

New auroral camera network in Antarctic polar cap

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New 11-year solar cycle began from Dec. 2019. During the new solar cycle, our strategy of the space weather and space climate research in Antarctica include the full system operation of cosmic ray observation and auroral camera network in Antarctic polar cap. In this talk we will present the latter part, i.e. polar cap science.

Polar cap auroras will be the main target of our geospace research activities in Antarctica, because of the following reasons. First, extending the all-sky auroral camera network in the missing polar cap region has been internationally anticipated to combine with other network observations, such as SuperDARN (convection pattern), GRAPE (GNSS, TEC), and SuperMAG (magnetometers). Fully combining these independent network data with recently developed global MHD simulation results of REPPU code will naturally lead to the next-generation re-analysis space weather data studies, which will provide a core tool for broad geospace-related community. Second, to quantitatively evaluate the total atmospheric impact from space, we need to observationally elucidate the basic energetics in the multi-scale processes occurred in the polar cap, such as dayside auroras, theta aurora, sun-aligned arcs, and others in detail. The quantitative reproduction of these observed auroras in global simulation is a challenging and interesting topic, in which the new polar cap observations provide the ground-truth data for those simulations. The observation must therefore be quantitative, and the wavelength must be selected or spectroscopy would help. Third, the development of automatic auroral camera observation network working under extremely cold environment is a challenging enough technical problem. The most extreme case will be the possible camera installation at the new Dome-Fuji station (2022-2028), in which unmanned operation during very cold place will be needed.

For the last half century, our ground-based geospace research in Antarctica has been rather focusing on the conjugate observation between Syowa Station and Iceland to study substorm phenomena in relatively high solar activities. We use these heritage and extend it to more open ionosphere and magnetosphere. The solar activity has been decreasing, and auroral oval extent will be smaller than that in previous solar cycles. The polar cap will therefore be more and more interesting and core place to investigate the solar wind-magnetosphere-ionosphere coupled system. International activities to investigate the solar wind will also reach the golden age (PSP, Solar Orbiter, and BepiColombo) at the next solar maximum in 2025, and it is the best timing to start the new observation planning at polar cap.