GSC1.2/GSC2.1.1/USNOA2 vs. SPMS/2MASS-G/2MASS-S RLS 30/XI/2000

In the previous update (15/XI/2000) we compared the three schmidt catalogues to the ICRF and SPM galaxy subsample (SPMG), here we extend the comparison to the SPM star subsample (SPMS), the 2MASS extended source sample and a subset of the 2MASS second release point source data.

Update 15/XI/2000 A note on the last update. I was mistakeningly ploting the median within the magnitude bins in Figures 2,4 and 5 so the results related to those graphs are not correct. As we are mainly interested in the GSC2.1.1 vs USNOA2 comparison with SPMG (the ICRS does not have enough data to give a clear signal and for the positions the GSC1.2 is not a large issue) I have ploted the correct ones in figure 1. Contary to waht was said then you can see a reasonably large variation in the sigmas of the positions with magnitudes. This is indicating the degrade in centerioding error and also magnitude terms that are not symetric on the plate.

An example of this type of magnitude term is guiding, the SPM in the schmidt catalogues are all products of the UKST and as such any systematic errors in guiding will be consistent. If the magnitude term moves all the objects in the same direction but as a function of magnitude by different amounts then the fact that you have plates from a large part of the sky it will not cancel. A radial term however will because for a star from the low right corner of a plate you will always have a counter star in the top left corner of the plate. Another point to note is the means of the differences, these are systematically grouped with the same sign, another indication that the magnitude term is such that it is zero for one magnitude (probably the mean of the reference stars) and positive and negative either side of that mean. This also explains the offset from zero we saw in the residuals that is beacuse more stars are on the negative side of the magnitude effect than the positive.

