Snow cover at high elevations records atmospheric environmental signals during the winter and spring. Mt. Tateyama is located near the coast of the Japan Sea in central Japan, where air pollution and Asian dust particles are actively transported from the Asian continent and the winter monsoon is highly affected by the Arctic climate condition. Snow-pit observation and sampling of snow in the pits at Murododaira (2450 m a.s.l) near the summit of Mt. Tateyama were performed in each April from 2004 to 2014. Measurements of formaldehyde (HCHO) and hydrogen peroxide (H$_2$O$_2$) as well as major ions of the snow samples were conducted.

The mean concentrations of nssSO$_4^{2-}$ and NO$_3^-$ are higher than those in snowpack in 1990s. The highest mean nssSO$_4^{2-}$ concentration was observed in 2007. The pH and nssCa$^{2+}$ were usually high in the upper parts of 2-3 m of snow deposited in the spring, when Asian dust (Kosa) particles are frequently transported. High concentrations of nssSO$_4^{2-}$ were detected in both the spring and winter layers. The high nssCa$^{2+}$ layers usually contained high concentrations of nssSO$_4^{2-}$. The results show that not only Kosa particles but also air pollutants might have been transported long-range from the continent of Asian.

The concentrations of H$_2$O$_2$ were high in the new snow (precipitation particles) and granular snow (coarse grain, melt forms) layers. High H$_2$O$_2$ concentrations may be preserved in granular snow layers having low concentrations of nssCa$^{2+}$. The concentrations of HCHO were well correlated with the anthropogenic ion components, such as nssSO$_4^{2-}$. Not only acidic species but also HCHO may be transported to high elevations in Japan from the Asian continent during the cold months. These results indicate that post depositional modification of H$_2$O$_2$ is more significant than that of HCHO in the snow cover at Murododaira, Mt. Tateyama. Snow pit observations may also be useful for the interpretation of ice core analysis, especially for unstable species, such as HCHO and H$_2$O$_2$. 