

Outline of six-year Japanese Antarctic Research Project phase IX and future prospects

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Understanding the mechanism of changes in the Antarctic subsystem is essential in order to elucidate changes in the Earth system and global environment. The six-year Japanese Antarctic Research Project phase IX centered on main scientific theme of "Investigation of changes in the Earth system from Antarctica" will be initiated from 2016/2017 austral summer season. The following three subthemes will be conducted under the main theme, "Investigation of the whole global atmospheric system through precise observation of the Antarctic atmosphere", "Investigation of the interaction of atmosphere, ice sheets, sea ice, and ocean from integrated research in areas bordering ice sheets and sea ice" and "Reconstruction of the Antarctic paleoclimate to elucidate changes in the Earth system" The three subthemes are established to understand present and past changes in the Antarctic subsystem in the Earth system, interaction within the subsystem, and the relationship between changes in the Antarctic region and the Earth system

We will introduce the outline of the six-year Japanese Antarctic Research Project phase IX and the three subthemes under the main scientific theme of "Investigation of changes in the Earth system from Antarctica." The future prospects during and after the six-year Japanese Antarctic Research Project phase IX will be discussed.

Keywords: Antarctica, Earth system, global environment

New Arctic Research Project "ArCS"

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The Arctic is the place where the changes caused by the Global Warming appear most conspicuously. The changes in the Arctic are not only a concern for local communities who are directly affected by the change, but also for people who live in the rest of the world, because the Arctic plays a special role in the global climate system. On the other hand, with the decrease in sea ice, the possibilities of development of new Arctic sea route and the exploitation of natural resources are drawing significant attention from the world, even from non-Arctic countries. While worldwide attention to changes occurring in the Arctic is growing, the scientific understanding of these changes and the data for analysis are still insufficient to show to the stakeholders how the Arctic changes affect global weather/climate and ecosystem, and what impact these changes have on human society and economy for both sustainable development and conservation of the natural environment in the Arctic region. The scientific knowledge, which provides the base of discussions on governance and international protocols regarding the sustainability of the Arctic, are expected to be developed from private sectors and policy-makers in the world. The research project for the Arctic, called ArCS (Arctic Challenge for Sustainability), was started in the autumn of 2015 as a Japanese national project funded by the Ministry of Education, Culture, Sports, Science and Technology. Under close cooperation with other Arctic projects in the world and working groups of Arctic Council and IASC, ArCS aims to elucidate the changes in the climate and environment and to evaluate their effects on human society. ArCS has three main pillars of its activity, namely, reinforcement of research bases and/or stations in the Arctic, capacity building of researchers (including those in private sector), and promotion of international cooperative researches. The National Institute of Polar Research (NIPR), Japan Agency for Marine-Earth Science and Technology (JAMSTEC) and Hokkaido University are playing the key roles in this project. ArCS will be continued until March 2020.

Keywords: Arctic, holistic research, international cooperation

Long-term Plan for Arctic Environmental Research compiled by JCAR

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Arctic environment specialists aim to present the research direction over the period of 10 to 20 years for the resolution of environmental issues to citizens concerned with environmental problems and researchers in various fields. Up to now, no long-term plan has focused on Arctic environmental research in our country, hence, it is important to present analyses of the current status and future direction to be taken. It is no exaggeration to say that the fact that this long-term plan has been developed by JCAR has confirmed its existence. This plan reflects the hopes of the next generation of researchers, encouraging forward progress toward common goals by working together. The four objectives are as follows. The first one, which is the background for formation of JCAR, is research on "Understanding of the abrupt-complex phenomenon and elucidation of the mechanisms and impacts associated with global warming enhanced in the Arctic, along with improvement of their future prediction". In this objective, seven themes have been selected such as amplification of warming in the Arctic. The second one, research to elucidate "Biodiversity in land and ocean, and also the effects of anthropogenic environmental change on ecosystem, not limited to global warming" is divided into terrestrial and marine themes. The third one covers "Broad and important research on the Arctic environment and its fundamental information" and includes three themes such as the geo-space environment surrounding the earth. The fourth objective covers three categories of methods related to the previous themes, "Monitoring, modelling and integration of the two, enabling breakthroughs in environmental research".

Keywords: global warming, biodiversity, basic research for Arctic environment, breakthrough methods

The SCAR long-term concept - Horizon Scan

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Antarctic and Southern Ocean science has been carried out to understanding natural variability, the processes that govern change and the role of humans in the Earth system. The international Antarctic community tried to scan the horizon to identify the highest priority scientific questions that Antarctic researchers should aspire to answer in the next two decades and beyond. The Horizon Scan identified the 80 important scientific questions through debate, discussion, revision and elimination by voting. Related questions were assembled into seven topical clusters: (i) Antarctic atmosphere and global connections, (ii) The southern ocean and sea ice in a warming world, (iii) The ice sheet and sea level, (iv) The dynamic earth beneath Antarctic ice, (v) Life on the precipice, (vi) Near-earth space and beyond - eyes on the sky, and (vii) Human presence in Antarctica.