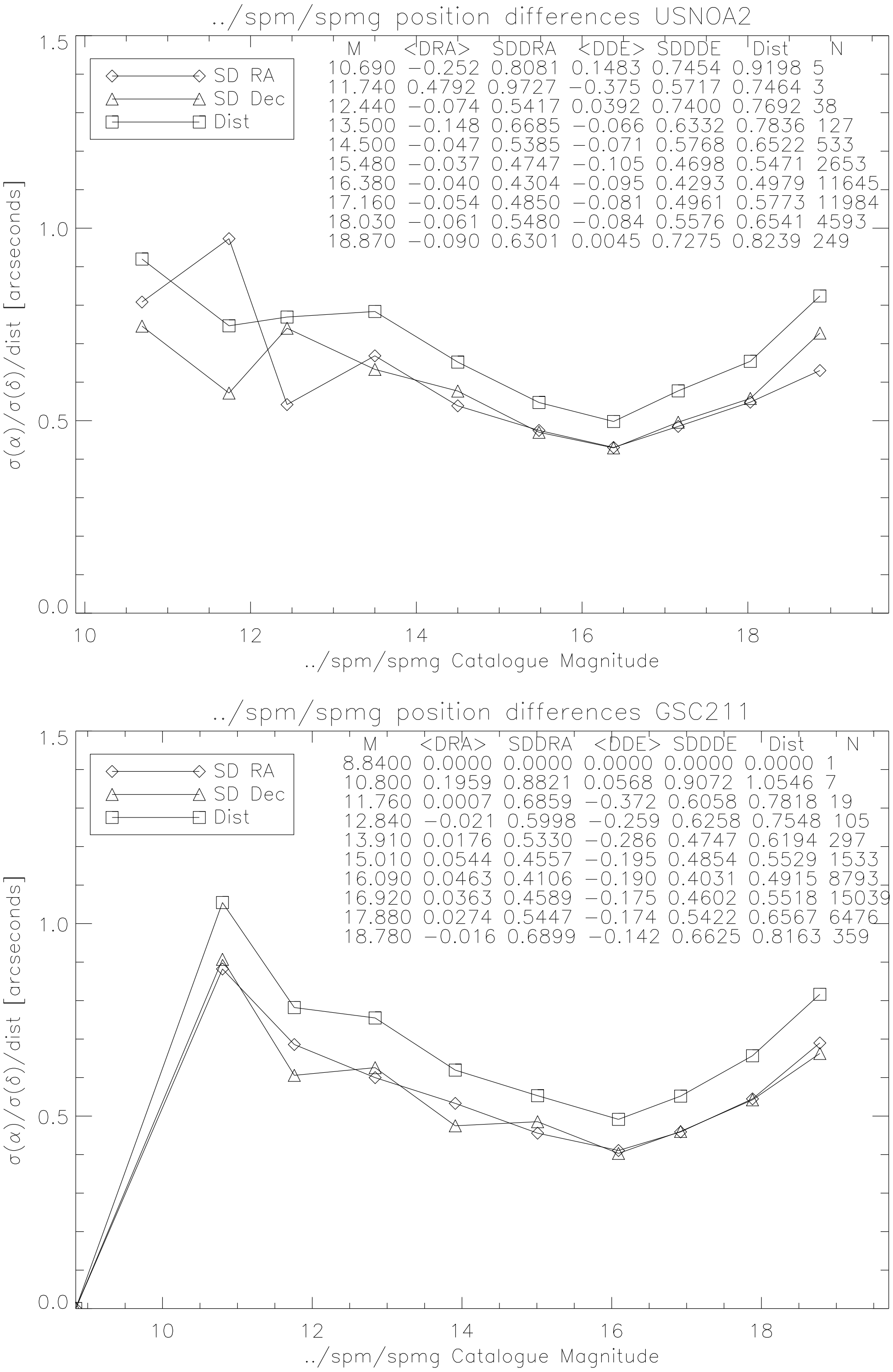


Figure 1: SPM Galaxy positional differences as a function of magnitude for USNOA2 and GSC2.1.1 (corrected figure 3 15/XI/2000)

SPM Stars (SPMS)

This is a selected set of stars ranging in magnitude from 6-18 choosen for scientific purposes from various catalogues and is explained in detail in the SPM web page (http://www.astro.yale.edu/spm/spm2cat/spm2.html). There were no surprises in the number of matches for the SPMS with both the fainter catalogues doing as well as each other and better than the brighter limited GSC1.2 (1st column below table). All the following stats are for stars fainter than 9th magnitude.

Position Differences: To recap, in the comparison to SPMG main statistic of interest was the overall standard deviations for the GSC1.2/GSC2.1.1/USNOA were .43/.47/.48 in RA and .43/.47/.49 in dec repesctively, while the only noticeable difference from zero in the means was in the declination of the GSC catalogues, as stated above this maybe due to a combination of a magnitude term and weighted distribution of objects in magnitude.

For the SPMS the overall deviations are significantly (10-20%) better for the deep Schmidt catalogues As these are the south all the Schmidt catalogues have about the same epoch difference to the SPMS and the proper motions errors are of the order of 3mas/yr we can ignore the addition precision lose in internal comparisons if not in the absolute reading of these results. The table below gives the comparison of the SPMS to the Schmidt catalogues and figures 2 sumerize these results.

Cat	Matched	mean RA st dev	mean Dec st dev
GSC1.2	130372	0.0421 +/- .533	0.0179 +/- .448
GSC2.1.1	260285	-0.00446 +/- .424	-0.0337 +/- .395
USNOA2	267285	-0.0754 +/- .420	-0.0258 +/- .380

Position Differences vs Magnitude: Figure 3 is a plot of the residual sigmas vs magnitudes for the two deep catalogues, the figure for GSC1.2 is very similar. Note the minimum is around 15 in V (SPM magnitude) which is probably brighter than you would expect the minimum to be if it was just centeroiding considerations and again an indication that we are probably dominated by systematic errors. The systematic trend in the means of the residuals is also quite notable though it is obviously not simple as shown by the switch in the declination means.

Classification vs Magnitude: In figure 4 we plot the classification of the GSC catalogues for the SPM stars. While the SPM objects are probably not 100The below table sumerizes the information in figure 4 that and basically for this magnitude range we are correct at the 90designation includes blends and some of these are bright stars this can probably be considered a worse case senario.

Cat	Matched	Stars	Non-stars	Defects
GSC1.2	129032	118560(91%)	10134(8%)	338
GSC2.1.1	257186	229690(89%)	27125(10%)	371

