Effect of bias in Leaf Area Index to climate in MIROC-ESM

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Leaf Area Index (LAI) is not only an important factor to determine the amount of photosynthesis, but also a key variable to represent ground surface condition which gives significant impact to atmosphere through biophysical processes such as albedo and transpiration. In this study, we first compared the present-day LAI in Earth System Models (ESMs) with remote sensing data and confirmed the significant overestimation by ESMs, which is pointed out by some existing studies. In order to investigate the effect of the bias, we next compared two pre-industrial control experiments: an ordinary control experiment in which LAI is prognosed by the terrestrial ecosystem component of the ESM, and an experiment in which LAI is replaced with dataset made from remote sensing data (the pre-industrial state was estimated by retuning the cultivated areas to natural vegetation). The result shows a significant temperature difference between the two cases, and by analysis of the related variables we concluded that the difference is caused by albedo change due to the change in snow depth/coverage in May-June and in the sea ice coverage in winter.

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