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New proposlas for observing atmospheric environment from space - GMAP-Asia and APOLLO

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Tropospheric ozone has been increased in the northern hemisphere in recent years, although emission of precursor gases has been reduced in Japan, Europa and US. The increase of tropospheric ozone and aerosols may cause the increase of mortality risk and the climate change. In Japan, surface ozone concentration often exceeds the environmental standard at most monitoring sites. Recently, the frequency of photochemical smog alert increases in Kyushu and prefectures face to the sea of Japan, implying that the transboundary transport from China and other Asian countries significantly contributed to the increase of the tropospheric ozone.

Remote sensing from space is quite useful for measuring regional-global distribution of the atmospheric constituents. The tropospheric species such as NO2 was measured with sensors onboard a low, sun-synchronous orbit satellite. However, there are some defects for these observation. In the Japan society of atmospheric chemistry, a working group was made for examining next-generation satellite observation of atmospheric environment from the space. This group with some other institutes (NNIES, MRI and others) proposed the Geostationary missions for Meteorology and Atmospheric pollution over Asia (GMAP-Asia), which measure tropospheric ozone, aerosol an their precursors from the geostationary orbit. Spatially and temporary continuous measurement by an geostationary satellite observation will enable us to understand both photochemical and transport processes on the ozone and aerosols, especially long-range/transboundary transport of pollutants. This observation will also enable us to understand the diurnal variation of emission of precursor gases. By assimilation of the observed data, this observation will improve the model simulation of atmospheric environment.

As a complimentary mission, this group also proposes the Air Pollution Observatory (APOLLO) mission from the international space station (ISS). A very low, non-sun-synchronous orbit of ISS provides us another unique observation of the atmospheric ozone and aerosols. The low orbit enables us to observe with higher horizontal resolution (4km by 4km) to understand ozone and aerosol concentration as well as the precursor emissions at urban, suburban, agricultural areas more precisely. Non- sunsynchronous orbit enables us to measure these species at various local times. In addition, simultaneous observation of tropospheric ozone and carbon monoxide (CO) with full-wavelength, UV/visible/SWIR/MIR/sub-mm, is planned in APOLLO mission for separating lower/middle/upper tropospheric ozone and CO. It is essential to measure the lower tropospheric ozone separately to estimate mortality risk by the ozone. Separate measurement of middle and upper tropospheric ozone and CO enable us to understand the long-range/transboundary transport of pollutants and the climate influence.

Keywords: Geostationary satellite, International space station, lower tropospheric ozone