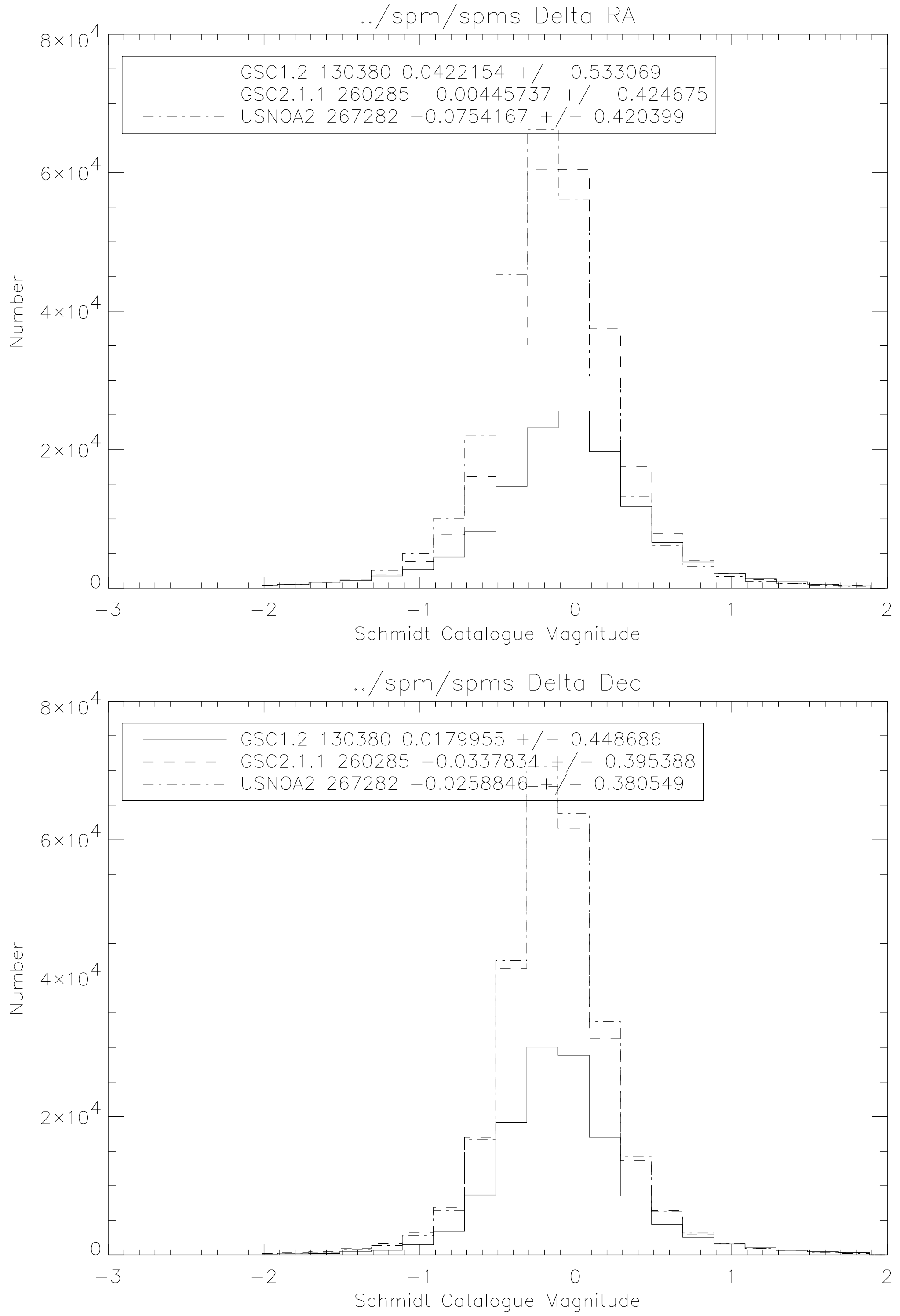


Figure 2: Differences of the SPM star subsample (SPMS) RA (top) and Dec (bottom) positions and the GSC1.2/GSC2.1.1/USNOA2 positions. The legend indicates the number of matches, mean difference and standard deviation of the difference.