Answering these questions will require innovative experimental designs, new applications of technology, invention of next generation field and laboratory methodologies and development of innovative observing systems and networks. Improved models are needed that realistically represent Antarctica and the Southern Ocean as an integral part of the Earth system, and provide predictions at spatial and temporal resolutions. Not only the scientific innovation, sustained year-round, access to Antarctica and the Southern Ocean will be essential. A coordinated, portfolio of cross-disciplinary and bipolar science, based on new models of international collaboration and funding, will be essential as no one scientist, program or nation can realize these aspirations alone.

Keywords: Antarctica, Horizon scan, Long-term concept

Frontier of Polar Science: toward SCJ Master-plan 2017

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Studies of polar region have been carried out in both Arctic and Antarctic regions. Besides Japan Antarctic Research Expedition (JARE) initiated during IGY, observational studies on the Arctic region have also been active in the last quarter of century. More recently, GRENE (2011-15) and ArCS (2015-19) projects have accelerated Arctic environmental research in this country, and contribution to the understanding of global environmental change is significant.

'Frontier of Polar Science' was, for the first time, submitted for Master-plan 2011 of Science Council of Japan. The current plan has been submitted for 2014 Master-plan, and approved. The master-plan 2017 of Science Council of Japan is a minor revision, and therefore the proposal of 'Frontier of Polar Science' for 2017 is based on the proposal in 2014. In this presentation, we will introduce the background history and the submitted proposal for Master-plan 2017. We also would like to continue the discussion for revising our plan for Master-plan 2020, which is expected to be a significant revision. The joint working group of IASC/SCAR will be a place for continuous discussions for 2020 revision.

Keywords: Polar region, Antarctic, Arctic

Antarctic Large Terahertz Telescope

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We propose construction of a 30-m class terahertz telescope at the plateaus of Antarctica like the (new) Dome Fuji station to make astronomical observations of cosmology to planets, including large field searching of extremely distant galaxies, at the frequencies of 200 to 1,500 GHz (1.5 THz). For the observations at such extremely high frequencies, a very dry site is required, because the high frequency radio emission from the universe is absorbed by water vapor in the atmosphere of the earth. The plateaus in the inland of Antarctica, which are extremely cold and high altitude and thus the driest on the earth, are the best and unique sites for the observations. We are proposing the project as the next large telescope to the astronomical society under the collaboration between astronomical and polar science societies.

Keywords: astronomical observations, large astronomical telescope, domes in Antarctica

南極大型望遠鏡計画: 30m級テラヘルツ望遠鏡

- ・建設地: 新ドームふじ(又はリッジA)
- ・口径: ~ 30 m
- ・重量: ~ 1000 トン
- ・電力: ~ 600 kVA (昭和基地×2)
- ・越冬隊: 5~10 人/冬
- ・建設費: ~ 300億円
- ・運用費: ~ 30億円/年
- ・国際協力

アジア, 豪州(大学), 米国(大学), 欧州(ESO?)

- ・国立天文台 + 国立極地研究所
- ・建物・輸送設備等

望遠鏡の付帯設備として要求

- ・運用期間: ~ 30年 (筑波大等)
- ・将来への発展 (南極30mWG)

赤外THz干渉計, 気球周回VLBI, 他
一大天文観測拠点化 (国際南極天文台)

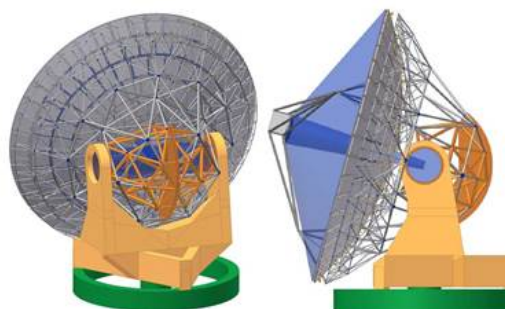


Figure 1: Truss with a distributed CFRP (grey) to steel (orange) construction. Masses for this design are given in Table I and rod sizes are given in Table II.

(CCAT25m) → 南極30m級

本格的に検討開始 (2016.01~)

- ・大規模輸送法、大電力供給法
- ・内陸輸送ルート開拓、他
- ・夏季基地建設 (第10期南極観測)

サイト調査等 (2017~)

- ・気象タワー (h~40m、気温、風速他)
- ・雪面下地盤調査、等

計画策定

- ・計画書作成 (2017-2019)
- ・観測の検討 (分野別6WG)・技術的検討