Quantifying and identifying future climate signal, noise, and internal variability at finer temporal scales

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Quantifying and identifying climate internal variability (CIV) plays an important role in climate change studies because of its irreducible and unpredictable characteristics. A large number of studies have addressed such an issue; however, the issue was only resolved at coarser resolution on the first order moments of few climate variables. Our recent study has estimated CIV of climate variables for a “current” period at finer spatial and temporal scales; however, whether CIV will change or remain constant in the future under the impact of representative concentration pathways (RCP45 and RCP85) is still questionable. To investigate how CIV will change in the future in both spatial pattern and magnitude, CIV is assessed over 30-year periods in both current and future periods with two scenarios in Korea by analyzing an ensemble of 100 simulations generated by an hourly weather generator. In this study, signal to noise ratio (SNR) used to evaluate the model performance will be applied to simulating ensemble for different periods. CIV is then estimated by two methods: “detrended” and “differenced”; SNR is estimated by “analysis of variance” and “trend analysis” methods. Both SNR and CIV are evaluated with four proposed matrices signifying rainfall volume, extremes and occurrence of rainfall. To consider the change of CIV in the future periods, t-test (test for mean difference) and f-test (test for variance difference) are applied to the ensemble of CIV. In this study, analyzing SNR’s values shows that the four proposed matrices are controlled by non-linear stochastic process and the change tend to increase in the future with increase of CO_2 concentration. CIV is proved to change in the future periods under impact of CO_2 scenarios. Spatial distribution of CIV’s change over future periods of which locations provides the important and useful information for decision making of water resources planning and proposing mitigation measures of disaster protection.

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