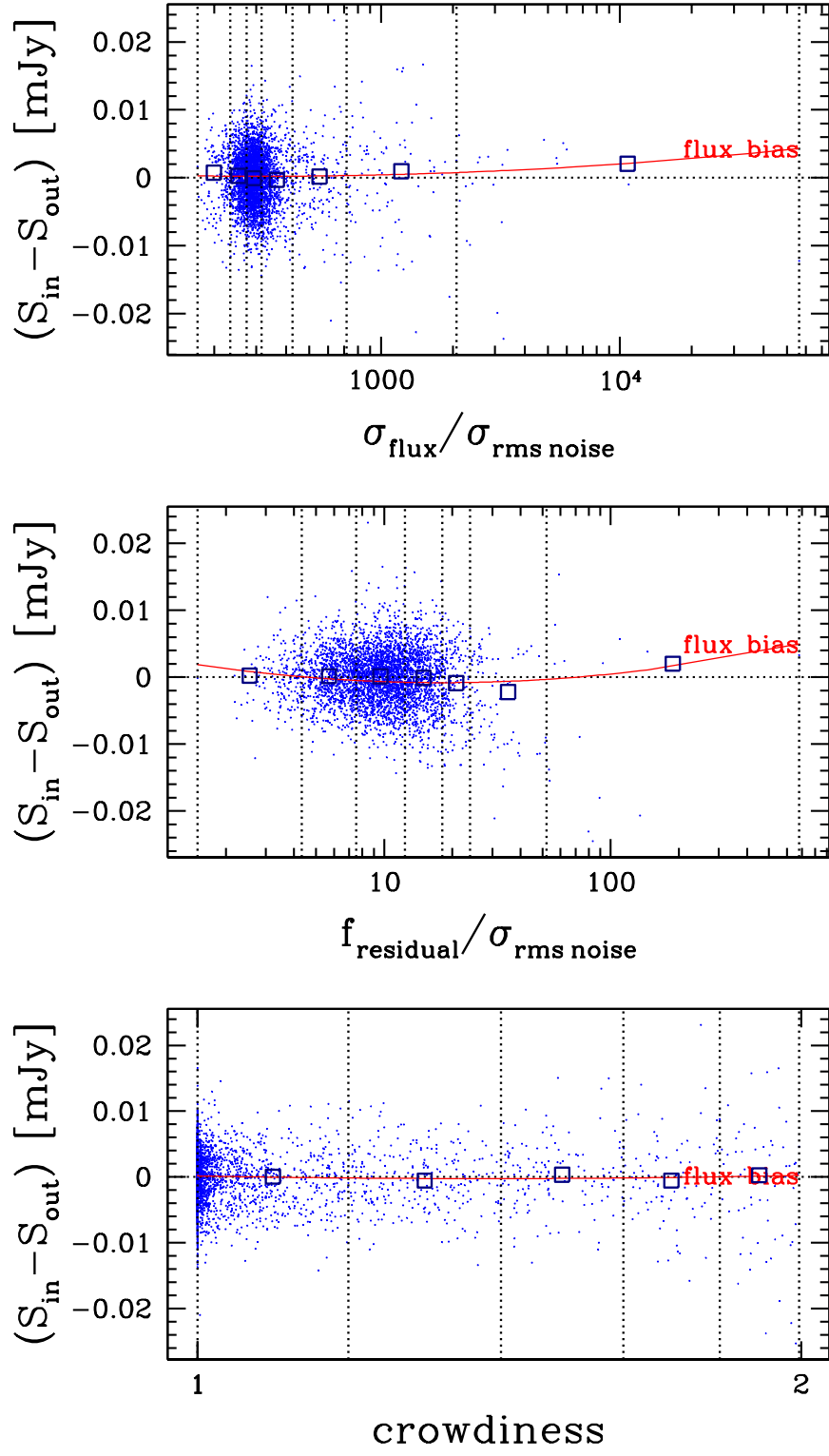
Below are our statistical analyses:

