



Upper ocean geostrophic transports in the North Atlantic based on EN3 data

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We present time series of the integrated zonal density differences and the upper ocean geostrophic transports in the North Atlantic between 40°N and 60°N based on the EN3 dataset from 1996 to 2012. We calculate zonal density differences from the EN3 temperature and salinity fields remapped to a 1°x1° grid by averaging all density values within a 10° band off either boundary. Due to the sparseness of density values in space and/or time we average vertically from the top to ~100m and temporally below ~1300m. Vertically integrated zonal density differences (~150m - 1150m) show a decrease of on average 0.0058 kg m⁻³/yr between 40°N and 50°N, while between 50°N and 60°N the temporal changes are generally weaker and not spatially uniform. In contrast, the vertically integrated basin wide zonal mean density from EN3 shows a decrease for the entire range of latitudes (-0.0051 kg m⁻³/yr).

We calculate upper ocean geostrophic transports from the full vertical profiles of the zonal density gradients, assuming a reference level at the bottom and a zonally constant mass balance correction. The resulting meridional transport integrated from the surface to 1150m shows similar annual mean variability at 41°N as the transport presented by Willis (2010). Consistent with the decreasing zonal density differences, we find in the meridional transports a decrease of on average -0.25 Sv/yr between 40°N and 50°N, while between 50°N and 60°N the temporal changes are generally weaker and not spatially uniform. These latitude-dependent temporal changes of the meridional transports dominantly originate from the densities at the western boundary.