Regional climate projections using the HadGEM3-RA

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Climate change information is necessary in order to assess the impacts of climate change on human and natural systems and to develop suitable adaptation and mitigation strategies at the national level (Giorgi et al., 2009). Most Coupled Atmosphere Ocean General Circulation models (AOGCMs) have provided valuable information on climate change at the global to sub continental scale (IPCC, 2007). But the horizontal resolution of most present day AOGCMs is still of the order of few hundred kilometres (Meehl et al,. 2007). This prevents them from capturing the effects of local forcing e.g. complex topography and land surface characteristics which modulate the climate signal at fine scale (Giorgi et al., 2009).

HadGEM3-RA is a regional atmospheric model that is based on the atmospheric component of the latest Earth System Model developed by Met Office Hadley Centre, i.e. HadGEM3. KMA has utilized this model for dynamical downscaling for seasonal-to-centennial scale over the East Asia region according to the collaboration agreement between KMA and Met Office Hadley Centre. For the preparation of national climate change scenario, experiment reproduced regional climate projections for 150 years from 1950 to 2100 over both CORDEX (Coordinated Regional climate Downscaling Experiment) East Asia domain with 50 km resolution and Korean peninsula domain with 12.5 km resolution. They used dynamical downscaling method from global climate change projection by a coupled atmosphere-ocean general circulation model, i.e. HadGEM2-AO with about 135-km resolution under Intergovernmental Panel on Climate Change (IPCC) Representative Concentration Pathway (RCP) 8.5/4.5.

Results of current climate simulation show that HadGEM3-RA has ability to reproduce small scale features more realistically than the HadGEM2-AO due to its high resolution including complicated topography and coast lines, although it has small large scale drift from lateral boundary forcing. For the surface air temperature and precipitation, HadGEM3-RA shows similar pattern to projection by the HadGEM2-AO. However, it tends to underestimate warming trends of temperature and inter-annual variability of precipitation. This underestimation is maybe caused by using constant mean values averaged over the 20th Century for greenhouse gases and aerosols for the whole projection period. In order to include the effects of these external forcing, another experiment forced with annual mean values of greenhouse gases and aerosols from CMIP5 is conducted, and will be compared, especially in terms of warming trend. More detailed results including projected with regional climate change experiment with forcing greenhouse gases and aerosol will be discussed in the poster.