Modeling emissions pathways for India's climate amid COVID-19 recovery

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As the global economic recovery from COVID-19 continues, decisions regarding emissions strategies can have important implications on regional climate change. A new paper in *Environmental Research Letters*

explores the impact of such decisions in India, modeling the effects of COVID-19 emissions recovery pathways on India's summertime climate.

"Anthropogenic emissions can be linked to extreme weather events in India and beyond," explains Peter Sherman, a researcher in the Harvard-China Project on Energy, Economy and Environment in the Harvard University John A. Paulson School of Engineering and Applied Sciences and Ph.D candidate in the Department of Earth and Planetary Sciences. "This study provides an important discussion on how India—a nation which is likely to be particularly susceptible to climate change over the coming decades—may be affected by emissions changes as the world transitions out of the COVID-19 pandemic."

The team of researchers—which include Harvard undergraduate Jonathan D'Souza as first author and two high school students from Cambridge Rindge and Latin School (mentored by Harvard University and University of Cambridge researchers) as contributing authors—modeled the impact of three different scenarios on India's climate: fossil-based recovery, a strong renewable-based recovery and a moderate scenario in between the two.

The team found that a fossil fuel-based recovery pathway leads to higher summertime aerosol concentrations in the long term, in contrast to greener scenarios. The greener scenarios may actually drive a positive feedback loop, where the solar PV capacity factor improves with reduced air pollution—incentivizing further investment in renewables which should further reduce aerosol emissions.

The researchers also found that extreme temperature and precipitation events in India are expected to increase in magnitude and frequency regardless of the emissions commitments going forward. However, the spatial patterns of these changes as well as the extent of the change are pathway dependent. They found that while decreasing fossil fuel

emissions will reduce the greenhouse effect (and consequently extreme temperature events), concurrent emissions reductions in aerosols and their precursors may balance these effects at the regional level.

"These projected changes in summertime temperature and precipitation extremes could have broad consequences for India from perspectives of both agriculture and human health," says Michael B. McElroy, Gilbert Butler Professor of Environmental Studies at Harvard University and Chair of the Harvard-China Project. "We found that the emissions of aerosols and its precursors will likely play a more dominant role on precipitation over India in the coming decades, relative to the changes expected for greenhouse gasses—meaning that while it is important to implement sustainable policies today, it is also important to be mindful of the complex balance between greenhouse warming and aerosol-induced cooling when reducing emissions."

More information: Jonathan D'Souza et al, Projected changes in seasonal and extreme summertime temperature and precipitation in India in response to COVID-19 recovery emissions scenarios, *Environmental Research Letters* (2021). DOI: 10.1088/1748-9326/ac2f1b

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