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# Past and future impact of North Atlantic teleconnection patterns on the hydroclimate of the Caspian catchment area in CESM1.2.2 and observations

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The Caspian Sea level has undergone dramatic variations of more than 3 m during the past century with important implications for the life of coastal people, economy and the ecosystem. The origin of these variations as well as future changes in the Caspian water budget are still a matter of debate. In this study, we examine the influence of the major seasonal North Atlantic teleconnection patterns, the North Atlantic Oscillation (NAO), the East Atlantic pattern (EA), the Scandinavian pattern (SCA), and the North Sea Caspian Pattern (NCP), on Caspian hydroclimate variability from 1850-2000 CE. Numerical experiments at different atmospheric grid resolutions (2° and 1°) are carried out with the coupled Community Earth System Model (CESM1.2.2). We test model skills under different resolutions through validation against observational data by various statistical methods (Empirical Orthogonal Functions, Taylor diagrams, linear regressions and Spearman rank correlation). Results reveal the strongest simulated signal in winter (DJF) with high explained variances for 1° CESM1.2.2 NAO (39%) and EA (15.7%), similar to observational data. The model is unable to reproduce the SCA pattern in the third EOF, which is found in the observations. The modelled NAO has a strong influence on winter temperature and rainfall over the Caspian catchment area. A strong winter NCP induces above-average 2-meter temperatures over north Caspian region and lower-than-normal precipitation over the eastern Caspian sea. Our study suggests that the 1° version of CESM1.2.2 (with CAM5 atmosphere physics) shows adequate performance with respect to teleconnection maps during the historical period. Lastly, 1° model climate projections (2005-2100 CE) are performed with different Representative Concentration Pathways (RCP 4.5 and RCP 8.5) to examine potential changes in the teleconnection patterns and their influence on the Caspian region.