Antarctic Study on Tropospheric Aerosol and Snow Chemistry (ASTASC) in JARE Phase X

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Antarctic area is the cleanest region on the Earth. Recently, signals by global warming have been observed even in the Antarctic. Furthremore, it is concenrned that atmospehric quality and environment are changed gradually in Southern hemisphere and the Antarctic in the future with economic development and population expansion in Southern hemispheric countires. Direct and indirect effects of atmospheric aerosols are one of the most important issues on climate change. Ice core study implied relations between climate change and sulfate aerosols (Iizuka et al., Nature, 2012). For the better understanding and prediction of relations between aerosols and climate change in the Antarctic in past, present, and future, we need to understand linkages among tropospherc aerosol system, atmospheric chemistry, and cryospheric chemistry, although the linkage has been known qualitatively and partly as shown in Fig. 1. Additionally, we must get knowledge on what is recoded in ice cores, because interpretation of ice core records is based on assumption that variations of atmospheric substances such as aerosols are kept in snow and ice. Therefore, we propose comprehensive study, "Antarctic Study on Tropospheric Aerosol and Snow Chemistry (ASTASC)", in JARE Phase X. This study aims to understand the processes to maintain tropospheric aerosol system, impact of aerosols on atmospheric chemistry, and material exchange between atmosphere and cryosphere.

In JARE Phase X, we are going to make field obserbvations at Syowa and Icebreaker Shirase and on continental ice sheet. This study is composed of (1) in-situ aerosol measurements of physical, chemical and biological properties, (2) remote-sensing measurements of reactive gases, (3) snow chemistry, (4) sampling of snow pits and shallow ice core on ice sheet near coast, and (5) model studies. From the viewpoint of troposheric aerosol sytem, we focus on supply processes such as precursor oxidation, new particle formation, and direct release of sea-salt aerosols from snow surface, atmospheric sea-salt-halogen chemisty related to O_3 chemistry, long-range transport of carbonaceous aerosols, minerals, and bio-aerosols, and so on. From the aspect of snow/cryospheric chemistry, the following processes are foccused; photochemical reactions in surface snow, records in snow and ice core. Moreover, model study is validated by results taken from aerosol measurements and snow/ice-core analysis to analyse and predict variations of aerosol consituents in near past–present–future. Eventually, our scientific goals are to elucidate quantitatively the processes to maintain tropospheric aerosol sytem under the present conditions, and to reconstruct and predict records/varitions/impact of aerosols during past-present-future.

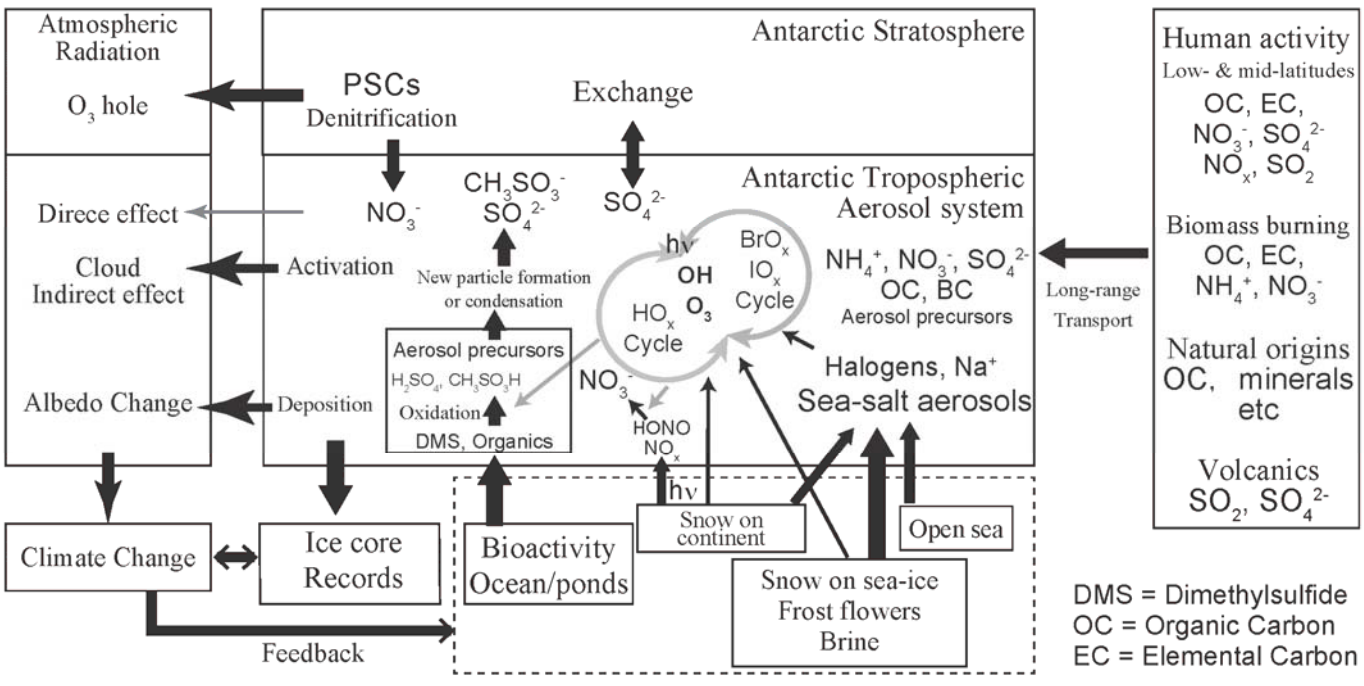

Figure 1. Schematic of tropsopheric aerosol system and the linkage.