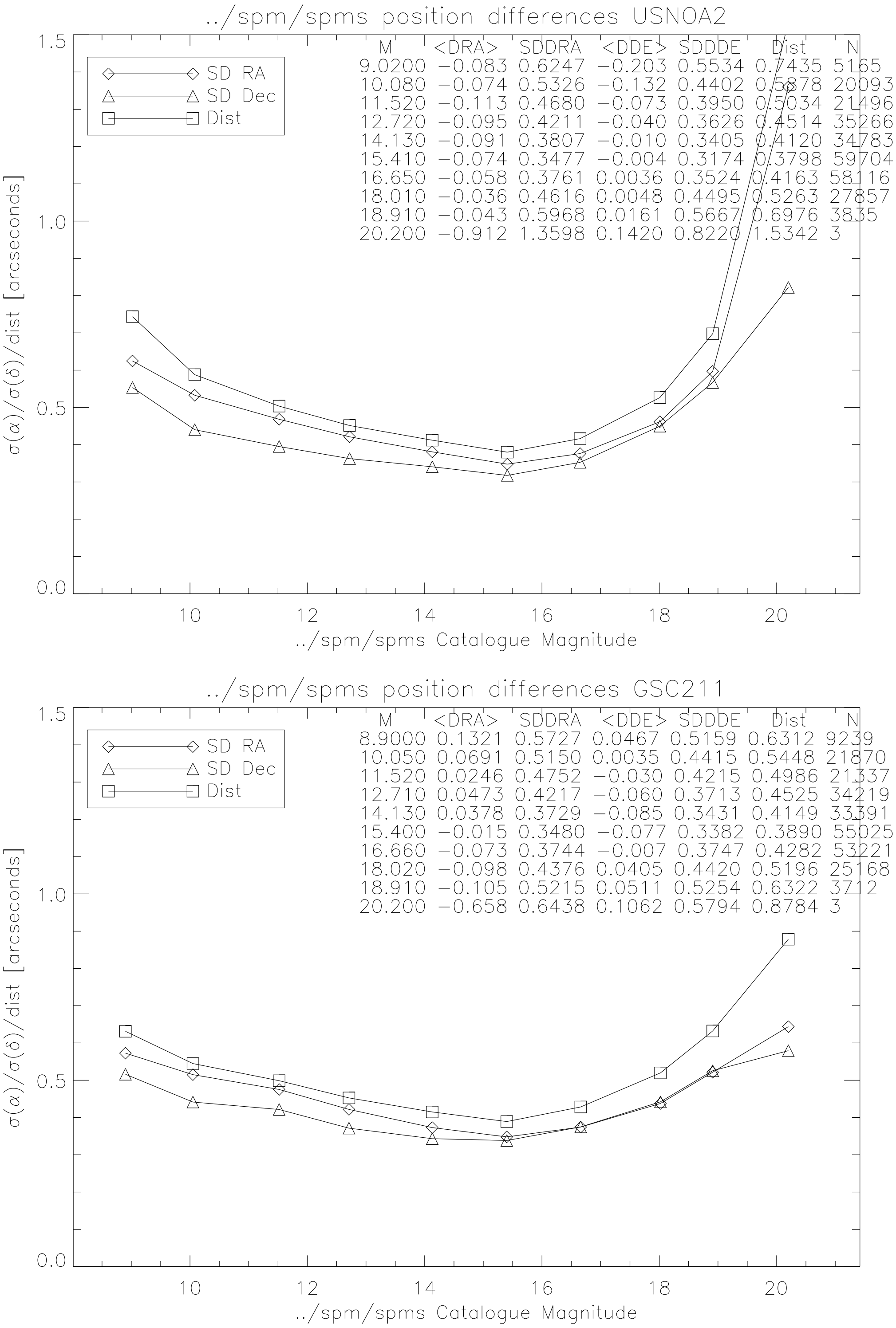
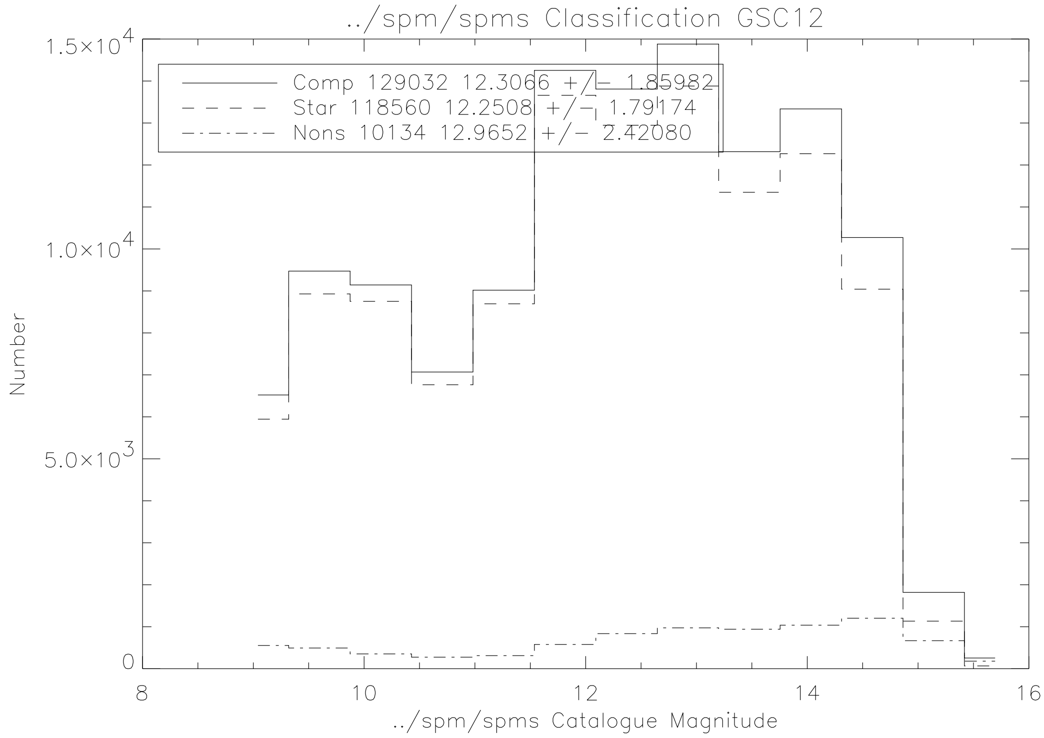


