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Long-term effects of solar activity on extratropical cyclone movement in different regions of the North Atlantic

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In this work we continue studying long-term variability of the main directions of extratropical cyclone movement (storm tracks) in the North Atlantic and its possible relation to solar activity, the MSLP (Mean Sea Level Pressure) archives from Climatic Research Unit, UK (1873–2000) and NCEP/DOE AMIP-II Reanalysis (1979–2021) being used. Variations of storm track latitudes in different longitudinal regions of the North Atlantic were compared. It was found that secular oscillations (with periods ~80–100 years) of storm track latitudes, which may be associated with the solar Gleissberg cycle, are strongly dominating in the western part of the North Atlantic (60–40°W), weaken in the Iceland Low region (30–10°W) and disappear to the east of Greenwich (0–20°E), where multidecadal oscillations (~50–60 years) were detected. On the bidecadal time scale, oscillations of storm track latitudes, with periods being close to the magnetic Hale cycle on the Sun, are observed. Storm tracks were found to be noticeably shifted to the north in even solar cycles and slightly to the south in odd ones; this effect is the most pronounced in the Iceland Low region and weakens sharply east of Greenwich. A possible mechanism of the detected effects of solar activity on extratropical cyclone movement seems to include variations in intensity of the stratospheric polar vortex influencing the position of the polar jet. Changes of the polar vortex intensity may be associated with galactic cosmic ray variations and auroral precipitations which affect the chemical composition and temperature regime of the polar middle atmosphere.