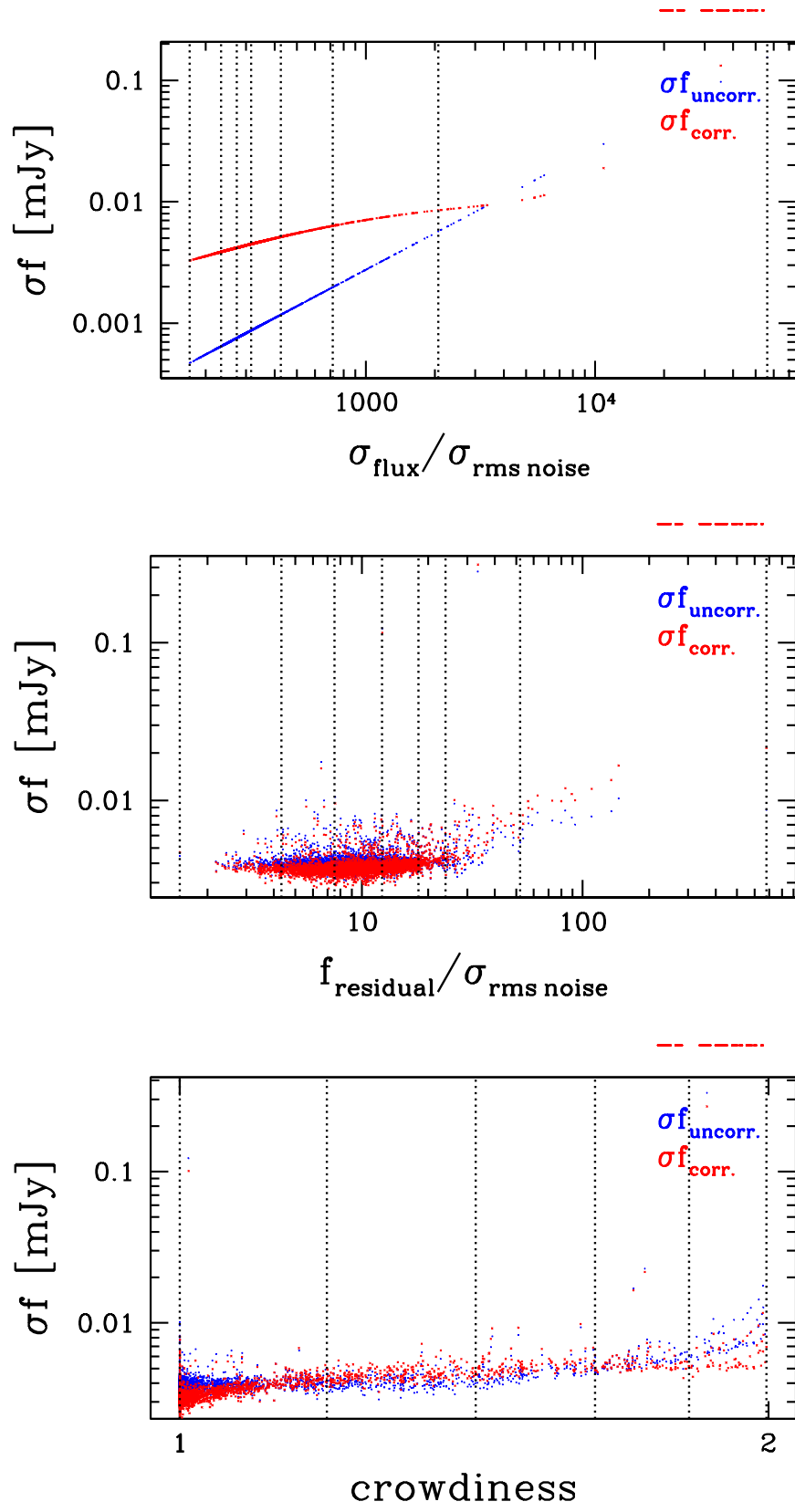Figure 4: Flux bias analysis from simulation.

