Climate, Water Resource and Cropping in South Asia

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Key word: South Asia, Climate Change, Representative Concentration Pathways (RCPs), Multi-Model Ensembles, Cropping system and cropping pattern, water resources

Climate of South Asia region is heavily influenced by large scale monsoonal circulation which alone contributes the major amount of annual rainfall. In the present study, future possible climate change scenario during 2006-99 over seven South Asian counties has been developed using latest generation CMIP5 GCMs for four available RCPs namely RCP2.6, RCP4.5, RCP6.0 and RCP 8.5 through multi-model ensembles (MME) approach. Future projection from all RCPs indicates a highly significant increasing trend of precipitation in India, Nepal and Bhutan. In India, precipitation trend will vary from 3.0 mm/decade to 12.1 mm/decade whereas the increase will be 8.2 to 34.3 mm/decade for Nepal and 11.4 to 37.9 mm/decade for Bhutan. All RCPs, except RCP 2.6 indicate high increasing trends over Bangladesh (8.4-20.6 mm/decade) and Sri Lanka (5.9-13.7mm/decade). In Pakistan, the trend is insignificantand the change will be nominal as per all the scenarios except RCP8.5. RCP 6.0 indicates a significant decreasing trend (0.7 mm/decade) over Afghanistan. Study reveals that a substantial increase of precipitation over most of the South-Asian countries namely India, Nepal, Bhutan, Bangladesh, and Sri Lanka where climates are largely influenced by the large scale-monsoonal circulation. On the contrary, the drier countries like Afghanistan and Western part of Pakistan will receive very less monsoonal effect and projected to increase a nominal precipitation in monsoon season.

Water resources in South Asia projected to be hugely affected by the impacts of climate change. The melting of glacier and its retreat poses greatest concern to the region.The increase in seasonal runoff in the initial years may accelerate the flood risk particularly in northeastern parts of India and Bangladesh. On the other hand, steep decrease in seasonal river flows in subsequent years may result in water shortage and droughts. All the available water resources in South Asia are heavy dependent on the monsoon; water availability in the region is projected to more scares and uncertain. Water availability is more vulnerable during the incidence of extreme events likecloud burst, glacial lake outburst which leads to produce intensive flood. In the coastal areas, salt water intrusion and increase in natural disaster like cyclones will create severe damages to the fresh water supply.

Cropping system and cropping pattern of South Asia region depends on the success and failure of the monsoon rainfall as three-fifth of the cropped area is rain-fed. Economy of South Asia is highly dependent on agriculture, which contributes significant amount of annual GDP (Nepal-35.1%, India-18.2%, Pakistan-25.1%, Afghanistan-23.6%, Banladesh-16.3% and Sri Lanka-10.8%) in this region. Irrigation demand for agriculture in arid and semi-arid regions of South Asia is likely to increase by 10% for temperature increase by 1%. Facing with 2-4C° temperature increase rice yields are expected to decline by 0.75 tons/ha. In general, crop yields could likely to decrease up to 30% in Central and South Asia even if the direct positive physiological effects of CO_2 are taken into account. There could be a significant decrease in non-irrigated wheat and rice yields for a temperature increase of greater than 2.5°C which could incur a loss in farm-level net revenue between 9% and 25% over this region. The net cereal production is projected to decline at least between 4% and 10% by the end of this century under the most conservative climate change scenario. Production of rice and wheat over Bangladesh might drop by 8% and 32%, respectively, by the year 2050. A 0.5°C rise in winter temperature could reduce wheat yield by 0.45 tons per hectare in India. Study also point out that, there will be a 2–5% decrease in Indian wheat and maize yield potentials for temperature increases of 0.5–1.5°C. South Asia will face a estimated decrease in maize and sorghum production of -16% and -11% respectively by 2050 but no mean change in yield was detected for rice if temperature increases by 1^oC and level of CO_2 elevated to double.