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The Arctic Ocean Halocline and its variability from 1997 to 2009

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As a key structure to understand the role of the ocean on the sea ice mass balance, the study of the Arctic Ocean halocline and its spatiotemporal variability requires serious attention. In this study, we are proposing a new definition of the halocline which is based on the salinity gradient structure, taking into account both the salinity amplitude and the halocline thickness, contrary to most previous definitions that were based on a salinity constant only. CTD data collected from 1997 to 2009 during icebreaker cruises or autonomous buoys drifts are used to determine the halocline, its time and space variability. This allows for the observation of the interannual spatiotemporal variability of the halocline stratification during three summertime periods, with a special focus on three main regions of the Arctic Ocean: the Canada basin, the Makarov basin and the Amundsen basin. Observations reveal that the halocline in the Amundsen basin was rather stable over the three time periods. On the contrary, the Canada and Makarov basins' halocline became much more stratified during the IPY rather than before mainly because of surface water freshening. Observations also confirm that the role of the halocline thickness for controlling the stratification variability should not be underestimated. Observations suggest that both large scale and small scale processes affect the halocline. In fact, changes in surface salinity observed in the Makarov basin might be linked to the AO index, as previously observed in the early 1990s. More locally, some observations point out that salt/heat diffusion from the Atlantic water underneath and brine rejection could be responsible for salt content variability at depth and, as a consequence, for the variability of the halocline. In spite of the existence of interannual variability, the Arctic Ocean main stratification still remains stable and robust suggesting that the deep ocean can not affect significantly the upper layer and sea ice, at least for the time being.