R/V Arni Fridriksson A200711 Cruise Summary: Shelf-Basin Exchange South of Denmark Strait

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Voyage A200711 of R/V *Arni Fridriksson* took place from 29 August to 6 September, 2007 in waters north and west of Iceland.[1] Programs being carried out represented a collaboration between the Woods Hole Oceanographic Institution (WHOI; R. Pickart, C. Ashjian), the Marine Research Institute of Iceland (HAFRO; H. Valdimarsson, S. Jonsson, A. Gislason), and the Johns Hopkins University (JHU; T. Haine). The main objectives of the cruise were (1) to turnaround an array of shelf moorings north of Iceland (HAFRO), (2) to deploy a mooring west of the Kolbeinsey Ridge (HAFRO), and (3) to deploy a mooring array across the East Greenland Current and Spill Jet south of Denmark Strait (WHOI). All of the objectives were successfully met.

Brief Synopsis

The *Arni* departed Isafjordur, Iceland, and after a brief stop in Akureyri, headed north to the vicinity of the Kolbeinsey Ridge where a moored profiler was deployed by HAFRO on the west side of the ridge. This is intended to measure the flow of water entering Denmark Strait from the Iceland Sea, which is believed to contribute to the overflow waters through the strait. After this we steamed south to the Icelandic shelf where two short HAFRO moorings were recovered and re-deployed. The purpose of these moorings is to measure the eastward flow of Atlantic Water north of Iceland.

Following a brief port stop in Isafjordur we then sailed west to the East Greenland shelfbreak near 65°N, which is the site of the WHOI array. The first two moorings (on the outer shelf) were deployed quickly, but work was then suspended for roughly 30 hours due to a low pressure system that traversed through the region. It is worth noting that the oceanic response to this very type of storm is one of the scientific objectives of our experiment; QuikSCAT imagery revealed that strong northerly barrier winds resulted from the storm. When work resumed the remaining moorings were deployed without incident. Despite a significant swell (due to the storm), energetic currents, and a steep continental slope, all of the moorings were placed at the intended locations (Fig. 1).

In addition to the mooring work we occupied 7 CTD stations (one at each of the mooring sites), and conducted multi-net tows at the four shoreward-most sites (where there is complete water column coverage with ADCPs). One of the purposes of the net tows is to calibrate the backscatter signal of the ADCPs in an effort to quantify the cross-stream fluxes of zooplankton. The cruise terminated in Reykjavik, Iceland.

[1] The cruise was originally planned to be on the *Bjarni Saemundsson*, but steering problems forced the ship into dry dock. Luckily HAFRO was able to provide their larger vessel, *Arni Fridriksson*, for the experiment. This took a great deal of effort on very short notice, and we are most grateful to HAFRO.

Some Preliminary Results

Since 2001 four hydrographic sections have been occupied along the array line (including the occupation on this cruise). Fig. 2 shows the salinity field, with potential density overlaid, for each of the sections. Some aspects are the same each year, including the presence of salty Irminger Water over the deeper part of the basin (which has recirculated from the region near Denmark Strait), and the downward sloping isopycnals from the shelf to the basin. The geostrophic shear associated with this isopycnal tilt supports the bottom-intensified East Greenland Spill jet, which is one of the features being studied in the experiment. From inspection of the four sections one gets the impression that it is common for Irminger Water to penetrate onto the shelf, whether in the form of eddies/lenses (as in the 2004 and 2007 occupations) or extensive "flooding" of the shelf with salty water (the 2003 occupation). Determining the processes by which water is exchanged between the shelf and basin is another aim of the experiment.

It is clear that the East Greenland shelfbreak south of Denmark Strait is highly variable and dynamic, and that high-resolution measurements are necessary to capture properly the scales of motion. Superposed on the sections in Fig. 2 are the mooring locations and the vertical coverage of the moored conductivity/temperature/depth (CTD) profilers (denoted by the vertical lines).[2] One sees that the array as deployed will be sufficient to resolve the water masses and velocity field in this region, both vertically and horizontally. By returning two hydrographic/velocity sections daily, the array will fundamentally advance our understanding of this important and complex current system.