Figure 3: Residual sigmas for the USNOA2 (top) and GSC2.1.1 vs SPM magnitude. The table indicates the sigmas and the mean in the various magnitude bins.


../spm/spms Classification GSC12
Comp 129032 12.3066 +/- 1.85982
Star 118560 12.2508 +/- 1.79174
Nons 10134 12.9652 +/- 2.42080
Number
../spm/spms Catalogue Magnitude

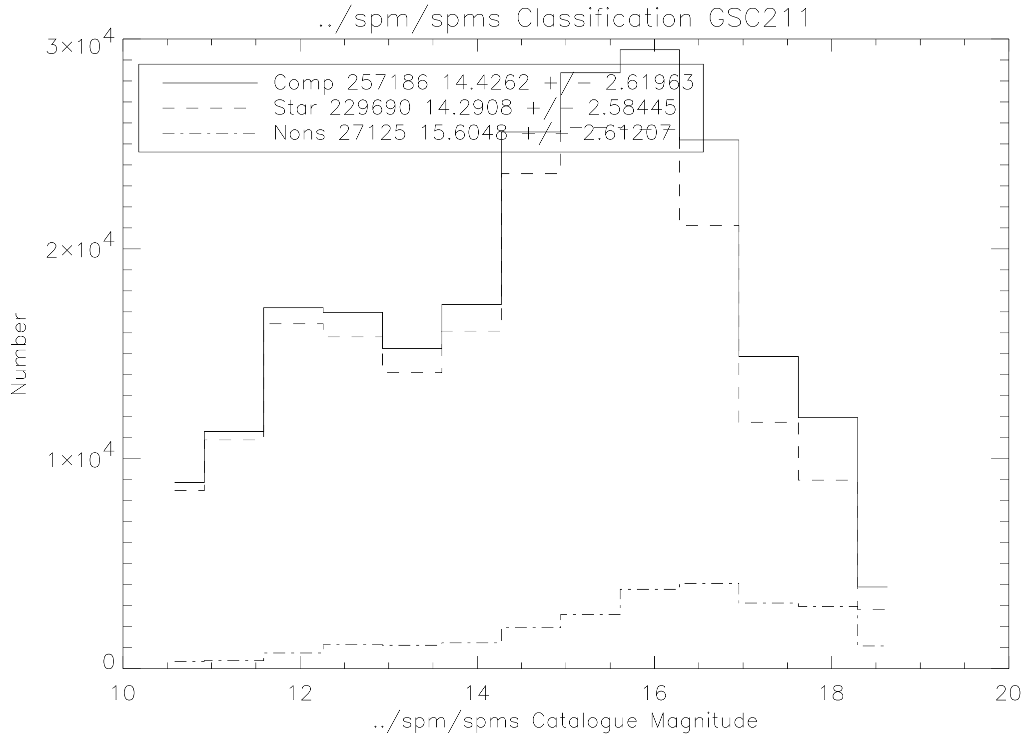

../spm/spms Classification GSC211
Comp 257186 14.4262 +/- 2.61963
Star 229690 14.2908 +/- 2.58445
Nons 27125 15.6048 +/- 2.61207
Number
../spm/spms Catalogue Magnitude

Figure 4:

2MASS Galaxies (idr2xsc)

This comparison set is 585056 extended sources from a large part of the sky (over 50extended source flag is a reasonable indication that it is a galaxy. Since 2MASS claim an accuracy of better than .2" we can again use these objects to compare the large schmidt catalogues and to check the classification accuracy of the GSC catalogues.

Position Differences: In the below table we summerize the positional comparison, figures for this comparison are not included as they do not different from the expected normal distribution. The positional differences have sigmas higher than previously seen but these are bright galaxies and we can not probably expect better.

