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The Impact of Gulf Stream Moisture Flux Suppression on Atmospheric Blocks

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In this study, we explore the impact of oceanic moisture fluxes on atmospheric blocks using the ECMWF Integrated Forecast System (IFS). Artificially suppressing surface latent heat flux over the Gulf Stream region leads to a significant reduction (up to 30%) in atmospheric blocking frequency across the northern hemisphere. Affected blocks show a shorter lifespan (-6%), smaller spatial extent (-10%), and reduced intensity (-0.4%), with an increased detection rate (+14%). These findings are robust across various blocking detection thresholds. Analysis indicates a resolution-dependent response, with resolutions lower than Tco639 (□18km) showing no significant change in blocking characteristics. Exploring the broader Rossby wave pattern, we observe that diminished moisture flux favors eastward propagation and higher zonal wavenumbers, while oceanic influence promotes stationary and westward-propagating waves with zonal wavenumber 3. This study underscores the critical role of western boundary current's moisture fluxes in modulating atmospheric blocking and associated Rossby wave dynamics.