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Corrigendum to “Stirring by deep cyclones and the evolution of Denmark strait overflow water observed at Line W” [Deep-Sea Res. I 109, 10–26]

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The Line W program was a 10-year study (2004–2014) to investigate variability in the Deep Western Boundary Current (DWBC) and the nearby ocean interior south of New England. Line W stretches from the Middle Atlantic Bight continental slope southeastward towards Bermuda along a satellite altimeter track and is roughly orthogonal to the 2500–3500 m isobaths along the continental slope here (Fig. 1a).

Observations collected through the program comprised time series of velocity, temperature and salinity from moorings along the slope crossing the DWBC (Fig. 1a, yellow circles) as well as repeated hydrographic sections of temperature, salinity and oxygen profiles collected at regular stations across the DWBC, Gulf Stream and into the Sargasso Sea one to two times per year. The shipboard data also included horizontal velocity profiles measured by a lowered acoustic Doppler current profiler (LADCP) on the CTD rosette and tracer data from water samples collected at discrete depths. Mapped sea surface height fields from satellite altimetry provided spatial context for these in situ Line W observations.

In a study of the coupling between upper-ocean (Gulf Stream) and abyssal processes, Andres et al. (2016) report on the velocity structure of the DWBC and Gulf Stream south of New England as inferred from the shipboard LADCP sections along Line W. From these LADCP data, Andres et al. (2016) calculated a full 18-section mean as well as means for sections sorted based on the state of the Gulf Stream at Line W at the time of the individual cruises (straight path versus meander trough) as observed in sea surface height maps from satellite altimetry. The various means were plotted as depth-distance sections showing the two components of horizontal velocities (see Figs. 4, 5 and 7 in Andres et al., 2016). However, a coding error resulted in the incorrect decomposition of the northward and eastward components of the LADCP-derived velocities—u_{East} and v_{North} (Fig. 1b)—into the along-track (x) and cross-track (y) coordinate system. Our intent was to produce velocity components (u, v) projected onto axes rotated east by 61°degrees (Fig. 1d), but instead the rotation we applied in the code was only 29° (Fig. 1c).

Here we reproduce three figures from Andres et al., 2016 but with the corrected coordinate system rotation and decomposition of the velocities into u (along-track velocity) and v (cross-track velocity). Fig. 2 shows the full 18-section mean velocity components (replacing Fig. 4 from Andres et al., 2016). Fig. 3 shows the mean velocity components generated from 13 sections when the Gulf Stream was in a straight-path state (replacing figure 5 in the Andres et al., 2016) and Fig. 4 shows the mean velocity components calculated from 5 sections when there was a meander trough in the Gulf Stream path at Line W (replacing figure 7 in Andres et al., 2016).

These corrected rotations do not lead to any substantial change in the results and conclusions of Andres et al. (2016), nor do they change the other figures in the original paper. However there are some differences with regard to the details reported in Andres et al. (2016), which are listed below.

First, in the mean generated for the 13 sections when the Gulf Stream was in a non-meander state (Fig. 3), the region of negative v (i.e., equatorward flow) below the surface-intensified Gulf Stream reaches −11 cm s^{-1} at 3150 m depth near station 14 (yellow arrow) rather than −12 cm s^{-1} at 3400 m near station 15 based on figure 5 of Andres et al. (2016). The location of the velocity core associated with Denmark Strait Overflow Water (DSOW, blue arrow) is not affected by the corrected rotation.

Second, for the 5-section mean when the Gulf Stream was in a large meander path at Line W (Fig. 4), the core of this equatorward flow (blue arrow) is onshore of the Gulf Stream and stretches from the surface to the seafloor near station 17 (as reported in Andres et al., 2016), but the magnitude of v is more pronounced reaching −32 cm s^{-1} (rather than −22 cm s^{-1} as reported in Andres et al., 2016). The Gulf Stream's deep-reaching subthermocline flow reaches 20 cm s^{-1} between 3500 and 4000-m depth (red arrow) rather than 18 cm s^{-1} as reported in Andres et al., 2016.

