XMM-ATLAS catalogue description

Excerpt from the paper "The XMM-Newton survey in the H-ATLAS field", Ranalli et al., 2015, accepted by Astronomy & Astrophysics.

The XMM-ATLAS catalogue includes 1700, 1582 and 814 sources detected by `EMLDetect` in the 0.5–8, 0.5–2 and 2–8 keV bands, respectively. The number of unique sources is 1816. The flux limits, defined as the flux of the faintest detected sources, are 2×10^{-15}, 6×10^{-15} and 9×10^{-15} erg s^{-1} cm^{-2} in the 0.5–2, 0.5–8 and 2–8 keV bands, respectively.

In addition ("supplementary catalogue"), we list a number of 175, 103 and 47 sources detected in the above bands by `ewavelet` but not confirmed by `EMLDetect`; in the following we refer to them as supplementary sources. The number of unique supplementary sources is 234.

All coordinates are in the J2000 reference system.

The RA and DEC columns are registered to the reference frame of the SDSS-DR7 QSOs (Schneider et al. 2010 AJ 139, 2360). All other coordinate columns are not registered and present shifts of $0.83''$ and $-0.29''$ in RA and REC, respectively, with a root mean square deviation of $2.1''$.

Column description

The symbols (`ML`) and (`W`) mark whether the column was derived from running `EMLDetect` or `ewavelet`, respectively.

1. IAU_IDENTIFIER — source identifier following International Astronomical Union conventions;

2. ID — unique source number;

3–5. ID058, ID052, ID28

6. RA — (`ML`) right ascension (degrees) from the 0.5–8 keV band, if available; else, from the 0.5–2 keV band, if available; else, from the 2–8 keV band. This column has been corrected for astrometry and registered to the SDSS-DR7 QSO framework;

7. DEC — (`ML`) declination (degrees) as above. This column has been corrected for astrometry and registered to the SDSS-DR7 QSO framework;

8. RADEC_ERR — (`ML`) error on position (arcsec; 1σ). This column was obtained by dividing the `EMLDetect` RADEC_ERR by $\sqrt{2}$. The RADEC_ERR from `EMLDetect` is computed as $\left(\mathrm{RA\_ERR}^2 + \mathrm{DEC\_ERR}^2\right)^{1/2}$. However, when two normalised one-dimensional gaussians of sigma s are combined, the corresponding normalised bi-dimensional gaussian also has sigma s, not $\sqrt{2}s$, which is what one would get with the expression above. Therefore, we divided the `EMLDetect` value by $\sqrt{2}$;

9. WAV_RA — (W) merged right ascension (degrees) from the likelihood ratio;

10. WAV_DEC — (W) merged declination (degrees);

11. WAV_RADEC_ERR — (W) merged error on position (arcsec; 1σ)

12. WAV_RA058 — (W) right ascension (degrees) in the 0.5–8 keV band;

13. WAV_DEC058 — (W) declination (degrees) in the 0.5–8 keV band;

14. WAV_RA052 — (W) right ascension (degrees) in the 0.5–2 keV band;

15. WAV_DEC052 — (W) declination (degrees) in the 0.5–2 keV band;

16. WAV_RA28 — (W) right ascension (degrees) in the 2–8 keV band;

17. WAV_DEC28 — (W) declination (degrees) in the 2–8 keV band;

18. RA058 — (ML) right ascension (degrees) in the 0.5–8 keV band;

19. DEC058 — (ML) declination (degrees) in the 0.5–8 keV band;

20. RA052 — (ML) right ascension (degrees) in the 0.5–2 keV band;

21. DEC052 — (ML) declination (degrees) in the 0.5–2 keV band;

22. RA28 — (ML) right ascension (degrees) in the 2–8 keV band;

23. DEC28 — (ML) declination (degrees) in the 2–8 keV band;

24. ASSOC_RELIAB058052 — association reliability between the (WAV_RA058, WAV_DEC058) and (WAV_RA052, WAV_DEC052) coordinates;

25. ASSOC_RELIAB05828 — association reliability between the (WAV_RA058, WAV_DEC058) and (WAV_RA28, WAV_DEC28) coordinates;

26–28. SCTS058, SCTS052, SCTS28 — (ML) sum of the net source counts from MOS1+MOS2+PN in the 0.5–8, 0.5–2 and 2–8 keV bands, respectively;

29–31. SCTS_ERR058, SCTS_ERR052, SCTS_ERR28 — (ML) errors on SCTS058, SCTS052, SCTS28 (1σ);

