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Simulation comparison of winter continental air mass and summer maritime air mass on background ozone near Taiwan

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ABSTRACT

Analysis of data collected at Lanyu Baseline Station suggests that the data quality was as good as those measured at WMO supported international baseline stations. Ozone can be selected as the best indicator for monitoring the seasonal change of continental and maritime air-mass at Lanyu. It reveals that night-time averaged surface ozone concentration reaches a maximum level between 36.4 ~ 48.5 ppbv in winter and a minimum level between 13.5 ~ 22.6 ppbv in summer during March 1995 ~ October 2003. Wintertime Asian cold airmass and summertime Pacific warm airmass are responsible for the observed higher and lower levels of ozone, respectively.

In this paper, a winter and a summer cases are selected to trace back the source origins of air masses reaching Lanyu and to quantify the upstream transport and anthropogenic effects on local ozone level. A 3-d regional chemical transport model is used in this study.

The results show that in summer, maritime air coming from the Pacific and South China Sea maintains the ozone level around Taiwan near 18ppbv, which includes the 14 ~ 28% increase of ozone level (about 2 ~4 ppbv) caused by ozone precursors released from Philippines, Indonesia, etc. In winter, upper level air above Siberia and Mongolia descends southeastward toward the western Pacific and maintains the ozone level around Taiwan near 45ppbv, which includes the 12.5% increase of level (about 5 ppbv) caused by ozone precursors released from mainland China. It is interesting to note that even though the absolute amount of anthropogenic emissions from Southeast Asia is not in a huge volume; their contributions to the ozone production in the maritime area can not be ignored.

Key words: Background ozone level, long-rang transport, numerical simulation

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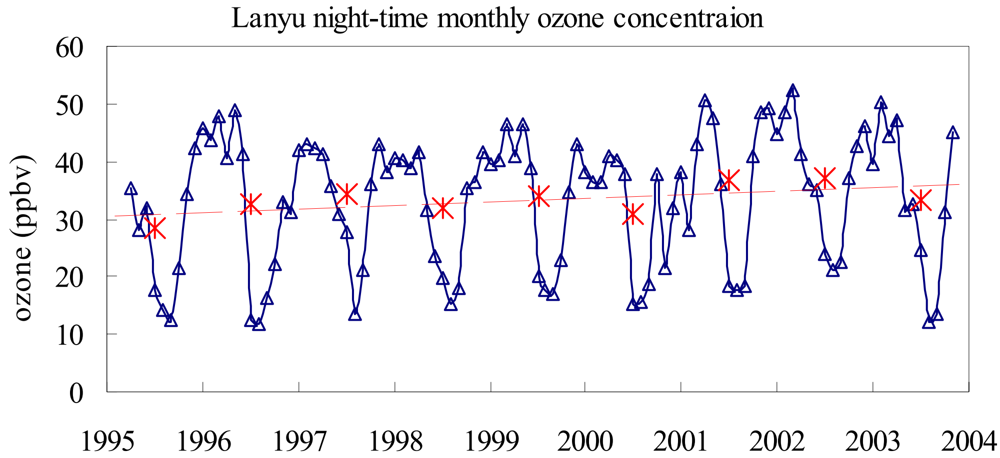