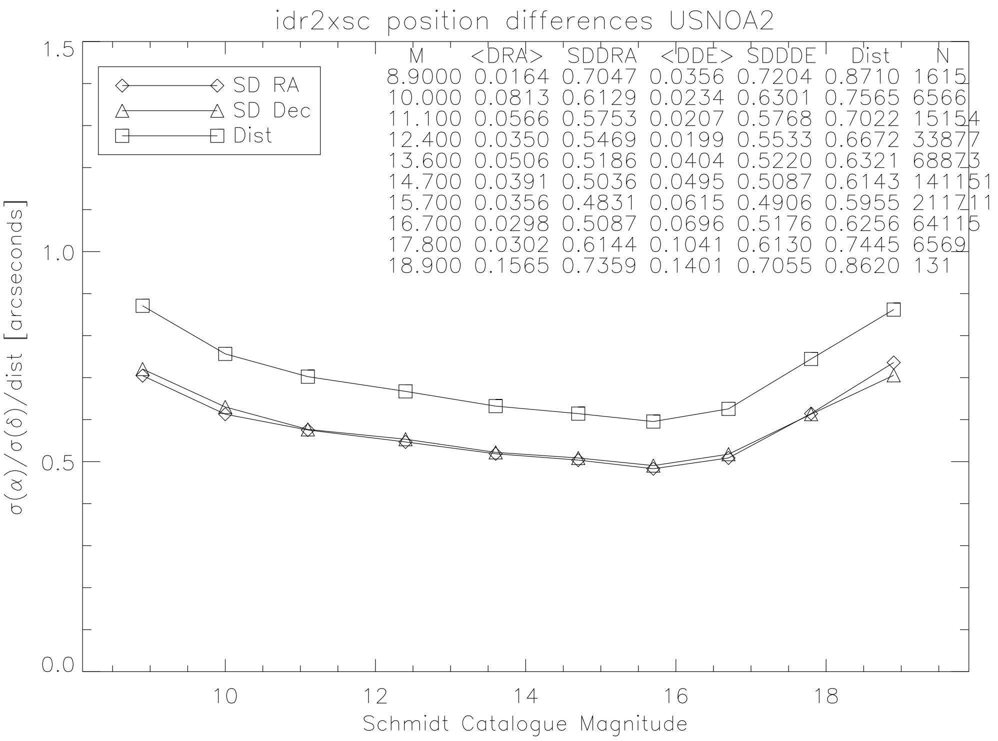
Cat	Matched	mean RA st dev	mean Dec st dev
GSC1.2	102090	-0.0217 +/- .504	-0.084 +/- .510
GSC2.1.1	496334	0.0176 +/- .547	-0.024 +/- .539
USNOA2	541898	0.0384 +/- .507	0.053 +/- .513

Position Differences vs Magnitude: Figure 5 is a plot of the residual sigmas vs magnitudes for the two deep catalogues, we have not plotted vs the schmidt magnitudes as 2MASS infrared magnitudes are not as familar. The trend with magnitude is not as pronounced but we have a combination of precison losses because the IR magnitudes do not follow the optical magnitudes and the 2MASS precisions are a function of theirs. The systematic effects will also not be as obvious here because the Schmidt catalogues come from at least three telescopes. Finally the overall lower precison hides possible systematic terms.

Classification vs Magnitude: In figure 6 we plot classification of these objects vs GSC magnitudes. This is sumerized in the below table.

Cat	Matched	Stars	Non-stars	Defects
GSC1.2	101939	17275(17%)	84100(83%)	564
GSC2.1.1	460825	87324(19%)	370982(80%)	2519

In the comparison to the SPMG we found that 17% of galaxies in this magnitude range are misclassified as stars, this results surpports that. Looking at the graph the sucess does not seem to be a function of magnitude.


idr2xsc position differences USNOA2
M <DRA> SDDRA <DDE> SDDDE Dist N
8.9000 0.0164 0.7047 0.0356 0.7204 0.8710 1615
10.000 0.0813 0.6129 0.0234 0.6301 0.7565 6566
11.100 0.0566 0.5753 0.0207 0.5768 0.7022 15154
12.400 0.0350 0.5469 0.0199 0.5533 0.6672 33877
13.600 0.0506 0.5186 0.0404 0.5220 0.6321 68873
14.700 0.0391 0.5036 0.0495 0.5087 0.6143 141151
15.700 0.0356 0.4831 0.0615 0.4906 0.5955 217711
16.700 0.0298 0.5087 0.0696 0.5176 0.6256 64115
17.800 0.0302 0.6144 0.1041 0.6130 0.7445 6569
18.900 0.1565 0.7359 0.1401 0.7055 0.8620 131
SD RA
SD Dec
Dist
σ(α)/σ(δ)/dist [arcseconds]
Schmidt Catalogue Magnitude

