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Recent variability in the Atlantic Water properties in the West Spitsbergen Current

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The Atlantic Water (AW) layer in the West Spitsbergen Current (WSC) is a major source of heat and salt for the Arctic Ocean and the areas of deep convection in the Greenland Sea. It is clear that recent variability in the AW properties is considerable and somehow linked to the North Atlantic Oscillation (NAO). In the southern Fram Strait, the WSC has two main branches, an eastern core on the continental slope and a western one in the Knipovich ridge area. Inferences of correlation between the AW properties and the winter NAO index have never been based on simultaneous hydrographic series across both branches of the WSC. Here we make such inferences using summer hydrographic data along a zonal section from 6^o to 15^{o}E at 76.5^{o}N occupied by R/V *Oceania* from 1996 to 2003. In the eastern branch, our time series go back to 1991. In particular, we analyze the interannual variability of the heat content and geostrophic flow in the AW layer (temperature above 2 ^{o}C and salinity above 34.9 psu). The series in the eastern core area show two warm periods, one at the beginning of the 1990s and one at the beginning of the 2000s, separated by a cold event in 1997-98. Links to the NAO are not clear. The cold event lags the spectacular drop of the NAO index in 1996 but the extremes of the heat content in the warm periods are concomitant with the extremes of the NAO index in these periods. However, if we consider the average AW layer thickness on the whole section in the 1996-2003 period, we obtain a high correlation (r=0.93 for unsmoothed series) in which the NAO index leads by 1 year. This indicates that concentration of hydrographic observations in a small band of the WSC may obscure conclusions about the NAO effects on the regional heat content changes. In contrast, the geostrophic flow shows a close relation to the NAO only in limited areas. The most striking result is a nearly perfect correlation for the strength of the western branch of the WSC, which evolves without a lag

and in the opposite phase to the NAO index (r=-0.96 for unsmoothed series). This suggests that a dynamic response of the Arctic Front is the most direct regional effect of the NAO-related forcing. We also draw, from an analysis of the AW salinity series, a rather surprising conclusion that the AW temperature in the WSC may be predictable 1 year in advance.