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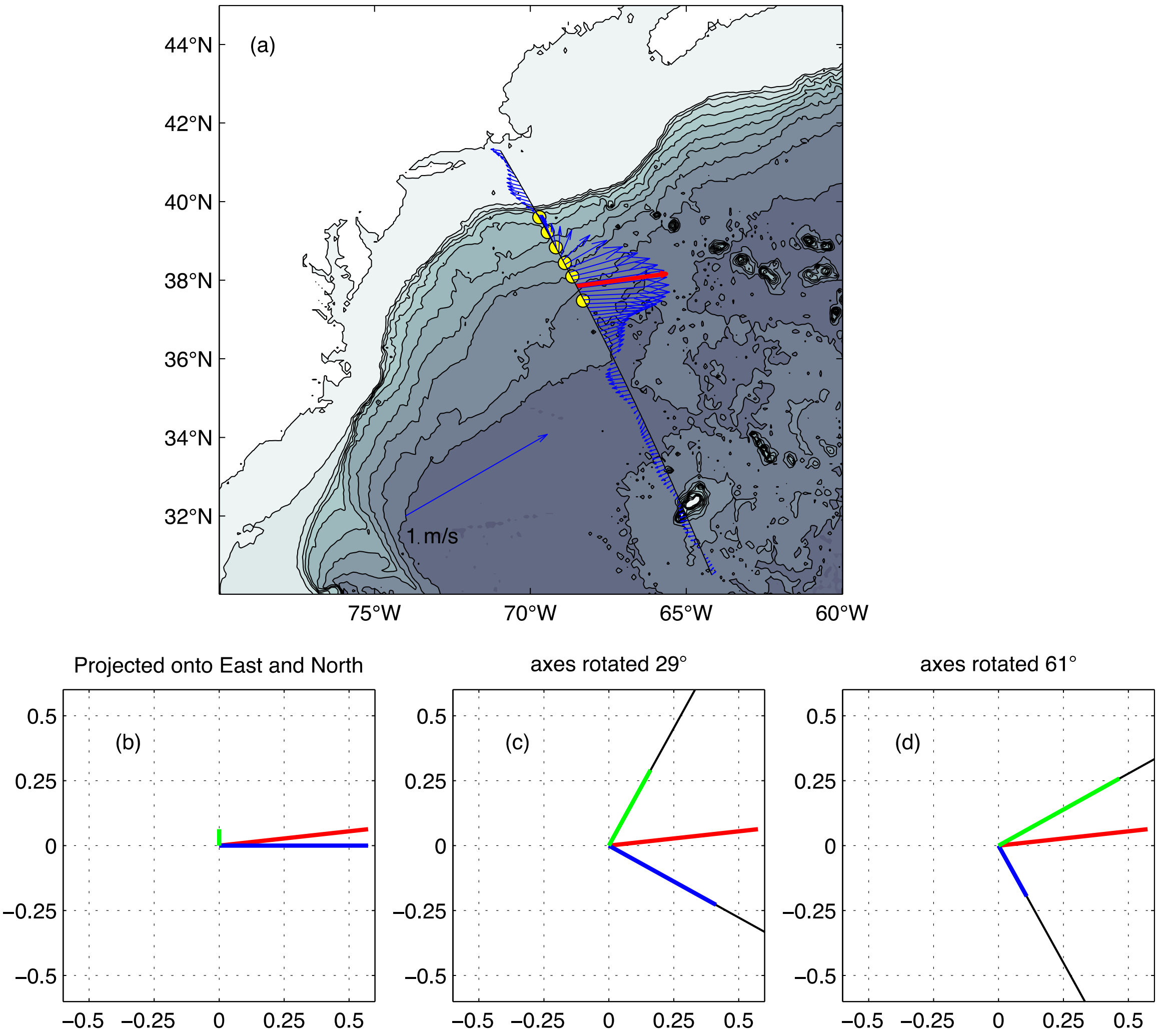