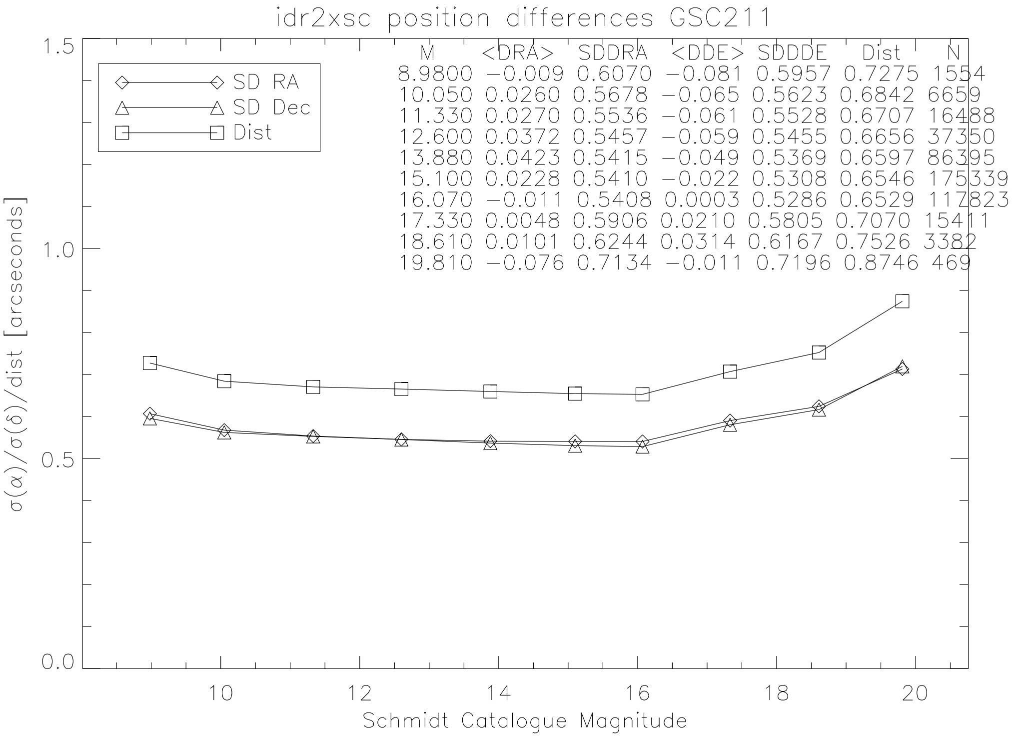

idr2xsc position differences GSC211
M <DRA> SDDRA <DDE> SDDDE Dist N
8.9800 −0.009 0.6070 −0.081 0.5957 0.7275 1554
10.050 0.0260 0.5678 −0.065 0.5623 0.6842 6659
11.330 0.0270 0.5536 −0.061 0.5528 0.6707 16488
12.600 0.0372 0.5457 −0.059 0.5455 0.6656 37350
13.880 0.0423 0.5415 −0.049 0.5369 0.6597 86395
15.100 0.0228 0.5410 −0.022 0.5308 0.6546 175339
16.070 −0.011 0.5408 0.0003 0.5286 0.6529 117823
17.330 0.0048 0.5906 0.0210 0.5805 0.7070 15411
18.610 0.0101 0.6244 0.0314 0.6167 0.7526 3382
19.810 −0.076 0.7134 −0.011 0.7196 0.8746 469
SD RA
SD Dec
Dist
σ(α)/σ(δ)/dist [arcseconds]
Schmidt Catalogue Magnitude

Figure 5:

