

지구온난화 시나리오에 따른 동아시아 식생 분포와 가뭄지수의 미래 변화 전망 분석

Changes in vegetation and drought condition over East Asia due to global warming based on the future regional projections

부경은 (기상연구소, bko@metri.re.kr)

권원태 (기상연구소, wontk@metri.re.kr)

백희정 (기상연구소, hjbaek@metri.re.kr)

The global scientific communities, as represented by the Intergovernmental Panel on Climate Change (IPCC), have sent a clear message that most of the warming observed for the last 50 years is attributable to human activities (IPCC, 2001). There also are indications that recent climate changes have already affected many physical and biological systems. Furthermore, the global mean surface temperature is projected to increase by 1.4-5.8°C in the year 2100 due to the projected increases of greenhouse gas concentrations in the atmosphere. Global warming is associated with climate changes such as temperature and precipitation. Since ecosystem distributions are mostly dependent on the climate conditions, changes in the climate impose a significant influence on the growth condition of the vegetation.

Based on the background, this study investigates the possible changes in the regional surface climate due to global warming from a MM5 downscaling simulation for the period of 1971-2100. The main focus of this study is on the changes in vegetation types over East Asia and drought conditions over Korea.

1. Vegetation change

To study the vegetation distribution over East Asia, BIOME4, an equilibrium terrestrial biosphere model, is utilized to simulate vegetation patterns. Regional projections of this study show the increase of surface air temperature by 5°C and precipitation by 6% over East Asia in the end of the 21st century. The present study also noticed that the increasing trend of temperature is associated with the increasing trends of the minimum temperature of the coldest month. Therefore, region of

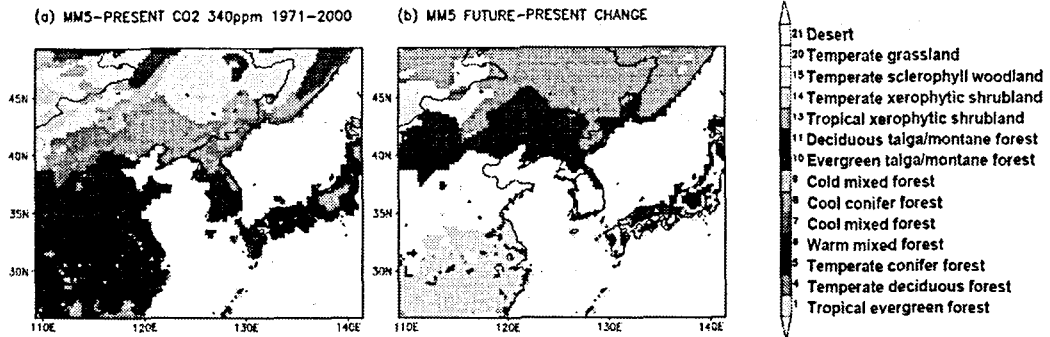


Fig.1. Vegetation distributions simulated by BIOME4 driven by the MM5 simulation for the period 1971-2000 and the possible change based on the future projection.

favorable temperature conditions for vegetation growth in lower latitudes seems to extend toward the higher latitude. It leads to a northward shift of vegetation distribution in the lower latitudes besides the area extension. For instance, the trend in which the warm mixed forest and temperate deciduous forest shift northward may be distinguished. At the same time, the area of temperate deciduous forest pervades the area and replaces temperate grassland regions. Of interest, the tropical evergreen forest is expected to appear over southern China in the end of the 21st century. The possible vegetation changes are mainly affected by a temperature increase rather than a precipitation increase.

2. Change in Palmer Drought Severity Index

For the drought conditions over Korea, Palmer Drought Severity Index (PDSI) is utilized as a measure of drought severity. The important findings show the increase of surface air temperature by 6oC and precipitation by 25% over Korea at the end of the 21st century. The Increasing trend of temperature is associated with an increasing trend of evapotranspiration and precipitation. Climatological precipitation amount appropriate for existing conditions is larger than the precipitation amounts. Hence, it actually produces deficit in precipitation. This exhibits a negative PDSI. As a result droughts are expected to be severe and frequent. Better resolved topography in MM5 induces large changes in local precipitation compared with temperature. Consequently peaks of negative PDSI anomalies appear over southern parts of Korea, where a large reduction in precipitation is noticed in addition to warming.

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