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A study on natural and manmade global interannual fluctuations of cirrus cloud cover for the period 1984–2004

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Abstract. The seasonal variability and the interannual variance explained by ENSO and NAO to cirrus cloud cover (CCC) are examined during the twenty-year period 1984–2004. CCC was found to be significantly correlated with vertical velocities and relative humidity from ECMWF/ERA40 in the tropics (correlations up to −0.7 and +0.7 at some locations, respectively) suggesting that variations in large-scale vertical winds and relative humidity fields can be the origin of up to half of the local variability in CCC over these regions. These correlations reflect mostly the seasonal cycle. Although the annual cycle is dominant in all latitudes and longitudes, peaking over the tropics and subtropics, its amplitude can be exceeded during strong El Nino/La Nina events. Over the eastern tropical Pacific Ocean the interannual variance of CCC which can be explained by ENSO is about 6.8% and it is ~2.3 times larger than the amplitude of the annual cycle. Natural long-term trends in the tropics are generally small (about −0.3% cloud cover per decade) and possible manmade trends in those regions are also small. The contributions of NAO and QBO to the variance of CCC in the tropics are also small. In the northern mid-latitudes, on the other hand, the effect of NAO is more significant and can be very important regionally. Over northern Europe and the eastern part of the North Atlantic Flight Corridor (NAFC) there is a small positive correlation between CCC and NAO index during the wintertime of about 0.3. In this region, the interannual variance of CCC explained by NAO is 2.6% and the amplitude of the annual cycle is 3.1%. Long-term trends over this region are about +1.6% cloud cover per decade and compare well with the observed manmade trends over congested air traffic regions in Europe and the North Atlantic as have been evidenced from earlier findings.

Final Revised Paper (PDF, 1124 KB) Discussion Paper (ACPD)

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