Fig. 1. Panel (a): mean velocity vectors along Line W–calculated from the 2004–2015 daily Aviso gridded velocity product–superimposed on the regional bathymetry with black lines showing isobaths to 5000 m depth at 500 m increments; yellow dots show the locations of the Line W moorings. The mean velocity vector with maximum speed (i.e. the core of the Gulf Stream) is highlighted in red to demonstrate the rotation error of Andres et al., 2016 (panels b-d.) Panel (b): decomposition of the vector at the core of the Gulf Stream (red) into northward (green) and eastward (blue) components. Panel (c): decomposition of the same vector onto axes rotated by 29° (i.e. the incorrect rotation, mistakenly used in Andres et al., 2016). Panel (d): decomposition of the same vector onto axes rotated by 61° to give the Line W cross-track (v, green) and along-track (u, blue) velocity components. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

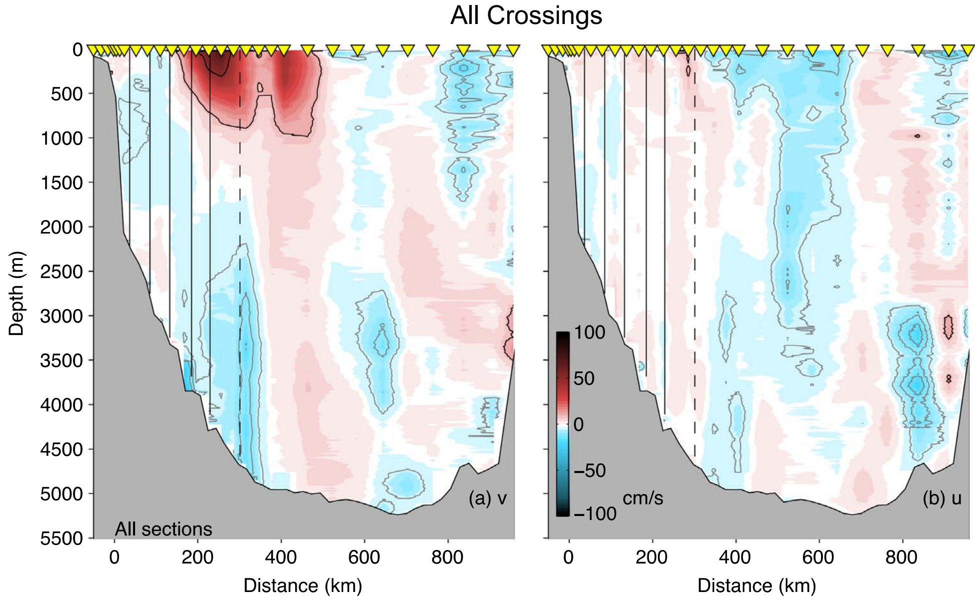

Fig. 2. Eulerian mean of velocity in the (a) *v* (cross-track) and (b) *u* (along-track) directions (rotated 61° east of North) from all 18 available LADCP sections. Grey contours highlight the structure of the negative velocities (and are at −5 cm s^{-1}, −10 cm s^{-1} and −15 cm s^{-1}); black contours are at 10 cm s^{-1} and 50 cm s^{-1}. Vertical lines indicate locations of Line W moorings (numbered 1 through 6 from left to right), with dashed line indicating mooring 6 (deployed only in the more recent settings of the Line W array). Yellow triangles indicate nominal Line W station locations. This replaces Fig. 4 of Andres et al. (2016). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

