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Exploring recent and projected climate change in a steep monsoonal catchment in the middle Himalaya through innovative synthesis of local observations, gridded datasets and community engagement

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Under the auspices of an “Innovation Partnerships” programme research exchange grant jointly funded by the India Department of Science and Technology and the British Council, Kumaun University and Newcastle University have been collaboratively exploring the recorded historical and projected future climate change implications for a case study catchment, the Ramgad river, in the Kumaon Lesser Himalaya (Uttarakhand state, India). This work weaves together diverse research strands with the aim of producing a coherent thorough characterisation of the impacts of recent/on-going and likely climate evolution on local communities.

Participatory research activities in multiple villages in the case study catchment have yielded a consistent narrative of changes posed by the increasingly erratic monsoonal rainfall as well as upward displacement and replacement crops in their historical elevation ranges due to temperature change. Multi-decadal climate records from both local observations and global meteorological records reveal a more complex picture with strong seasonal asymmetry of changes in both temperature and precipitation: a) trend analysis shows mild weakening of the early phase (May, July) but strengthen in the later stages (August, September); b) temperature trends show much stronger warming in late winter and early spring (February to April) than the rest of the year with additional asymmetry in both sign and magnitude of change between individual components (Tmax, Tmin) of the diurnal temperature cycle. On-going research seeks to associate this asymmetry with causal mechanisms (cloud radiative effect, atmospheric circulation). Analysis of historical records will provide the basis for validation and assessment of individual regional climate model projections from the CORDEX South Asia domain ensemble.

For the terraced agricultural communities of the Kumaon Himalaya, the most directly consequential effects of climate variability and change are impacts on crop yields which impact both livelihoods (household revenue) and food security. Thus another research strand focuses use of remote sensing vegetation data products (MODIS MOD13Q1 and Landsat NDVI) to derive both locally relevant land cover classes differentiating natural vegetation from cropped areas as well as assessing vegetation response to climate anomalies (precipitation, temperature). These responses, characterised from observations over the past decade, will be considered in terms of both historical climate records and projected climate change.

The ultimate aim of this collaborative project is to report all of these findings to the local communities through appropriate media and in comprehensible terms in order to enable participatory exploration of potential adaptation pathways to improve local resilience and sustainability.