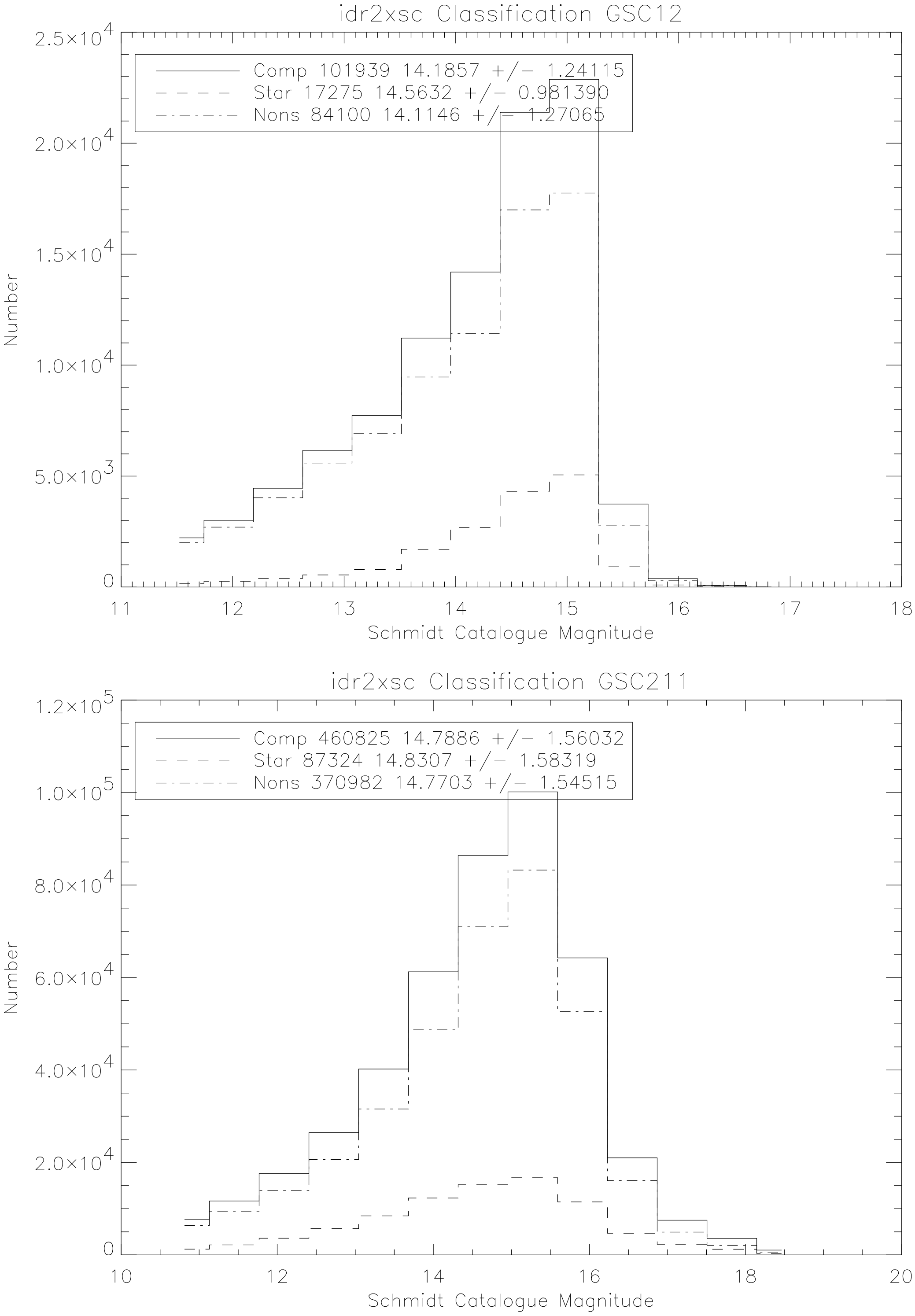

idr2xsc Classification GSC12
Comp 101939 14.1857 +/- 1.24115
Star 17275 14.5632 +/- 0.981390
Nons 84100 14.1146 +/- 1.27065
Number
Schmidt Catalogue Magnitude
idr2xsc Classification GSC211
Comp 460825 14.7886 +/- 1.56032
Star 87324 14.8307 +/- 1.58319
Nons 370982 14.7703 +/- 1.54515
Number
Schmidt Catalogue Magnitude

Figure 6:

2MASS Stars (idr2psc10)

The 2MASS group made the second point source release available in divsions of right ascension. We have taken the 1680899 objects from the RA=10-11 (idr2psc10.tbl) and macthed them to the three schmidt catalogues. These are nominally stars however since they were observed in the infrared what the percentage of contamination is has to be addressed. The quoted precision is better than .2" and is not dependant on magnitude as they only include objects with a high signal to noise.

Conclusions

The results of GSC2.1.1 again indicates that we can expect to produce an excellent catalogue. The comparison data used in this report is again being put on the Torino ftp site, astroserver.to.astro.it, user CRA, password ask me or Jane directly, directory cra_pi/comparison. With the amount of data in the 2MASS comparison we can now also consider looking at bining in plate based coordinates, declination zones and even QAing the 2MASS data. For further QA of the GSC2 projects the most gain will come from having a pre-release of the expected final product, with the appropiate selection criteria. The software used is also on the OATo site so futher catalogues can be produced this way (NPM/UCAC/Other 2MASS regions etc).