Geophysical Research Abstracts, Vol. 7, 10293, 2005
SRef-ID: 1607-7962/gra/EGU05-A-10293

Distribution and ventilation of ocean heat on the western Antarctic Peninsula continental shelf

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The Palmer LTER program has been sampling the western Antarctic Peninsula (wAP) continental shelf waters since 1993, a region subject to regional warming among the fastest documented on Earth. Consequently, it is host to rapidly melting marine glaciers, considerable changes in the sea ice field (transition of coastal perennial sea ice to seasonal ice fields) and marine ecosystem migrations. The Palmer LTER project has been systematically sampling this region since 1993. Presented here are the results of the analysis of ten years of LTER upper ocean physical data designed to address (among other things): (1) the relationship of shelf waters to those of the (warm) Antarctic circumpolar waters, (2) source of the anomalous freshwater pool in the coastal regions, and (3) regional spatial and temporal coherent patterns, and their relationship to extra-polar climate variability. Primarily, this talk focuses on the delivery and distribution of ocean heat on the wAP continental shelf, in an effort to establish an ocean foundation against which to further evaluate the glacial retreat, marine ecosystem migrations and other changes in the marine system, such as those indicated from recent high-resolution sediment cores suggesting alternating episodes of warm versus cold shelf bottom waters. Classic Antarctic water masses are present throughout the LTER wAP sampling grid; the distribution of warm ACC waters on the continental shelf are mapped annually (suggesting the frequency of shelf renewal of this warm water, and how it enters the shelf). T-S scatter plots and the spatial-temporal decompositions show that the waters fall into distinct groupings according to their geographic setting (e.g., slope, shelf or coastal waters). Summer coastal waters show an anomalously fresh and cold surface freshwater pool, attributed to glacial meltwater.

We find that the nature of the ocean static stability, and air-sea heat loss suggests that water column destabilization and deep shelf water (bottom water) formation is a possibility in the region (a region notable for not displaying any apparent bottom water formation previously).