Regional Drought Assessment Due to Climate Change Using MRI-AM20km: Standardized Precipitation Index (SPI)

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In this study, changes of drought characteristics induced by climate change were discussed based on Standardized Precipitation Index (SPI; McKee et al., 1993) using the outputs from MRI-AM20km provided by KAKUSHIN program. Firstly, to check the applicability of SPI in drought assessments, SPIs corresponding to several water shortage events recorded in Japan from 1980 to 2001 were calculated using ground rain gages' data (AMeDAS) and evaluated in time and space. And we assessed changes in severity and frequency of drought for effective (SPI<-1.0) and extreme (SPI<-2.0) drought using the outputs from MRI-AM20km. Major findings in this study are as follows;

(1) It was found that SPIs could express the spatio-temporal behaviors of drought very reasonably and efficiently through comparing SPIs and the recorded water shortage events.

(2) Even though MRI-AM20km predicts that there would be considerable increase in annual precipitation, both intensity and frequency would be increased in terms of drought risk, particularly in the case of 'extreme drought.' (Figure 1)

(3) Seasonal change of drought occurrences could be found for effective and extreme droughts. From the results for the 1st experiment, Japan is projected to experience the agricultural extreme drought more frequently in May. We could also see the same trend in Monsoon Area of Far East Asia.

(4) For most countries located in Monsoon region of Far East Asia, the severity of drought may be intensified at the same area of influence. And as the duration of drought becomes longer, more obvious increase could be seen.

(5) Needless to say, SPI considering only precipitation cannot express the drought status exactly since drought occurs due to a large number of factors like water demand, infrastructures for water supply system to cope with drought and so on. SPI can, however, be used as a 'potential' to lead to drought.

In future, we will enlarge the study area to global scale. And for reasonable regional assessments, it is needed to introduce the regionalization scheme such as statistical clustering techniques.
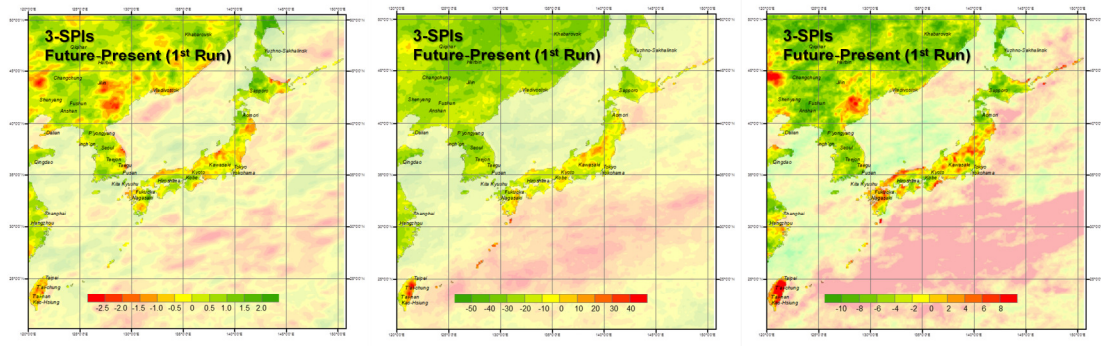

Fig. 1. Change of maximum drought severity (left panel) and frequency (middle panel: effective drought, right panel: extreme drought) for the 1st experiment results of MRI-AM20km