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Temperature statistics above a deep-ocean sloping boundary: turbulence, intermittency and signs of convection.

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A detailed analysis of the statistics of temperature based on an oceanographic observational dataset is presented. The data is collected using a moored array of 144 thermistors, 100m tall, deployed above the slopes of a seamount in the North Eastern Atlantic Ocean from April to August 2013. The thermistors are built in-house at the Royal NIOZ, and provide a precision better than $10^{-3}K$ and very low noise levels. The thermistors measure temperature every second, synchronised throughout the moored array. The thermistor array ends 5m above the bottom, and no bottom mixed layer is visible in the data, indicating that restratification is constantly occurring and that the mixed layer is either absent or very thin. Intense turbulence is observed, and a strong dependence of turbulence parameters on the phase of the semidiurnal tidal wave is also evident.

We compute the statistical moments (generalised structure functions), of order up to 12, of the distributions of temperature fluctuations and increments. Strong intermittency is observed in particular during the downslope phase of the tide and in the upper half of the array, but the inertial range of turbulence is clearly detected by the thermistors. Skewness and higher order moments of temperature increments suggest that convective structures are present in the upper half of the array during the upslope phase. On the other hand, in the lower half of the array during the same tidal phase, the statistics of temperature increments are compatible with those of a passive scalar in grid turbulence, as measured in various laboratory experiments. We suggest that during the upslope phase convective plumes may be ejected from the bottom layer as suggested by numerical simulations by other authors. The downslope phase is sometimes thought to be more shear dominated, but our results suggest on the other hand that convective activity could still be playing a role at small scales.