The global distribution of magnetic helicity in the solar corona[★] (Corrigendum)

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It has come to our attention that incorrect units were inadvertently used for the axes and colour scales of a number of figures in our paper (Yeates & Hornig 2016). Specifically:

1. The units of field line helicity $\mathcal{A}$ are quoted as Maxwells [Mx], but the values for $\mathcal{A}$ shown in Figs. 3, 5, 7, 10, 11e and 12 in the original paper were actually in $\text{Mx } R_{\odot}^{-2}$. They should be multiplied by $(6.96 \times 10^{10})^2$ to reach the true value in Mx.
2. The units of total helicity H , and of dH/dt are quoted as Mx^2 , but the values were actually in $\text{Mx}^2 R_{\odot}^{-4}$. This applies to Figs. 4c, d, 8c, d and 11d. They should be multiplied by $(6.96 \times 10^{10})^4$ to reach the true value in Mx^2 .

Corrected versions of the affected figures are included here. This does not in any way affect the qualitative results or conclusions of the paper, but we would like to correct the error for the benefit

of future readers who may wish to make quantitative comparisons.

To put the corrected values into context, DeVore (2000) estimates that the typical helicity content of a single interplanetary magnetic cloud is of the order $2 \times 10^{42} \text{ Mx}^2$, which is similar to that shed in our axisymmetric flux rope (Fig. 8c). And Berger & Ruzmaikin (2000) estimate a net transfer rate of helicity due to solar rotation of up to $5 \times 10^{43} \text{ Mx day}^{-1}$ in each hemisphere, at solar maximum. This is also consistent with our results, although a more detailed comparison with a fully data-driven simulation remains to be performed in the future.

References

- Berger, M. A., & Ruzmaikin, A. 2000, *J. Geophys. Res.*, **105**, 10481
DeVore, C. R. 2000, *ApJ*, **539**, 944
Yeates, A. R., & Hornig, G. 2016, *A&A*, **594**, A98

[★] Movies associated to Figs. 10 and 12 are available at <http://www.aanda.org>

Fig. 3. Illustration of the dipolar simulation with $\nu_0 = 0.36 \times 10^{-5} \text{ s}^{-1}$ on days 0, 1, 2, and 20. Greyscale shading on $r = r_0$ shows B_r (white positive, black negative, saturated at $\pm 0.5 \text{ G}$), and projected coronal magnetic field lines traced from height $r = R_\odot$ are coloured (red/blue) according to $\mathcal{A}$, saturated at $\pm 5 \times 10^{19} \text{ Mx}$ with white indicating $\mathcal{A} \approx 0 \text{ Mx}$.

Fig. 4. Various integrated quantities as a function of time, for the dipolar simulations with different ν_0 (indicated by line styles). Panel **a)** shows the open magnetic flux $\int_{r=r_1} |B_r| d\Omega$, panel **b)** shows $\int_D |j| dV$, and panel **c)** shows H_N (asterisks) and H_S (circles). Panel **d)** shows the terms in Eq. (18) for the northern hemisphere, with asterisks denoting S_0 , circles S_1 , squares S_{eq} , and diamonds S_V .

Fig. 5. Latitudinal distribution of field line helicity for the dipolar simulations, showing how the peak value tends to zero as the friction parameter ν_0 is successively doubled. A log-log fit shows that $\mathcal{A}_{\max} \sim \nu_0^{-0.8}$.

Fig. 7. Illustration of the quadrupolar simulation with $\nu_0 = 0.36 \times 10^{-5} \text{ s}^{-1}$ on days 0, 20, 66, and 68. Greyscale shading on $r = r_0$ shows B_r (white positive, black negative, saturated at $\pm 2 \text{ G}$), and projected coronal magnetic field lines traced from height $r = 1.2R_\odot$ are coloured (red/blue) according to $\mathcal{A}$, saturated at $\pm 10^{21} \text{ Mx}$ with white indicating $\mathcal{A} \approx 0 \text{ Mx}$.

Fig. 8. Various integrated quantities as a function of time, for the quadrupolar simulations with different ν_0 (indicated by line styles). The format is the same as Fig. 4. For clarity, panel **d**) shows only the run with $\nu_0 = 0.36 \times 10^{-5} \text{ s}^{-1}$, and only for the northern hemisphere, although the hemispheres are no longer symmetric. The peak value of S_1 during the flux rope eruption is not shown, and is much larger, about $-2.7 \times 10^{43} \text{ Mx}^2 \text{ day}^{-1}$.

Fig. 10. Projected magnetic field lines in the period A (*left column*) and B (*right column*) simulations, on days 0, 60, 120, and 180. Greyscale shading on $r = r_0$ shows B_r (white positive, black negative, saturated at ± 10 G), and projected coronal magnetic field lines traced from height $r = r_0$ are coloured (red/blue) according to $\mathcal{A}$, saturated at $\pm 2.5 \times 10^{21}$ Mx. [Animated versions](#) of these sequences are available online.

Fig. 11. Various integrated quantities as a function of time, for the non-axisymmetric simulations (periods A and B). Panel **a**) shows the total photospheric magnetic flux $\int_{r=r_0} |B_r| d\Omega$, panel **b**) shows the total open flux $\int_{r=r_1} |B_r| d\Omega$, panel **c**) shows $\int_D |j| dV$, panel **d**) shows H_N (asterisks) and H_S (circles), and panel **e**) shows the root-mean-square field line helicity $(\int_D \mathcal{A}^2 dV / \int_D dV)^{1/2}$. The vertical grey lines indicate times of strong flux rope ejections, as explained in the text.

Fig. 12. Example of a flux rope ejection from period A. *From top to bottom*, the rows show days 122, 124, 126, and 128. The *left column* shows the (absolute) running daily difference of horizontal field $B_{\perp} := (B_{\theta}^2 + B_{\phi}^2)^{1/2}$ at the outer boundary $r = r_1$. The *middle column* shows the distribution of $\mathcal{A}$ on $r = r_0$ (saturated at $\pm 10^{22}$ Mx), and the *right column* shows the distribution of Tw at $r = r_0$ (saturated at ± 40). The dashed lines in the *left column* show the neutral line where $B_r(r_1, \theta, \phi) = 0$. Black circles in the other columns identify footpoints of field lines traced down from locations at $r = r_1$ where the running difference of $B_{\perp}$ exceeds 0.05 G day^{-1} . [Animated versions](#) of this figure for both periods A and B are available online.