Observed temporal and spatial variability in the marine environment at the Sub-Antarctic Prince Edward Islands–evidence of a changing climate?

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The sub-Antarctic Prince Edward Islands (PEI) (47°S,38°E) are classified as isolated, hostile, impoverished regions, in which the terrestrial and marine ecosystems are relatively simple and extremely sensitive to perturbations. Their location between the Sub-Antarctic Front (SAF) and the Antarctic Polar Front (APF), bordering the Antarctic Circumpolar Current (ACC) provides an ideal natural laboratory for studying how organisms, ecological processes and ecosystems respond to a changing ocean climate in the Southern Ocean. Recent studies have proposed that climate changes reported at the PEI may correspond in time to a southward shift of the ACC and in particular of the SAF. This southward migration in the geographic position is likely to coincide with dramatic changes in the distribution of species and total productivity of this region. This study focuses on the inter-comparison of observations available at these islands. Using spectral analysis which is a study of the frequency domain characteristics of a process, we first determine the dominant characteristics of both the temporal and spatial variability of physical and biogeochemical properties. In doing so the authors are able to determine whether and how these indices of variability interact with one another in order to understand better the mechanisms underpinning this variability, i.e. the seasonal zonal migrations associated with the SAF. Additionally, we include in our analysis recent data from 2 ADCP moorings deployed between the islands from 2014 to 2015. These in-situ observations of circulation and hydrography in the vicinity of the islands provide a unique opportunity to establish a better understanding of how large scale climatic variability may impact local conditions, and more importantly its influence on the fragile ecosystem surrounding the PEI.