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GCM - Derived Future Climate of Arid Western India and Implications for Land Degradation

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Abstract: An analysis of the present and future patterns of rainfall, aridity, and wind and water erosion potentials in arid western part of Indian subcontinent, based on GCM data for A2 scenario, revealed that only few GCMs could be used with greater confidence. The study suggests strong possibility of a prolonged drought phase during 2021-2025, which may continue with some respite till the mid-century. It also shows the likelihood of aridity spreading beyond the present eastern boundary of the region during the same period. Since wind strength is likely to increase gradually and soils dry, the wind erosivity is expected to increase manifold across Thar Desert and Megathar region, especially from the middle of this decade, destabilizing the sandy landscape over a much larger area and contributing more to the atmospheric dust load. Likely periods of higher monsoon rainfall than the 1951-2000 mean have been identified, which may encourage higher fluvial erosion along the Aravalli foothills and Kachchh mainland due to increasing rainfall intensity that was predicted earlier by PRECIS model. Since the degradation processes are already getting accentuated by increased human pressure on the vulnerable land resources, and since there is an apprehension that normal monsoon behavior of the subcontinent has already started to get affected by the degradation processes in the region, serious efforts are needed to understand the atmosphere-land-human interaction mechanism for improving the conditions.

Key words: GCM, A2 scenario, rainfall, aridity, wind erosivity, dust load, degradation, arid west, Megathar, sub-zones.

Since the last two decades global temperature is increasing at a much faster rate than the average rate during the Twentieth Century. The major cause of the change has been identified as large-scale emission of anthropogenic Green House Gases (GHG) into the atmosphere, which is somewhat reduced by sulfur emission. Compiling information on the likely future climates simulated by several General Circulation Models (GCMs), the Intergovernmental Panel on Climate Change (IPCC) has apprehended in its Fourth Assessment Report (2007) that at the current rate of GHG emission, global temperature may increase by about 0.2°C per decade during the next two decades. If the emission is restricted to the level of year 2000, global temperature may increase by ~0.1°C per decade. In subsequent decades the rate of increase will most likely depend more on the specific emission scenarios being followed, such that by the last decade of this century the global temperature may increase over the 1980-1999 mean by 1.8°C (range 1.1-2.9°C) under B1 scenario (defined by IPCC, 2000, as a convergent world with changes in population with time; rapid changes in economic structures towards a service and IT-based economy, with reduction in material intensity; introduction of clean and resource-efficient technologies; minimum energy requirements and emissions) to 3.4°C (range 1.4-3.8°C) under A2 scenario (defined by IPCC, 2000 as a very heterogeneous world; emphasis on self-reliance and preservation of local identities; fertility patterns across regions converge very slowly, leading to continuously increasing global population; economic development is primarily regionally oriented; per-capita economic growth and technological changes more fragmented and slower than other storylines; high energy requirements; emissions less than in A1F1 scenario) and 4.0°C (range 2.4-6.4°C) under A1F1 scenario (defined by IPCC, 2000, as one with very rapid economic growth, rapid introduction of new and more efficient technologies, high energy needs met through fossil-intensive

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