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Difference of boreal summer climate between coupled and atmosphere–only GCMs

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Effects of atmosphere-ocean coupling have been investigated using the CCSR/NIES/FRCGC coupled and atmospheric general circulation models (CGCM and AGCM). The latter is integrated with monthly sea surface temperatures (SSTs) taken from the former. The given SSTs being independent of the atmospheric fluctuations, the AGCM supplies more water vapor to the atmosphere to adjust larger air-sea temperature difference. In our AGCM, the summertime land temperatures are higher due to greater greenhouse effect, because the change of the cloud amount is too small to affect the radiative fluxes. More evaporation induces stronger rainfall in some regions, and circulation and moisture distribution control the horizontal distribution of rainfall. Hence the coupling effect in rainfall distribution could change if the climate condition changed. As an example in our model, the decoupling does not affect summer Japanese rainfall under the preindustrial condition but strengthens it under the global warming condition.