32–34. RATE058, RATE052, RATE28 — (ML) net count rates in the 0.5–8, 0.5–2, 2–8 keV bands, summed over the three cameras;

35–37. EXP_MAP058, EXP_MAP052, EXP_MAP28 — exposure times in the 0.5–8, 0.5–2, 2–8 keV bands, summed over the three cameras;

38–40. BG_MAP058, BG_MAP052, BG_MAP28 — (ML) background counts/arcsec^2 in the 0.5–8, 0.5–2, 2–8 keV bands, summed over the three cameras;

41–43. FLUX058, FLUX052, FLUX28 — (`ML`) flux in the 0.5–8, 0.5–2, 2–8 keV bands (erg s^{-1} cm^{-2});

44–46. FLUX_ERR058, FLUX_ERR052, FLUX_ERR28 — (`ML`) error on FLUX058, FLUX052, FLUX28 (1σ);

47–49. DETML058, DETML052, DETML28 — (`ML`) detection likelihoods in the 0.5–8, 0.5–2, 2–8 keV bands;

50–51. EXT058, EXT052 – (`ML`) source extent in the 0.5–8 and 0.5–2 keV bands[1] (σ of Gaussian model in pixels; 1 pixel = $4''$);

52–53. EXT_ERR058, EXT_ERR052 – (`ML`) error on EXT058, EXT052 (1σ);

54–55. EXT_ML058, EXT_ML052 – (`ML`) likelihood of extent in the 0.5–8 and 0.5–2 keV bands;

56. HR — hardness ratio, computed from S = SCTS052 and H = SCTS28 as HR = $(H - S)/(H + S)$;

57. HR_ERR — error on HR (1σ; see below);

The columns from 58 to 87 contain source properties (counts, count rates, fluxes, exposure times, background, wavelet detection scale, source extent) from `ewavelet`; while we report them for all sources, they are actually interesting only for the supplementary sources.

58–60. WAV_SCTS058, WAV_SCTS052, WAV_SCTS28 — (`W`) sum of the net source counts from MOS1+MOS2+PN in the 0.5–8, 0.5–2 and 2–8 keV bands, respectively;

61–63. WAV_SCTS_ERR058, WAV_SCTS_ERR052, WAV_SCTS_ERR28 — (`W`) errors on SCTS058, SCTS052, SCTS28 (1σ);

64–66. WAV_RATE058, WAV_RATE052, WAV_RATE28 — (`W`) net count rates in the 0.5–8, 0.5–2, 2–8 keV bands, averaged over the three cameras;

67–69. WAV_EXP_MAP058, WAV_EXP_MAP052, WAV_EXP_MAP28 — (`W`) exposure times in the 0.5–8, 0.5–2, 2–8 keV bands, summed over the three cameras;

70–72. WAV_BG_MAP058, WAV_BG_MAP052, WAV_BG_MAP28 — (`W`) background counts/$arcsec^2$ in the 0.5–8, 0.5–2, 2–8 keV bands, summed over the three cameras;

73–75. WAV_FLUX058, WAV_FLUX052, WAV_FLUX28 — (`W`) fluxes in the 0.5–8, 0.5–2, 2–8 keV bands (erg s^{-1} cm^{-2});

[1] EXT28 and related columns are not included since no source was found to be extended in the 2–8 keV band.

76–78. WAV_FLUX_ERR058, WAV_FLUX_ERR052, WAV_FLUX_ERR28 — (W) errors on WAV_FLUX058, WAV_FLUX052, WAV_FLUX28 (1σ);

79–81. WAV_WSCALE058, WAV_WSCALE052, WAV_WSCALE28 — (W) wavelet detection scale (pixels; 1 pixel = $4''$);

82–84. WAV_EXTENT058, WAV_EXTENT052, WAV_EXTENT28 — (W) source extent (pixels);

85–87. WAV_EXT_ERR058, WAV_EXT_ERR052, WAV_EXT_ERR28 — (W) errors on WAV_EXTENT058, WAV_EXTENT052, WAV_EXTENT28 (1σ; pixels).

The error on the hardness ratio (column 57, HR_ERR) is defined as

$$\mathrm{HR\_ERR} = 2\frac{\sqrt{(H\,\sigma_{\mathrm{S}})^2 + (S\,\sigma_{\mathrm{H}})^2}}{(H+S)^2} \tag{1}$$

where H and S are the hard (SCTS28) and soft net counts (SCTS052), respectively, and σ_{H} (SCTS_ERR28) and σ_{S} (SCTS_ERR052) are their errors.