IASC Atmosphere Working Group Workshop

- Rapid Arctic Climate Change -

14 January 2013, Tokyo Japan (ISAR-3)

Organized by
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Draft Minutes

Participants

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1. Opening

Hiroshi Tanaka opened the meeting and Volker Rachold gave short introduction on IASC and IASC/AWG.

Objectives and scope of the workshop:

The IASC AWG needs to organize national and international research projects in an optimum way in order to avoid unneeded duplication and conflicts of various projects by individual countries. Exchanging ideas for future research and adjusting possible international collaborations is an important role of IASC AWG. The theme of the workshop includes a wide range of topics in Arctic Climate Change, including:

1. Polar Predictability
2. Arctic Amplification
3. Linkage to Global Process

2. Presentation

There were presentations by eight delegates to share research activities and ideas on the Arctic climate modeling.

2.1 Dynamical Theory of the Arctic Oscillation (Tanaka, Hiroshi L.)

Global warming and sea ice melting cause Arctic amplification, which triggers the AO negative. Warmer Arctic and colder mid-latitude of the AO negative is the most efficient cooling action to the earth. Global warming is decelerated by the AO negative. Climate models predicting AO positive in the future must overestimate the global warming.

2.2 Uncertainty in Arctic Predictions (Walsh, John E.)

There are uncertainties in climate model projections, and there are three major sources of uncertainty: Uncertainties in scenarios of greenhouse forcing, formulational differences among models, and Internal (low-frequency) variability in data and models.

2.3 Enhanced High-Lower Latitude Interactions and Extreme Climate/Weather Events in a Rapidly Changing Arctic (Zhang, X.-D.)

Changed spatial pattern of the hemispheric scale atmospheric circulation enhanced high-lower latitude interaction, and it caused warm Arctic and cold Eurasia. Intensified anticyclones drove colder daily minimum surface air temperature, causing extreme cold weather events.

2.4 On Mechanisms of Arctic Amplification in MIROC GCM (Yoshimori, Masakazu)

The relative contributions of feedback processes to Arctic amplification in MIROC3 and MIROC5 was explained. MIROC5 has a stronger Arctic amplification than MIROC3, and the major difference is seen in the albedo feedback. The warming aloft is larger in MIROC3, which is perhaps because larger climate sensitivity in MIROC3 induces larger moist-static energy transport to the Arctic.

2.5 Multi-Decadal Mobility of the North Atlantic Oscillation (Moore, G.W.K., Renfrew, I.A., Pickart, R.S.)

Teleconnectivity matrix of the sea-level pressure field over the North Atlantic shows mobility in its COAs on the decadal timescale. The interaction of the NAO and EA can explain the anomalous zonal shift in the COAs of the Icelandic Low and Azores High observed during the GFDex field campaign. An eastward shift in the northern center of action of the North Atlantic sea-level pressure dipole occurred around 1980, and there are evidences of a similar eastward shift in the 1930s-1950s. The one-point correlation of teleconnectivity matrix approach should be re-examined as to provide information on the spatial structure of teleconnections that may not be captured by the leading EOF.

2.6 Arctic Research Activity of KOPRI (Kim, Seong-Joong)

There is teleconnection between Arctic Amplification and East Asia. Arctic sea-ice reduction and stratospheric sudden warming is related. Considerable potential predictability increases can be attained using snow initialization.

2.7 Abrupt Climate Changes and Emerging Ice-Ocean Processes in the Pacific Arctic (Moto Ikeda and Jia Wang)

Dipole Anomaly (DA): inter-annual and intra-seasonal variability

+DA (Dipole Anomaly) is the leading forcing to ice minima, while –DA to the ice maxima. +DA has an asymmetric forcing of sea ice compared to –DA since there exists TDS. Thus, loss of sea ice seems to be difficult to recover unless there is "extreme" cooling event to change the tendency.

2.8 North Atlantic warming and declining volume of arctic sea ice (Vladimir A.Alexeev, Vladimir V.Ivanov, Ron Kwok and Lars H. Smedsrud)

The Arctic is warming, sea ice is disappearing. Delayed freeze-up, more open water and consequent heat input to the atmosphere lead to significant changes in atmospheric circulation. Significant negative AO/NAO trend in the recent years is a manifestation of the warming in the Arctic Ocean. North Atlantic warming and associated increase in the AW temperature is responsible for melting of a significant portion of arctic sea ice.

3. Closing summary

Recent rapid Arctic warming is considered to be a research frontier in the study of global warming. Arctic sea ice is melting drastically, exceeding IPCC projections. Although ice–albedo feedback plays an important role in the arctic amplification, it must be just an amplifier of certain warming processes in the Arctic. Long-term natural (internal) variability is a possible cause of the arctic amplification as well as anthropogenic forcing.

A conceptual simple earth system model is proposed by Dr. V. Alexeev to interpret the arctic amplification. Anthropogenic global warming by increased carbon dioxide enhances northward heat transport by the atmosphere and ocean to build the arctic amplification. Melting sea ice amplifies the arctic amplification by the ice-albedo feedback. It may be important to realize that such an arctic amplification is the most efficient cooling mechanism that the climate system has chosen to respond to the anthropogenic global warming. Moreover, the arctic amplification results in the AO negative, causing warm Arctic and cold mid-latitudes to cool the entire earth system to decelerate the global warming. We need to be aware of the fact that the global warming is decelerated in conjunction with the enhanced arctic amplification and AO negative trend in recent years. This scientific work shop provides us an excellent opportunity to inspire the meaning of the arctic amplification in a global context of the earth system.