



## **Future changes of interannual variation of the Asian summer monsoon precipitation using the CMIP5**

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The Asian summer monsoon (ASM) region is one of the most populated areas in the world. Since the life of people who live in the region and the industry are strongly dependent on the ASM precipitation, it is interested that how it would change under the circumstance of global warming. Many studies have reported that the mean ASM precipitation would increase by comparing the CMIP models' climatology. Although the changes in mean climate are important, the long-term changes of interannual variability in precipitation are also significant. This study investigated the long-term trend of interannual precipitation variation over the ASM region by using 22 CMIP5 models. The RCP4.5 scenario was used. To investigate the long-term trend of the interannual variation of the ASM precipitation, each model data was recreated to 2.5 degree resolution and a running standard deviation for 21 years of June-July-August (JJA) precipitation were calculated. Next, we created the coefficient variation (CV) by dividing the running standard deviation by the mean JJA precipitation. Then we run a Mann-Kendall test for the CV at each grid.

There were more areas which were indicated a statistically significant increasing trend than a decreasing trend in the ASM region. 40.6% of the region indicated an increasing trend in the future. On the other hand, 16.8% of the area was indicated to have a decreasing trend. It was also common in the global scale that there were more areas that indicated an increasing trend than a decreasing trend. We also divided the area into three groups: land, shore and open ocean. In the ASM region, the shore areas particularly had an increasing CV trend.

To investigate the long-term changes of the interannual variability of the precipitation and the atmospheric circulation over the ASM region, we conducted a composite analysis for the five wettest and driest years for two periods: the early 21st century (2007-2031) and the late 21st century (2076-2100). The special patterns of the interannual variation of the precipitation and the atmospheric circulation between the two periods had differed only slightly. A positive deviation precipitation band with a cyclonic circulation was recognized from across the Bay of Bengal to the equatorial Northwest Pacific. The none-big-difference of the patterns may suggest that interannual variation in the ASM region would increase not because the pattern changes, but because the pattern's strength gets stronger or its frequency gets higher.