X33a   ALMA twenty-six arcmin^2 survey of GOODS-S at one millimeter (ASAGAO): Source catalog and number counts

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ASAGAO is a deep ($1\sigma \sim 61~\mu$Jy beam^{-1}) and wide area (26 arcmin^2) survey on a contiguous field at 1.2 mm with ALMA. By combining with ALMA archival data, we obtained a deeper map ($1\sigma \sim 30~\mu$Jy beam^{-1} for a deep region, synthesized beam size $0.59'' \times 0.53''$), providing the largest sample of sources (25 sources at $\geq 5\sigma$, 45 sources at $\geq 4.5\sigma$) among ALMA blank-field surveys. The number counts shows that $52^{+11}_{-8}\%$ of the extragalactic background light at 1.2 mm is resolved into discrete sources at $S_{1.2\mathrm{mm}} > 135~\mu$Jy. We create infrared (IR) luminosity functions (LFs) at $z = 1$–3 from the 5σ sources with K_S-band counterparts, and constrain the faintest luminosity of the LF at at $2.0 < z < 3.0$. The LFs are consistent with previous results based on other ALMA and SCUBA-2 observations, which suggest a positive luminosity evolution and negative density evolution with increasing redshift. We find that obscured star-formation of sources with IR luminosities of $\log{(L_{\mathrm{IR}}/L_{\odot})} \gtrsim 11.8$ account for ≈ 60–90% of the $z \sim 2$ cosmic star-formation rate density.