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Changes in Polar Jet Circulation Bring More Dust from Sahara Desert to the Arctic

Diana Francis (1), Clare Eayrs (1), Jean-Pierre Chaboureau (2), Thomas Mote (3), and David Holland (4)

(1) Center for Global Sea Level Change, New York University, Abu Dhabi, United Arab Emirates (diana.francis@nyu.edu), (2) Laboratoire d'Aérologie, Université de Toulouse, CNRS, UPS, Toulouse, France, (3) Department of Geography, University of Georgia, Athens, Georgia, USA, (4) Center for Atmosphere Ocean Science, Courant Institute of Mathematical Sciences, New York University, USA

In this study, we identify a new mechanism by which dust aerosols travel over long distances across the eastern side of the North Atlantic Ocean toward the Arctic. The meandering polar jet was at the origin of both dust emission through cyclogenesis over Northwest Africa and poleward transport of the uplifted dust towards the Arctic, through cut-off circulation. The dust emission was associated with an intense Saharan cyclone that formed over Northwest Africa in early April 2011. The formation of the cyclone was caused by the intrusion into subtropics, of a high-latitude-upper-level trough, linked to the meandering polar jet. The trough initiated cyclogenesis over Northwest Africa after orographic blocking by the Anti-Atlas Mountains. The still meandering polar jet led to the formation of a cut-off low further south with which the Saharan dust-cyclone merged 2 days later and moved northward with the main stream. Beside satellite observations, a simulation at high resolution was performed using the prognostic-dust permitting model MesoNH. The total dust load carried during this event to areas located north of 40 N was estimated by the model to be 38 Tg and dust deposition was estimated to be 1.3 Tg.

The Saharan dust reaching Greenland was accompanied by warm and moist air masses that caused a rise in surface temperature of about 10C for more than 3 consecutive days over the southeastern Greenland. Ice melt over this area of Greenland was detected in the brightness temperature observations.

These findings have been published recently in JGR.

Keywords: Arctic, North Africa, dust storm, cut-off low, ice melt, polar jet.