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Possible increases in tropospheric dust, tritium, and ozone over Alaska due to increasing storm activities in East Asia

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Atmospheric dust absorbs and scatters solar radiation, and affects global radiative balance [Intergovernmental Panel on Climate Change (IPCC), 2001]. On the other hand, the stratosphere-troposphere exchanges by cyclonic activities are important phenomena for the stratospheric substances intrusion into the troposphere (e.g. tritium and ozone) [Holton et al., 1995; Monks, 2000; Stohl et al., 2003; Gat et al., 2001]. Ozone is greenhouse gas, and tritium is dangerous radioactive material. Therefore, these relate to human health, climate change and material circulation. To reconstruct the past amount of those, a 50-m ice core drilled at the summit of Mount Wrangell volcano, Alaska [Shiraiwa et al., 2004] was used. It covered the years from 1992 to 2002. Dust-particle number density (0.52-16.00 micro meter), tritium concentration and stable hydrogen isotope ratio in the ice core were analyzed. We found that the concentration of fine dust (0.52-1.00 maicro meter) as an indicator of long range transport increased every spring, which was highly correlated with coarse dust concentration (1.00-8.00 maicro meter). Moreover, the calculated fine and coarse dust fluxes increased drastically after the year 2000, corresponding to the recent increase of Asian Dust outbreaks in spring [Japan Meteorological Agency (JMA), 2004; Chun and Lim, 2004]. They imply that Asian dust transports to Alaska every spring. Additionally, tritium concentration had late-spring maxima almost every year.

Yasunari et al. [2006] showed that highly positive correlation existed from late-spring to summer among the calculated tritium, fine and coarse dust fluxes, suggesting that the stratosphere-troposphere exchange and Asian dust outbreaks are strongly connected with Asian cyclonic activities in late-spring because their activities are weak in summer [JMA, 2004; Chun and Lim, 2004]. If Asian dust storms in late-spring increase in the future, dust, tritium, and ozone in the troposphere may also increase, finally leading to cause human health breaking down, greenhouse effect increasing and radiative balance change. Further studies on the relation between the STE and Asian storm activities in late-spring may be the key to assess global warming, material circulation, and human health in the future.

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