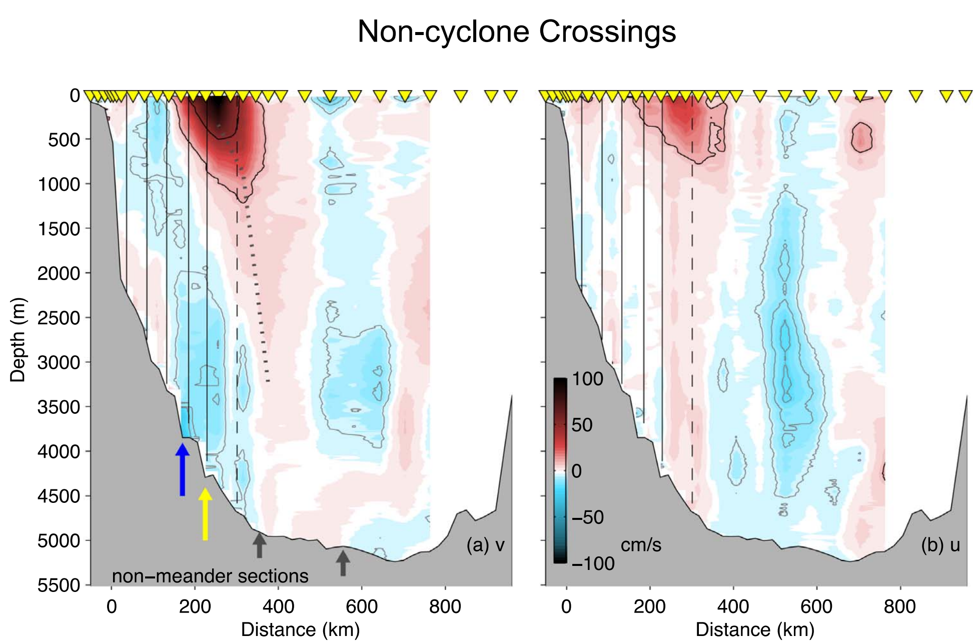

Fig. 3. Eulerian mean of (a) *v* and (b) *u* for the 13 sections that do not sample through a Gulf Stream meander trough. Yellow arrow highlights the core of equatorward flow aligned beneath the Gulf Stream and blue arrow highlights the velocity maximum associated with DSOW. Grey dotted line highlights the "tilt" in the Gulf Stream; dark grey arrows highlight the edges of the deep poleward velocities offset from the upper ocean Gulf Stream flow. Vertical lines, symbols and contours as in Fig. 2 and this replaces figure 5 of Andres et al. (2016). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

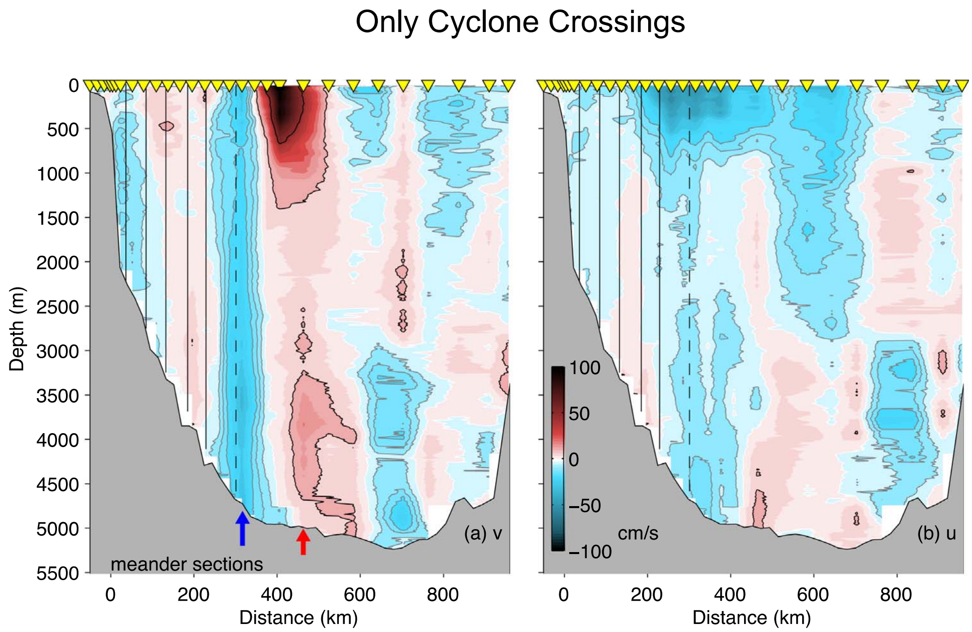

Fig. 4. Eulerian mean of (a) *v* and (b) *u* for 5 sections (6, 8, 15, 16, and 18) that sampled a Gulf Stream meander trough. Red and blue arrows highlight flow features discussed in the text. Vertical lines, symbols and contours as in Fig. 2 and replaces figure 7 in Andres et al. (2016). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

Reference

Andres, M., Toole, J.M., Torres, D., Smethie, W.M., Jr., Joyce, T.M., Curry, R.G., 2016. Stirring by deep cyclones and the evolution of Denmark strait overflow water observed at line W. Deep Sea Res. 109, 10–26. http://dx.doi.org/10.1016/j.dsr.2015.12.011.