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# Dynamical and thermodynamical coupling between the North Atlantic subtropical high and the marine boundary layer clouds in boreal summer

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This study investigates dynamical and thermodynamical coupling between the North Atlantic subtropical high (NASH), marine boundary layer (MBL) clouds, and the local sea surface temperatures (SSTs) over the North Atlantic in boreal summer for 1984–2009. On interannual timescales, the summer mean subtropical MBL clouds to the southeast of the NASH is actively coupled with the NASH and local SSTs: a stronger (weaker) NASH is often accompanied with an increase (a decrease) of MBL clouds and abnormally cooler (warmer) SSTs along the southeast flank of the NASH. To understand the physical processes between the NASH and the MBL clouds, the authors conduct a data diagnostic analysis and a numerical modeling investigation using an idealized anomalous atmospheric general circulation model (AGCM). Results suggest that significant northeasterly anomalies in the southeast flank of the NASH associated with an intensified NASH tend to induce stronger cold advection and coastal upwelling in the MBL cloud region, reducing the boundary surface temperature. Meanwhile, warm advection associated with the easterly anomalies from the African continent leads to warming over the MBL cloud region at 700 hPa. Such warming and the surface cooling increase the atmospheric static stability, favoring growth of the MBL clouds. The anomalous diabatic cooling associated with the growth of the MBL clouds dynamically excites an anomalous anticyclone to its north and contributes to strengthening of the NASH circulation in its southeast flank. The dynamical and thermodynamical couplings and their associated variations in the NASH, MBL clouds, and SSTs constitute an important aspect of the summer climate variability over the North Atlantic.