Table A.2. Correlations of the absolute calibration uncertainties (R_{cal} matrix; Eq. (A.2)).

	IRAC				MIPS			PACS			SPIRE			WISE				IRAS				HFI		
IRAC1	1	0.02	0.02	0.02	0	0	0	0	0	0	0	0	0	0.13	0.06	0.04	0	0	0	0	0	0	0	0
IRAC2	0.02	1	0.02	0.02	0	0	0	0	0	0	0	0	0	0.07	0.12	0.04	0	0	0	0	0	0	0	0
IRAC3	0.02	0.02	1	0.02	0	0	0	0	0	0	0	0	0	0.07	0.06	0.04	0	0	0	0	0	0	0	0
IRAC4	0.02	0.02	0.02	1	0	0	0	0	0	0	0	0	0	0.07	0.06	0.09	0	0	0	0	0	0	0	0
MIPS1	0	0	0	0	1	0	0.34	0	0	0	0	0	0	0	0	0	0.57	0	0	0	0	0	0	0
MIPS2	0	0	0	0	0	1	0.43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MIPS3	0	0	0	0	0.34	0.43	1	0	0	0	0	0	0	0	0	0	0.20	0	0	0	0	0	0	0
PACS1	0	0	0	0	0	0	0	1	0.86	0.86	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PACS2	0	0	0	0	0	0	0	0.86	1	0.86	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PACS3	0	0	0	0	0	0	0	0.86	0.86	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SPIRE1	0	0	0	0	0	0	0	0	0	0	1	0.47	0.47	0	0	0	0	0	0	0	0	0.40	0.41	0
SPIRE2	0	0	0	0	0	0	0	0	0	0	0.47	1	0.47	0	0	0	0	0	0	0	0	0.40	0.41	0
SPIRE3	0	0	0	0	0	0	0	0	0	0	0.47	0.47	1	0	0	0	0	0	0	0	0	0.40	0.41	0
WISE1	0.13	0.07	0.07	0.07	0	0	0	0	0	0	0	0	0	1	0.21	0.14	0	0	0	0	0	0	0	0
WISE2	0.06	0.12	0.06	0.06	0	0	0	0	0	0	0	0	0	0.21	1	0.13	0	0	0	0	0	0	0	0
WISE3	0.04	0.04	0.04	0.09	0	0	0	0	0	0	0	0	0	0.14	0.13	1	0	0	0	0	0	0	0	0
WISE4	0	0	0	0	0.57	0	0.20	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
IRAS1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.69	0.52	0.38	0	0	0
IRAS2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.69	1	0.36	0.26	0	0	0
IRAS3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.52	0.36	1	0.72	0	0	0
IRAS4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.38	0.26	0.72	1	0	0	0
HFI1	0	0	0	0	0	0	0	0	0	0	0.40	0.40	0.40	0	0	0	0	0	0	0	0	1	0.69	0
HFI2	0	0	0	0	0	0	0	0	0	0	0.41	0.41	0.41	0	0	0	0	0	0	0	0	0.69	1	0
HFI3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

Notes. See Table 1 for waveband naming conventions.

The extended source calibration uncertainty is not quantified by the instrument team.

A.5. Herschel/SPIRE

SPIRE calibration, presented by Griffin et al. (2013) is performed on Neptune. The uncertainty comes from three sources. There is a 4% correlated uncertainty on Neptune's model. There is also a 1.5% uncorrelated uncertainty due to the noise in Neptune's observations. Finally, there is a 4% uncorrelated uncertainty on SPIRE's beam area.

A.6. WISE

WISE data have been calibrated by Jarrett et al. (2011) using observations of a network of stars in both ecliptic poles (Cohen et al. 2003) and an additional red source, the galaxy NGC 6552. These calibrators have been observed with *Spitzer*/IRAC and *Spitzer*/MIPS, and compared to WISE. It appears that the relative WISE calibration, tied to *Spitzer*, is accurate to 2.4%, 2.8%, 4.5%, and 5.7% (for WISE1, WISE2, WISE3, and WISE4, respectively). These uncertainties come from the scatter of individual calibrators and can therefore be considered independent. The red calibrator (NGC 6552) is reported to be too bright by ≃6% by Jarrett et al. (2011). However, Brown et al. (2014) revised the central wavelength of the WISE4 band to correct systematic discrepancies observed with red sources.

The absolute calibration accuracy of WISE is not discussed by Jarrett et al. (2011). We can simply assume that each WISE band will be tied to the closest *Spitzer* band: WISE1 with IRAC1; WISE2 with IRAC2; WISE3 with IRAC4; WISE4 with MIPS1. We can thus quadratically add the *Spitzer* calibration uncertainties to these bands and assume that this term will be correlated with the *Spitzer* bands. However, we do not include the IRAC uncertainty on the extended source correction (Appendix A.2), as these calibrators are point sources.

A.7. IRAS

The IRAS flux calibration is presented by Wheelock et al. (1994, Sect. VI.C.2)[27]. The 12 µm flux is calibrated on observations of the star α-Tau, assuming the absolute flux value derived from the ground-based 10 µm photometry by Rieke et al. (1985), accurate within 3%. An additional source of error comes from the uncertainty of 2% on the model used to extrapolate the flux at 12 µm. The 25 and 60 µm fluxes are calibrated by extrapolating the 12 µm flux, using stellar models, normalized to the Sun. The uncertainty in this extrapolation, based on the scatter of individual stars, is estimated to be 4% and 5.3%, respectively (Table VI.C.1 of Wheelock et al. 1994). These uncertainties, which can be assumed to be independent, have to be quadratically added to the 12 µm uncertainty, which is a fully correlated term. The 100 µm calibration is based on observations of asteroids, where the 60 µm flux is extrapolated to 100 µm, assuming that the 25/60 and 60/100 color temperatures are identical. Wheelock et al. (1994) estimate that the total relative calibration uncertainty at 100 µm is 10%, due to the model uncertainty and scatter of the asteroid observations. This uncertainty is correlated with the 60 µm.

For extended sources, uncertainties in the frequency response and the effective detector area have to be considered (Wheelock et al. 1994, Sect. VI.C.4). The uncertainty on the frequency response is not fully quantified, except that it should be 7%/µm of the central bandwidth, with an uncertainty of 0.3 µm on the bandwidth (Sect. VI.C.3 of Wheelock et al. 1994). It is also specified that the 100 µm uncertainty can be significant for objects cooler than 30 K, which is our case. The uncertainty on the detector areas is given by Table IV.A.1 of Wheelock et al. (1994) showing the flux dispersion of each individual detector, during a cross-scan of the planetary nebula NGC 6543. The average dispersions of 6.4%, 6.5%, 11%, and 10.9% (for IRAS1,

[27] https://irsa.ipac.caltech.edu/IRASdocs/exp.sup/toc.html