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Observations of semi-diurnal energy fluxes at the western boundary of the North Atlantic at 16° N and $47/49^\circ$ N

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Semi-diurnal energy fluxes in horizontal direction have been estimated from repeated profile measurements with Lowered Acoustic Doppler Current Profilers (LADCP) and a Conductivity-Temperature-Depth probe (CTD). Profiling took place at three sites in the Deep Western Boundary Current (DWBC): off Flemish Cap at 47° N and 49° N and in the tropics at 16° N. Integrated energy flux at 47° N and 49° N is directed along the shelf and reaches (1.8 ± 0.4) kW m^{-1} and (0.25 ± 0.11) kW m^{-1}, respectively. In addition to the energy flux, diapycnal diffusivity and energy dissipation have been calculated from density inversions off Flemish Cap at 47° N. Strong mixing is observed below 2000m with an integrated dissipation of $\epsilon_{47^\circ\,\mathrm{N}}(z < -2000\,\mathrm{m}) = 340\,\mathrm{mW\,m^{-2}}$ and diapycnal diffusivity reaching up to $1.7 \times 10^{-1}\,\mathrm{m^2 s^{-1}}$. At 16° N, the energy flux is (0.74 ± 0.23) kW m^{-1} in uphill direction. Due to the proximity to the shelf at 16° N, the westward energy flux below 200 m can only partially be dissipated. The residual part has to be reflected or propagate further over the shelf. The energy fluxes at 47° N and 49° N are dissipated over a distances of the order $\mathcal{O}(L) = 1 - 10$ km indicating local generation of internal tides. The differences in both direction and magnitude at the three sites illustrate the variability of internal wave characteristics along the DWBC: While internal waves off Flemish Cap can in principle propagate further along the DWBC, they have to be dissipated or reflected in the tropics at 16° N. Strong fluxes and dissipation below 2000 m support the idea that tides belong to the processes that provide energy for deep mixing required to close the Meridional Overturning Circulation.