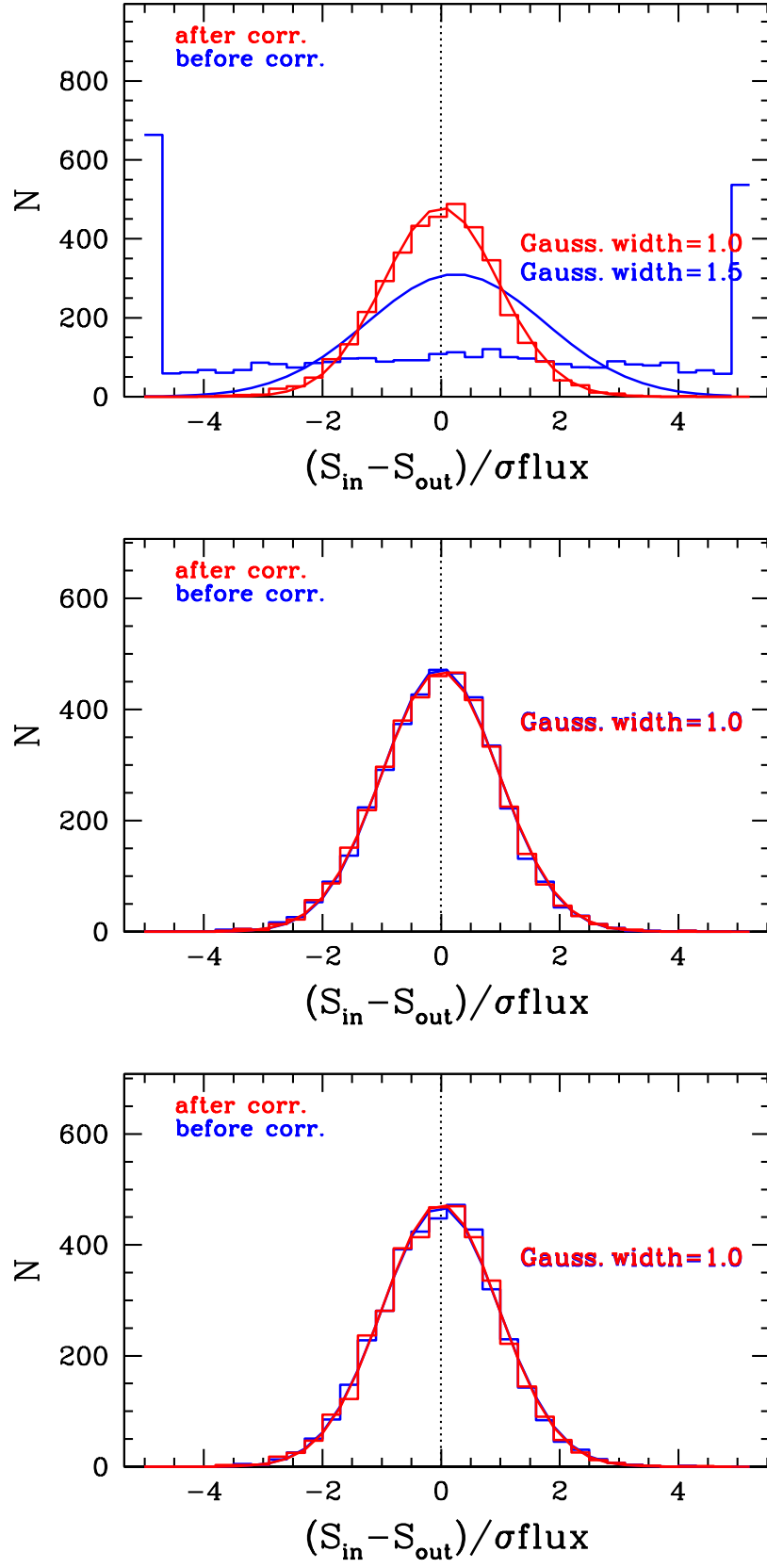Figure 5: Flux uncertainty analysis from simulation.

