Recalibration of the Photometric Zero Point of SDF/SXDS Catalogs

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As products from Subaru Observatory Projects, Subaru Deep Field (SDF) and Subaru XMM-Newton Deep Survey (SXDS) public catalogs [1,2] are publicly available. Recently, [3] reported that B-R color distribution was inconsistent between SDF and SXDS. We therefore recalibrated the B, V, R, i, and z magnitudes of SDF and SXDS against the Sloan Digital Sky Survey (SDSS) [4].

We first constructed color conversions from the SDSS filter system [5] to the Suprime-Cam filter system. The model calculation by ATLAS9 [6] and Yonsei-Yale isochrone [7,8] was used to construct a set of spectral energy distributions (SED) of stars. The transmittance of SDSS and Suprime-Cam were multiplied to the SEDs to calculate the magnitudes, and polynomial function was fitted to the SDSS color vs SDSS-Suprime colors.

Then, possible error sources, such as the mass and temperature of the star, metallicity, recession velocity, Galactic extinction, and atmospheric absorption in the observation were examined. The color constraint of SDSS color in which the variation by these factors is small enough (no more than 0.04 mag) was calculated. The conversion was tested with empirical stellar spectral libraries (BPGS [9], HILIB [10], STELIB [11], CFLIB [12]), and it also worked well within the error.

We selected r~20 mag stars in SDSS, converted them into AB magnitude, converted to Suprime-Cam magnitude, and compared with the SDF/SXDS catalogs. Some data showed an offset larger than 0.1 mag (Table 1). If we correct the offset, the color distribution of R~24 objects in SDF and SXDS became consistent, which were inconsistent if we used the original catalog values (Fig. 1). Since the offset around 20 mag corrected the data around 24 mag, it should be an offset of the zero point.

band	SDF	SXDS-C	SXDS-N	SXDS-S
B	−0.12	0.00	0.02	0.01
V	−0.03	−0.02	−0.02	−0.01
R	−0.05	−0.04	−0.05	−0.05
i	−0.11	−0.10	−0.11	−0.16
z	−0.06	−0.13	−0.14	−0.12

Table 1: Part of the offset of zero point between SDF/SDXS and SDSS. Significant difference is in red.

The origin of the offset was partly explained by relatively higher metallicity of model stars which were used for color calibration of SDF B-band. Also, the calibration of the spectrophotometric standard star SA95-42 [13] which was used for i-band calibration was doubtful. The origin of other offsets remained unclear.

References

[1] Kashikawa, N., et al.: 2004, *PASJ*, **56**, 1011.
[2] Furusawa, H., et al.: 2008, *ApJS*, **176**, 1.
[3] Yamanoi, H., et al.: 2012, *AJ*, **144**, 40.
[4] Yagi, M., et al.: 2013, *PASJ*, **65**, 22.
[5] Doi, M., et al.: 2010, *AJ*, **139**, 1628.
[6] http://wwwuser.oat.ts.astro.it/castelli/grids.html.
[7] Yi, S., et al.: 2001, *ApJS*, **136**, 417.
[8] Demarque, P., et al.: 2004, *ApJS*, **155**, 667.
[9] http://www.stsci.edu/hst/observatory/cdbs/bpgs.html.
[10] Pickles, A.: 1998, *PASP*, **110**, 863.
[11] Le Borgne, J.-F., et al.: 2003, *A&A*, **402**, 433.
[12] Valdes, F., et al.: 2004, *ApJS*, **152**, 251.
[13] Oke, J. B.: 1990, *AJ*, **99**, 1621.

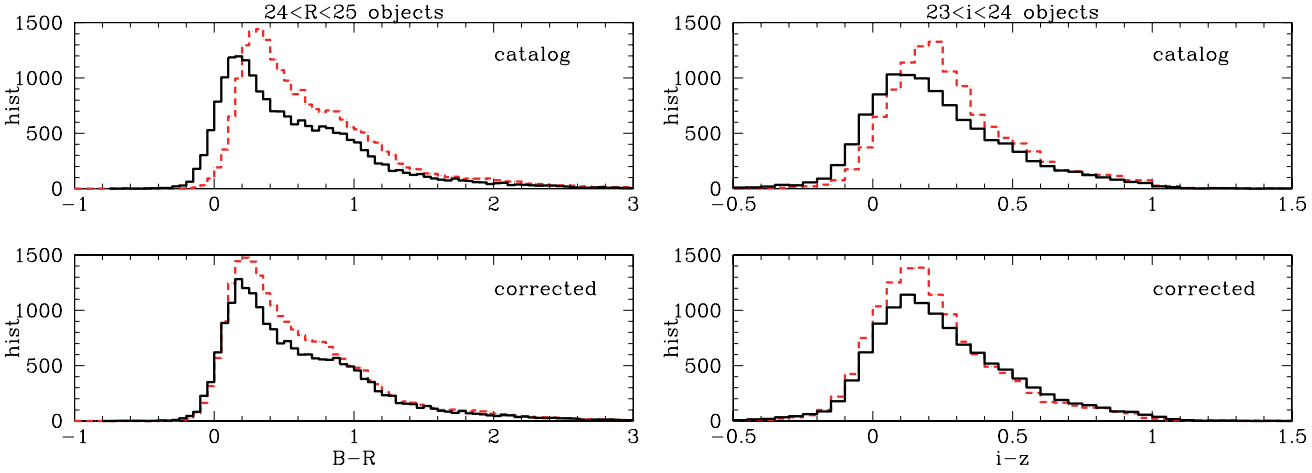

Figure 1: Color distribution of faint objects in SDF (black) and SXDS (red). Top panel uses the catalog values, and bottom panel is after zero point correction. Left panels show B-R color distribution of 24<R<25 magnitude, and right ones show i-z color distribution of 23<i<24 objects.