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Aerosol transport to the Arctic during moisture intrusion events

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Understanding how and when aerosols are transported to the Arctic is crucial to evaluating the contribution of remote aerosol emissions on Arctic Amplification. Climate models show large discrepancies in long-range aerosol transport, significantly impacting estimates of local aerosol-driven forcing at the Arctic. Long-range aerosol transport is intimately linked to moisture transport. Aerosol transport is generally high during periods of low precipitation (i.e. low wet scavenging) and strong temperature inversions (with low vertical mixing). But studies have shown the importance of intense moisture intrusion events for moisture transport, with almost 30% of total annual moisture being transported during these intervals. These events are associated with warm, cloudy moist air transport that leads to strong downwelling longwave radiation and warm surface temperatures at the Arctic. Notably, the blocking patterns established during these events also give rise to favourable conditions for long-range aerosol transport from the mid-latitudes. Here, we use two reanalysis datasets – Copernicus Atmospheric Monitoring Service (CAMS) and Modern-Era Retrospective analysis for Research and Application (MERRA-2) – to investigate moisture and aerosol transport into the Arctic for a 20-year period. We present a comparison of the relative importance of intrusion events to the total annual moisture transport into to the Arctic during intrusion events for the two different datasets and whether aerosols correlate with these moisture intrusions. This comparison can advance our understanding of aerosol transport to the Arctic and improve the representation of seasonal cycle of aerosols in climate models. Finally, we investigate whether changes in aerosol transport during these events could have led to significant changes in local forcing at the Arctic.