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

4 Band 20cm (Morrison's map)

4.1 Galfit at band 20cm (Morrison's map)

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

```
1  # run first-pass without varying source position
2  ./do_Galfit 20cm_Glenn 201500 -catalog irac_mips_fluxes_hdfn.dat
3  cd boxgalfit; do_GalfitRunqsub; cd ..
4  ./do_Galfit 20cm_Glenn 201500 -catalog irac_mips_fluxes_hdfn.dat -postparallel
5  # then second-pass varying source position
6  ./do_Galfit 20cm_Glenn 201500 -catalog irac_mips_fluxes_hdfn.dat -vary
7  cd boxgalfit_vary; do_GalfitRunqsub; cd ..
8  ./do_Galfit 20cm_Glenn 201500 -catalog irac_mips_fluxes_hdfn.dat -vary -postparallel
```

4.2 Galsim at band 20cm (Morrison's map)

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

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

4.3 Galsim Analysis at band 20cm (Morrison's map)

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

```
1  cd doing20cm_Glenn/
2  sm
3  macro read run_simu_stats_v7.sm run_simu_stats_v7 20cm 201500
```
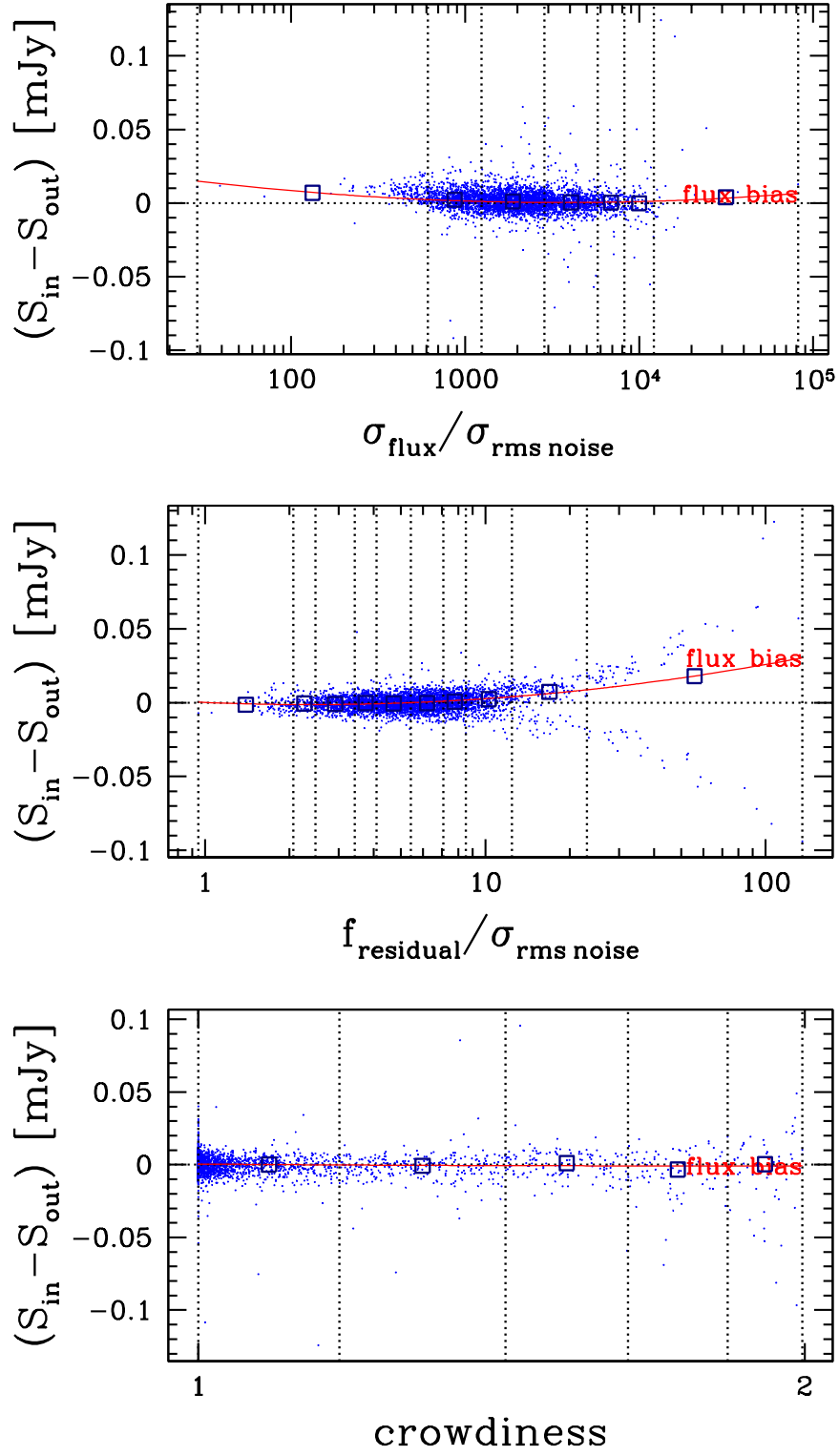
Below are our statistical analyses:

