IPRC Seminar

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“Significant aerosol influence on the recent decadal changes in the tropical Pacific climate”

The Pacific trade winds, coupled with the zonal sea surface temperature (SST) gradient in the equatorial Pacific Ocean, control regional sea levels and thereby their trend is a great concern in the Pacific Rim. Over the past two decades, easterly winds have been accelerated in association with eastern tropical Pacific cooling. They may represent natural interdecadal variability in the Pacific and possibly explain the recent global warming hiatus. However, the intensification of the winds has been the strongest ever observed in the past century, the reason for which is still unclear. Here we show using multiple climate simulations for 1921-2014 by the global climate model MIROC that approximately one-third of the trade wind intensification for 1991-2010 can be attributed to changes in sulphate aerosols. The multidecadal SST anomaly induced mostly by volcanic aerosols dominates in the western North Pacific (WNP), and its sign rapidly changed from negative to positive in the 1990s coherently with Atlantic multidecadal variability. The WNP warming resulted in intensification of trade winds to the west of the dateline. These trends have not contributed much to the global warming hiatus, but have greatly impacted rainfall over the western Pacific islands. Furthermore, a remarkable decrease in the number of tropical cyclones (TCs) observed in the southeastern part of WNP for 1992-2011 was found to be influenced by the aerosol-induced circulation changes in the western tropical Pacific. Specifically, about 60% of the observed decreasing trends in TC genesis frequency in the southeastern WNP was mainly attributed to the increased vertical wind shear and decreased low-level vorticity, associated with a trans-basin multidecadal SST change driven by aerosol forcing. The near-future projection shows that the aerosol forcing still has some potential influence on decadal TC change, but the projected decreasing frequency is mainly due to increasing greenhouse gases forcing.

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