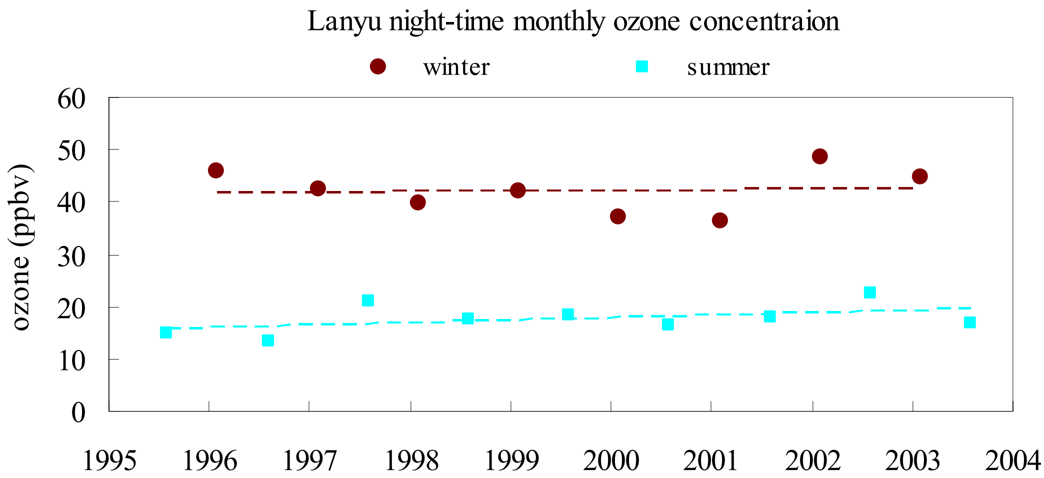

Fig. 1：(a) Monthly-mean and (b) seasonly-mean nighttime surface ozone at Lanyu.

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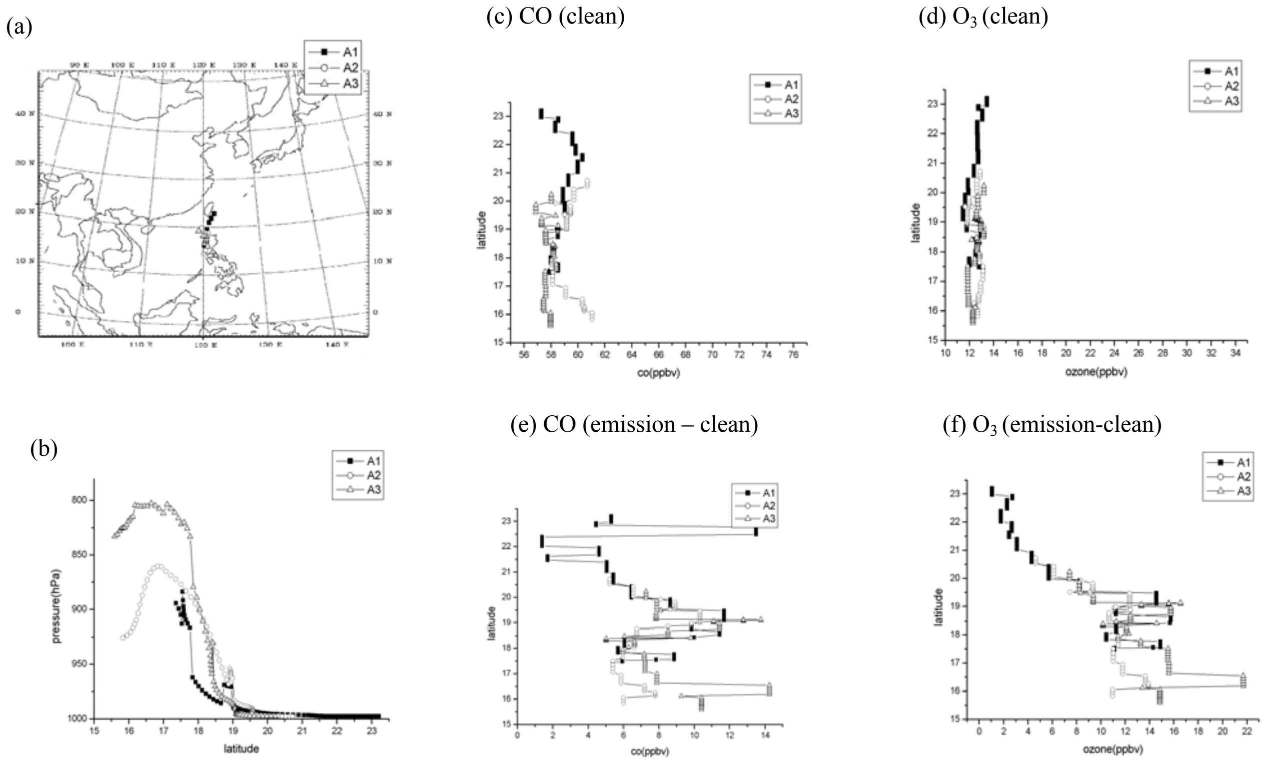

Fig 2：Air parcel trajectories on (a) latitude – longitude map and (b) height-latitude map, and (c) CO and (d) O_3 level (on a latitude – level diagram) along the track for simulation with no anthropogenic emission considered, and the increased level of (e) CO and (f) O_3 caused by anthropogenic emission during July 16 ~ 18, 1996..