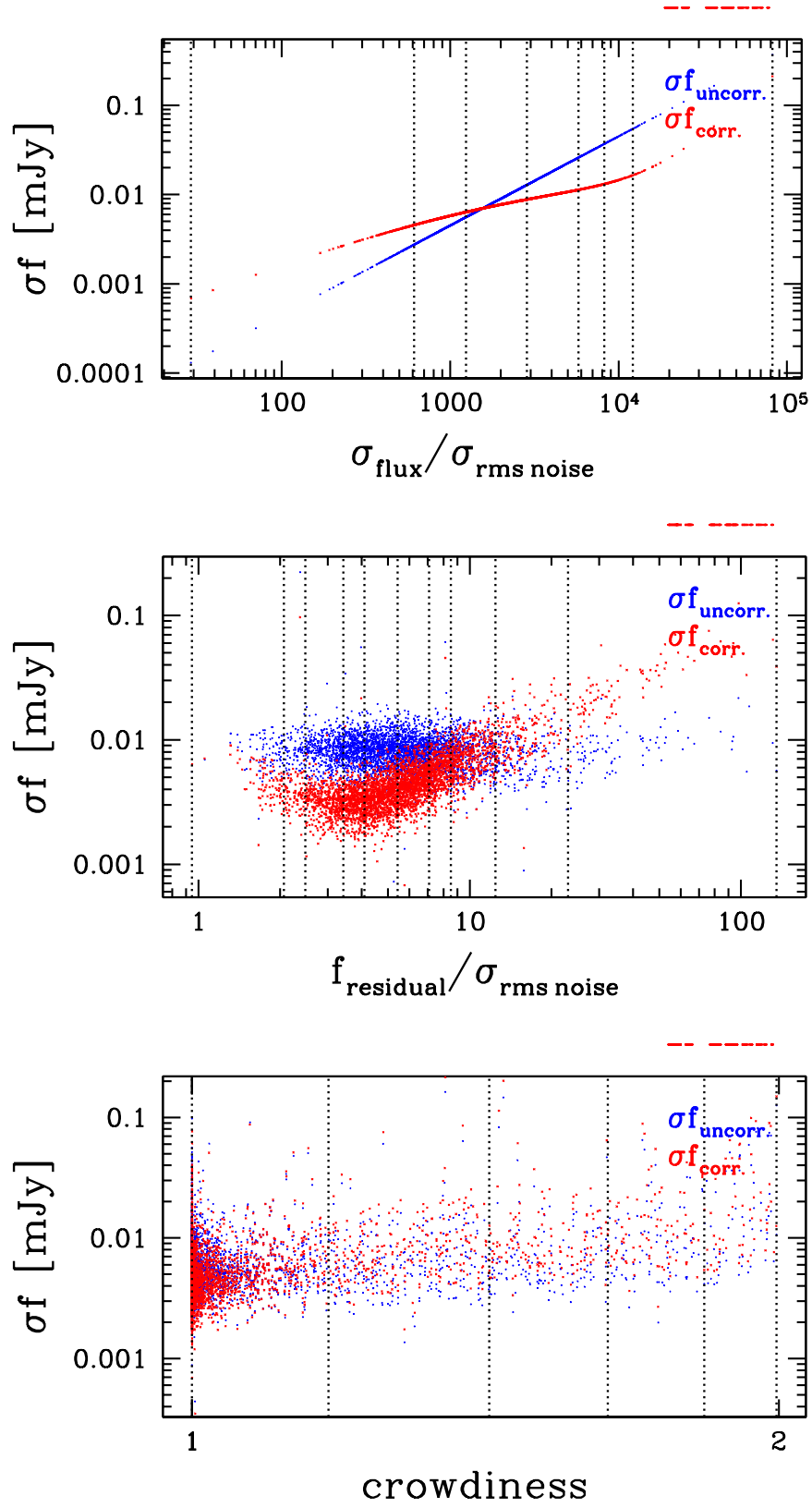Figure 7: Flux bias analysis from simulation.

