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INCREASES IN JET CONTRAIL COVERAGE FOR THE U.S. AND IMPLICATIONS FOR CONTEMPORARY CLIMATE CHANGES

D. Travis1 and A. Carleton2, J. Johnson1

1Department of Geography and Geology, University of Wisconsin-Whitewater, 2Department of Geography, The Pennsylvania State University (travisd@uww.edu)

In a recent study facilitated by the 3-day grounding of all U.S. commercial aircraft following the September 11^{th}, 2001 terrorist attacks we showed that jet contrails are reducing the diurnal temperature range (DTR) at Earth's surface. We attributed this DTR reduction to the unusual ability of contrails to efficiently reduce both the surface receipt of incoming solar radiation during the daytime and the outgoing infrared radiation at night. In contrast, the radiative forcing of most natural clouds tends to be preferentially in one direction (i.e. either net cooling or warming). Although increases in jet contrail coverage have been speculated for many years, little quantitative assessment has been done to determine the magnitude of increase. Here we show that the jet contrail coverage for much of the U.S. has more than doubled during the past 25 years. Furthermore, we show that the greatest increases have occurred in areas where the change in DTR was most pronounced during the Sept. 11-13, 2001 grounding-period (i.e. the Midwest and Northeast). The magnitude of contrail increase corresponds well with widely reported decreases in DTR for large areas of the world (e.g. the U.S., western Europe).

The analysis is undertaken using Advanced Very High Resolution Radiometer (AVHRR) satellite data from National Oceanic and Atmospheric Administration polar orbiting satellites at 1.1km^2 resolution. An average of 8 AVHRR images per day were manually inspected for jet contrail coverage over the conterminous U.S. for the mid-season months of 2000-02, with all contrail locations input into a geographic information systems (GIS) database. GIS software was then used to compare the contemporary coverage of contrails against the only other satellite-based study available,

that for the period 1977-79. Large increases in contrail coverage occurred for nearly all locations of the U.S., with the greatest increases concentrated in those areas that are most heavily trafficked by commercial aircraft (i.e. the Northwest, Midwest and Northeast regions). We also distinguish between magnitudes of contrail increase for daytime versus night, and discuss the possible implications of these differences on present and future regional-scale climate changes caused, in part, by continued increases in jet traffic and associated contrail production.