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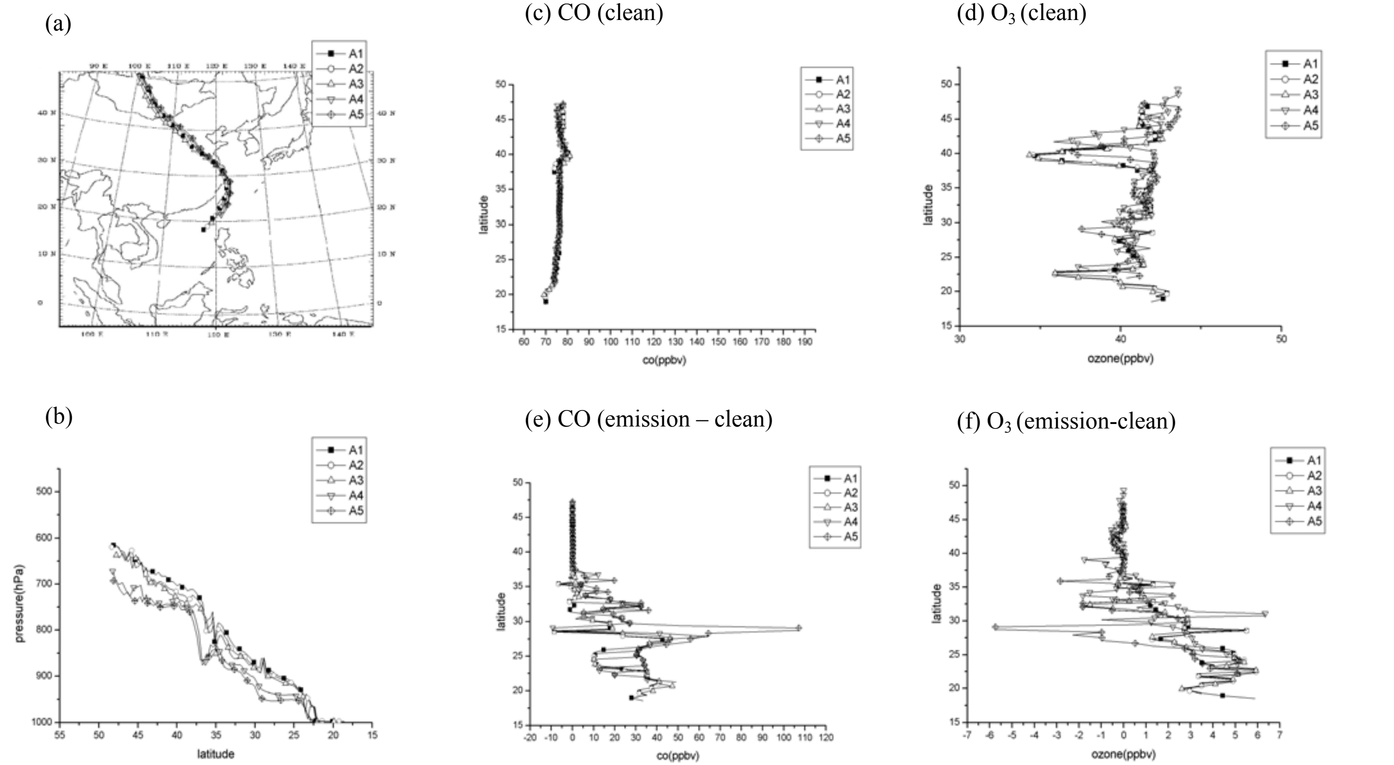

Fig 3：Air parcel trajectories on (a) latitude – longitude map and (b) height-latitude map, and (c) CO and (d) O_3 level (on a latitude – level diagram) along the track for simulation with no anthropogenic emission considered, and the increased level of (e) CO and (f) O_3 caused by anthropogenic emission during December 18 ~ 20, 1996..