[2]There is an additional Microcat situated within a tube float at 50 m depth, and the ADCP velocity coverage extends to just below the sea surface.

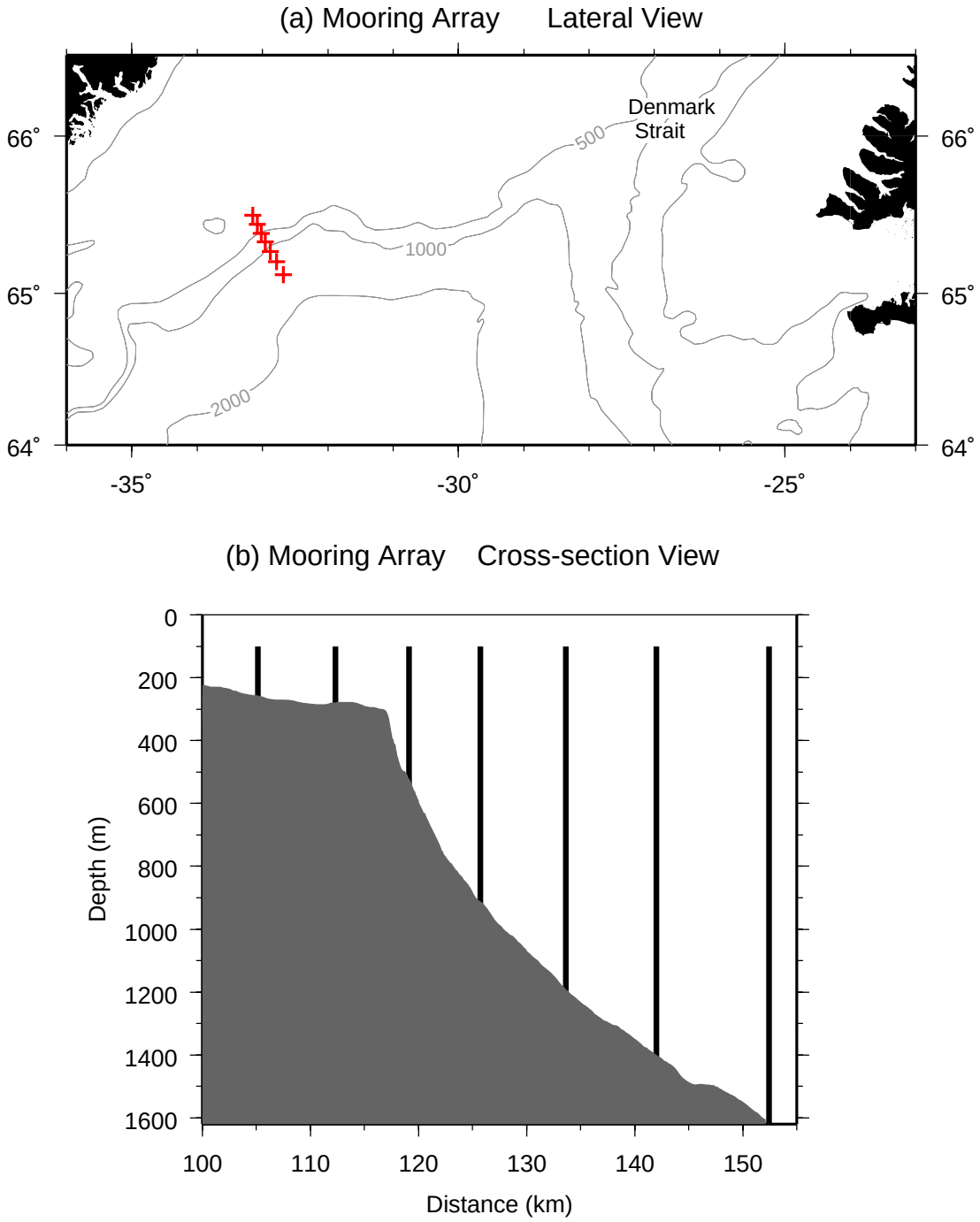

Figure 1: Mooring array deployed by the *Arni Fridriksson* in September 2007. (a) lateral view; (b) Cross-section view showing the coverage of the CTD moored profilers.

