ZONAL CORRELATION AMONG DUST, WATER ICE CLOUDS AND TEMPERATURE IN THE MARTIAN ATMOSPHERE OBSERVED BY MRO-MCS. K. Noguchi[1], M. Ueda[1] and H. Hayashi[2], [1]Nara Women's University (Kita-uoya Nishi-machi, Nara 630-8506, Japan), [2]FUJITSU FIP CORPORATION (SEAVANS North Building, 2-1, Shibaura 1-chome,Minato-ku, Tokyo 105-8668, Japan).

Introduction: Dust and water ice clouds are important factors which control the radiative balance of the Martian atmosphere. Mars Climate Sounder (MCS) [1] on board Mars Reconnaissance Orbiter (MRO) [2] observes the opacities of dust and water ice clouds together with air temperature in the Martian atmosphere more than five Mars Years (MYs). Aiming at revealing the effect of dust and water ice clouds on the temperature field in the Martian atmosphere, we studied the zonal correlation among dust opacity, water ice cloud opacity and air temperature observed by MRO-MCS.

Data: We utilized a NASA Planetary Data System (PDS) Version 3 Derived Data Records (DDR) archive, which improves data retrieval analyses to probe spherically asymmetric structures of the Martian atmosphere [3]. Since the MCS data provided from PDS includes a huge number (> 1,000,000) of original vertical profiles of atmospheric physical properties measured along the MRO orbit, it was not easy to use them for our analyses. We gridded the data by five degrees in longitude, latitude and time (Ls) directions and adopted a visualization method [4], which utilized Grid Analysis and Display System (GrADS). Using the gridded data, we calculated correlation coefficients between a) temperature and dust opacities, b) dust opacities and water ice cloud opacities, and c) temperature and water ice cloud opacities, in longitude ("zonal correlation").

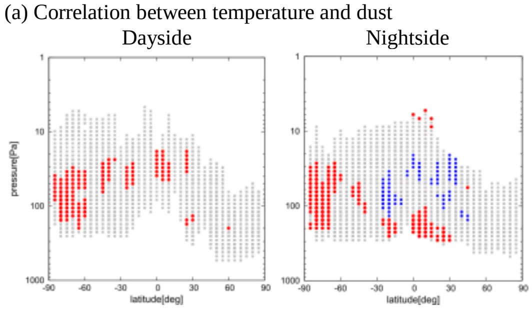
Results and discussion: Positive correlation between temperature and dust was dominant in the dayside (Figure 1(a)). The positive correlation in the dayside can be attributed to the local heating of dust due to the absorption of solar radiation. In the nightside, negative correlation appears in the high altitudes (~100-10 Pa) above the regions with positive correlation in low latitudes. The positive correlation in low latitudes in the nightside was due to the local effect of Tharsis Montes. The negative correlation suggests radiative cooling of dust and/or dynamical cooling of air-mass ascending.

Figure 1(b) shows that dust and water ice clouds have no clear correlation in the dayside but positive correlation in the nightside, especially in the low latitudes. The possible scenario of the positive correlation in the nightside is that the radiative cooling of dust causes the increase of clouds and/or dust acts as nuclei of clouds.

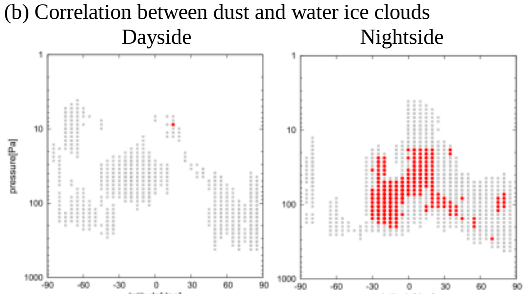
Negative correlation between temperature and water ice clouds was dominant both in the dayside and the nightside (Figure 1(c)). This suggests that water ice clouds cause radiative cooling and/or water ice clouds occur in local temperature minima. Positive correlation was localized in the high latitudes in the nightside, where temperature water ice clouds had clear zonal structures with a wavenumber of one and two.

In the future works, we will analyze the seasonal dependence of the correlation among the three physical quantities and examine the results from numerical models. We will also examine the effect of the atmos-

(a) Correlation between temperature and dust



(b) Correlation between dust and water ice clouds



(c) Correlation between temperature and water ice clouds

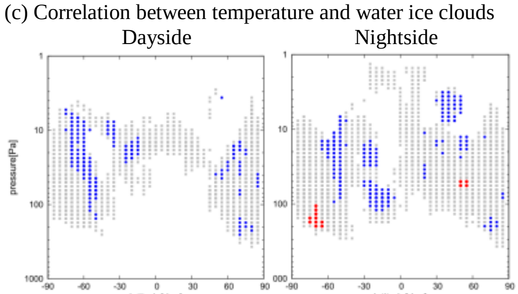


Figure 1: Latitude-pressure cross sections of zonal correlation coefficients between (a) temperature and dust, (b) temperature and water ice clouds and (c) temperature and water ice clouds observed by MRO-MCS in MY29. Positive and negative correlation coefficients with the absolute values larger than 0.7 are shown in red and blue, respectively.

pheric dynamics on the correlation shown above.

References: [1] McCleese et al. (2007) JGR, 112, E05S06. [2] Zurek and Smrekar (2007) JGR, 112, E05S01. [3] Kleinböhl A. et al. (2017) JQSRT, 187, 511-522. [4] Noguchi K. and Hayashi H. (2017) J. Space Sci. Inform. Jpn., 6, 109-116.