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Plant phenological change in Korea and its relation to air temperature and circulation

Kyoungmi Lee[1*], Hee-Jeong Baek[1], Won-Tae Kwon[1], Seungho Lee[2]

[1]NIMR, KMA, [2]Dept. of Geography, Univ. of Konkuk

Plant phenology, the study of the timing of recurring biological phenophases such as budding, flowering, and leaf colouring provides useful information for environmental monitoring because of the capability of detecting changes and correlating climatic parameters with natural ecosystems. It also can provide a mean whereby the general public can get motivated to contributing to monitoring and discussing climate changes issues because of the simplest method to observe and the simple concept to understand. Therefore, phenological observations of tree developmental stages are the most effective impact indicators of climate change.

In the present study, the plant phenological change in Korea was analyzed and related to air temperature and atmospheric circulation. The budding and flowering dates of five spring species, forsythia (*Forsythia koreana*), azalea (*Rhododendron mucronulatum*), cherry (*Prunus yedoensis*), peach (*Prunus persica*) and pear tree (*Pyrus pyrifolia*) from 1960 to 2009, and the beginning and peak dates of leaf colouring of two autumn species, ginkgo (*Ginkgo biloba*) and maple (*Acer palmatum*) from 1989 to 2009 used in this study. The increase in mean air temperature from February to March of 0.5 degrees Celsius per decade over last 50 years (1960-2009) led to earlier phenophases of spring by 1.7 to 2.6 days per decade. In contrast to these, the autumn phenophases of plant were significantly delayed by 2.4 to 3.4 days per decade for the short period 1989-2009. The observed trends in plant phenology in Korea corresponded well with changes in air temperature. Spring phenophases advanced by 3.2 to 3.9 days with the increase of air temperature of 1 degree Celsius from February to March, whereas warming in October by 1 degree Celsius caused a delay in the autumn phenophases by 1.4 to 2.8 days. The spring phenological phases also had high correlation with Siberian High intensity and Arctic Oscillation (AO) in late-winter and early-spring (February-March). These results suggest the possibility of using the air temperature, as well as AO-index and Siberian High for predicting phonological dates of plant.

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Keywords: phenology, climate change, temperature, AO, Siberian High