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# Upper ocean mixing processes and their impact on the mixed layer heat balance during the onset of the Atlantic Cold Tongue.

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An extensive measurement program within the Atlantic Cold Tongue (ACT) region was carried out during the ACT onset in boreal summer 2011. During two consecutive cruises shipboard microstructure profiles, conductivity-temperature-depth-$O_2$ (CTD-$O_2$) profiles and shipboard velocity profiles were collected between mid-May and mid-July. The shipboard measurements were complemented by a Glider swarm experiment during which 5400 CTD-$O_2$ profiles were collected along specified transects within the ACT region. One of those Gliders was equipped with a MicroRider turbulence package and collected a 5-week microstructure time series of about hourly-resolution in the center of the cold tongue on the equator at 10°W. The MicroRider/Glider package was circling a PIRATA mooring from which additionally high-resolution acoustic Doppler current profiles are available for this time period to allow analysis of the background conditions. In this contribution we use a subset from the above data to detail mixing processes in the upper stratified ocean and describe the background conditions favoring enhanced mixing. From end of May to mid–July, sea surface temperature decreased from 26°C to below 22°C at 10°W. During the whole period of autonomous microstructure observations, strong bursts of turbulence were observed extending from the mixed layer into the upper thermocline. These bursts lasted for 3-5 hours and were found to penetrate to about 30m below the base of the mixed layer. They were observed to occur predominately during night-time while during day-time they were less frequent. Dissipation rates of turbulent kinetic energy ($\epsilon$) during these bursts were above $3x10^{-6}Wkg^{-1}$ in the upper stratified water column and turbulent eddy diffusivities ($K_\rho$) often reached $1x10^{-3}m^2s^{-1}$. The data set suggests that strength and frequency of occurrence of the turbulent bursts is modulated by the presents of Tropical Instability Waves which additionally enhance background shear at the equator. The presents of internal waves having frequencies close to the buoyancy frequency during enhanced mixing events will be discussed. From the first 6 days of microstructure data, a diapycnal heat flux divergence from the mixed layer into the upper stratified ocean of $80Wm^{-2}$ was inferred. Other contributions to the mixed layer heat balance will be examined to evaluate their relevance during ACT onset.