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Contributions of Arctic Sea-ice Loss and East Siberian Atmospheric Blocking to 2020 Record-breaking Meiyu-baiu Rainfall

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Heavy Meiyu-Baiu rainfall occurred over central-east China and Japan in June-July 2020. This study analyzes observational and reanalysis data and performs atmospheric model simulations to investigate its causes. It is found that low Arctic sea ice cover (SIC) in late spring-early summer of 2020 along the Siberian coast was an important factor. The low SIC caused local warming and high pressure, resulted in excessive atmospheric blockings over East Siberia, which caused cold air outbreaks into the Meiyu-Baiu region, stopped the seasonal northward march of the Meiyu-Baiu front, and increased the thermal contrast across the front, leading to record-breaking rainfall in June-July 2020. Our results suggest that the 2020 extreme Meiyu-Baiu was partly caused by the low SIC around the Siberian coast through its impact on East Siberian blockings. Further analysis shows that Indian Ocean warming and the Arctic sea-ice loss has combined effect on the particularly heavy rainfall in July 2020. Their effects are interdependent rather than additive. Strong IO warming is rarely observed alongside severe Arctic sea-ice loss before 2020 because of their discordant interannual variations. In the future, the combined effects of IO warming and Arctic sea-ice loss on the Meiyu-Baiu rainfall may become more pronounced as their long-term trends continue.