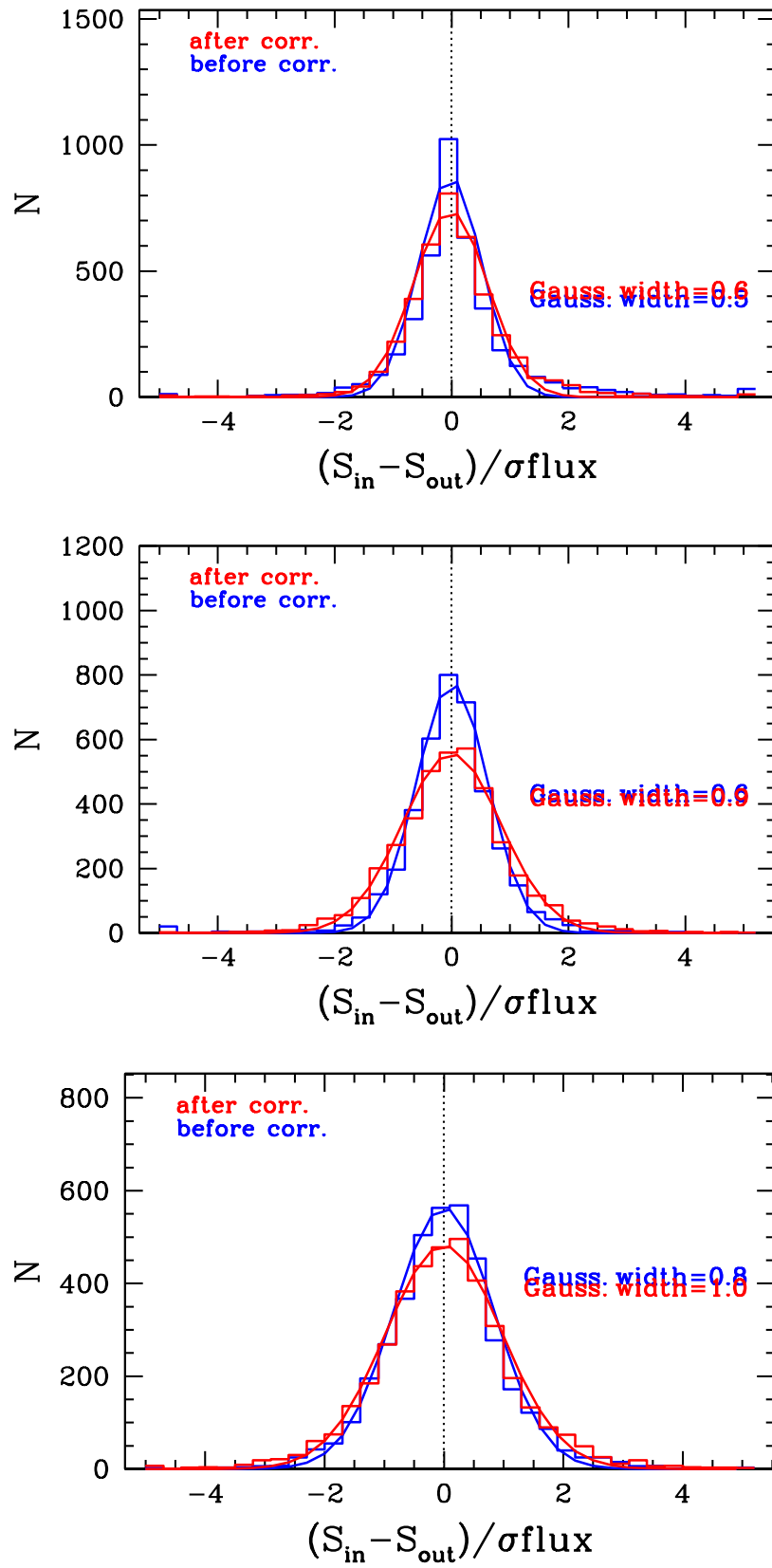Figure 8: Flux uncertainty analysis from simulation.

Figure 9: Statistical behavior of input minus output differences before and after correction.