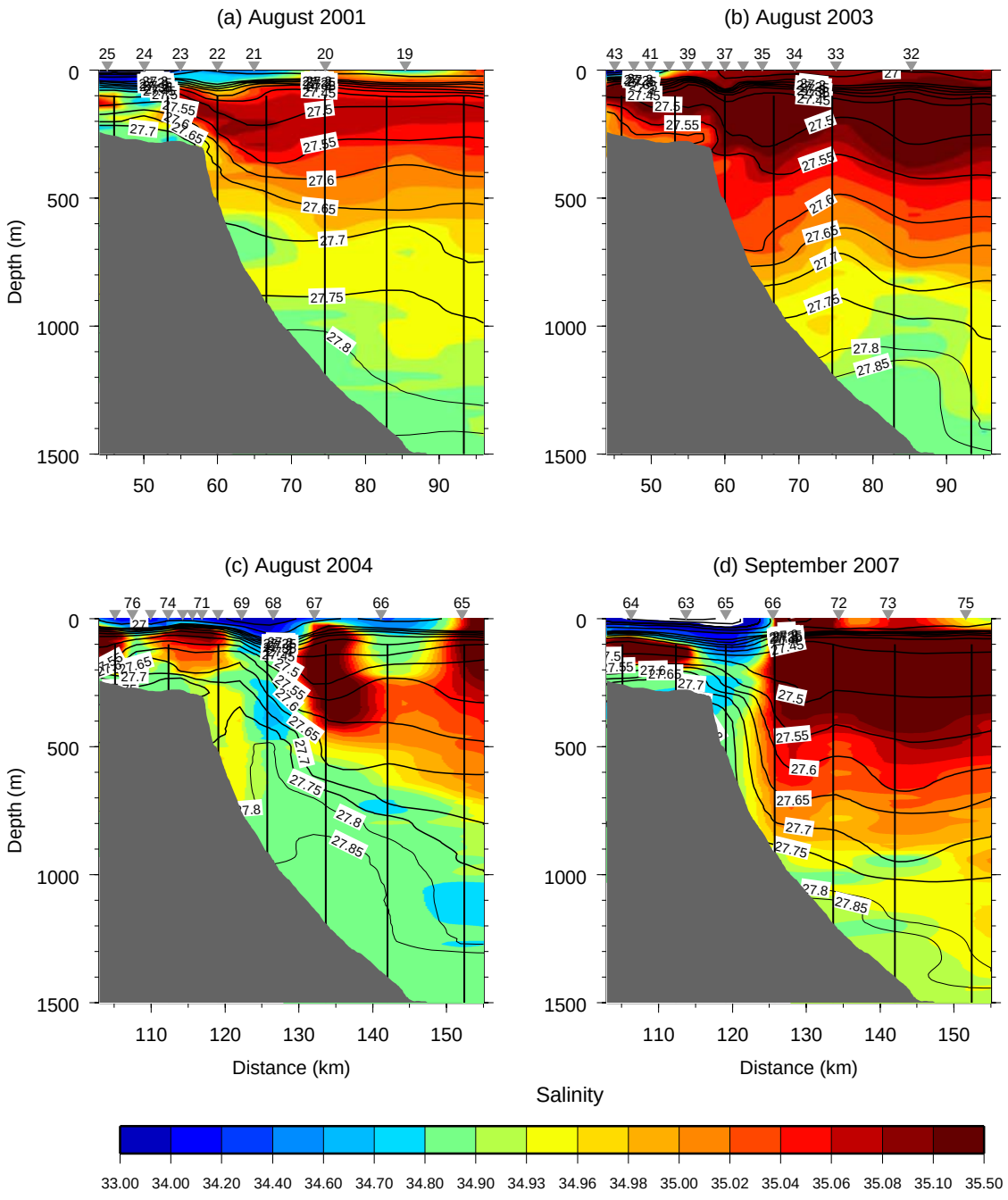

Figure 2: Four hydrographic sections occupied along the array line. The color is salinity (see color scale) and the contours are potential density referenced to the sea surface (kgm^{-3}). The locations of the CTD stations are indicated along the top. The coverage of the CTD moored profilers is indicated by the black vertical lines.