

Orbital to millennial-scale variability of Asian Monsoon and its potential significance to global climate

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Asian Monsoon is a regional phenomenon with global significance. It exerts a significant influence on lives of people living in Asia, which exceeds one half of the global population, through controlling hydrological cycle, agriculture, and geo-hazards such as floods, droughts, and storms. It is also worth to note that impacts of Asian monsoon extends into the surrounding oceans through controlling surface water circulation, upwelling intensity, nutrient input, and deep and intermediate water production. Thus to understand mode of Asian Monsoon variability, its controlling factor(s), and potential impact of Asian Monsoon variability to other parts of the earth system in the past will provide us a useful information to predict and prepare for the future climate change.

Monsoon is driven by thermal contrast between the continent and ocean with stronger heating (cooling) on the continent during summer (winter) results in stronger summer (winter) monsoon. Consequently, larger insolation over the continent during the summer is considered to result in stronger summer monsoon. Based on this idea, modulation of summer monsoon intensity by orbital precession cycle is proposed. On the other hand, presence of phase lag between summer insolation maxima on the continent interior and summer monsoon intensity is suggested based on compilation of various proxy data on Asian and Indian monsoon. Thus phase relation between summer insolation and Asian summer monsoon intensity is still controversial. In case of the winter monsoon, stronger winter monsoon may be expected at the time of winter insolation minima. In this respect, the time of stronger winter monsoon should coincide with the time of stronger summer monsoon. However, recent data seems to suggest different story.

As to the millennial-scale variability of Asian monsoon, strong linkage with Dansgaard-Oeschger Cycles [DOC], millennial-scale abrupt climatic changes observed in Greenland and North Atlantic, has been suggested during the last glacial period based on sedimentary record of the Japan Sea and stalagmite records from Chinese Caves. However, tele-connection mechanism is still not well understood, so as their origin.

In this presentation, I will focus on orbital to millennial-scale variability of Asian Monsoon especially with respect to its origin and mechanism(s), synthesize the recent progress of paleoclimatic and paleoceanographic researches on this topic, and demonstrate its potential significance and implications to our future.