HYDROLOGY

Under-estimated recharge

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ERIC NATHAN / ALAMY STOCK PHOTO

Global-scale hydrological models used to estimate hydrological characteristics — such as groundwater recharge — from climate model projections mostly assume simple uniform subsurface properties.

To investigate the implications of this simplifying assumption, Andreas Hartmann from the University of Freiburg, Germany, and co-authors investigate groundwater recharge in highly heterogeneous limestone regions of Europe, Northern Africa, and the Middle East. These areas constitute about 25% of the total land area investigated and are disproportionately important aquifer regions.

They compare simulations from two large-scale hydrological models, one accounting for subsurface heterogeneity and one using conventional assumptions of uniform subsurface conditions. Results show that heterogeneity enhances recharge rates by up to four times for present conditions and changes by up to five times under climate change. These differences in recharge rates suggest that management strategies in areas with heterogeneous subsurface features need to be adapted to account for fast transit of water into aquifers. *AB*

PUBLIC OPINION

Indigenous beliefs

Global Environ. Polit. **17,** 40–58 (2017)

Most research on acceptance of climate change is conducted in the United States, where political ideology is a powerful predictor of climate change belief. However, these results may not translate worldwide given the idiosyncratic nature of the US two-party system and other differences in domestic politics. For instance, politicians in Latin America routinely draw on indigenous culture, which emphasizes connection to weather and the earth, to legitimize climate policies.

Todd Eisenstadt from the American University and Karleen Jones West from the State University of New York at Geneseo conducted a national survey to examine factors driving climate change attitudes in Ecuador. Endorsement of indigenous belief systems, but not political ideology, predicted climate change attitudes. Adherence to Western scientific ideas reduced, but did not eliminate, this effect, suggesting that indigenous beliefs and Western science do not represent a simple dichotomy. Finally, proximity to oil extraction activities, but not reliance on rainwater or river water, influenced climate change belief, suggesting that the former may be a more appropriate measure of vulnerability in this context. These results highlight the importance of taking a global approach to studying public opinion on climate change. *JR*

AGRICULTURE

Mitigation through food

Agric. Ecosyst. Environ. **237,** 234–241 (2017)

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Food production is an important source of greenhouse gas emissions, particularly as the rapidly growing world population increases the demand for food. Emissions vary considerably across food types and production techniques. Consequently, changing food consumption patterns have the potential to significantly reduce emissions.

Sylvia Vetter from the University of Aberdeen, UK, and co-authors compared the greenhouse gas emissions of major crops (for example, wheat and rice) and livestock-based products (for example, mutton) in India. They found mutton and rice were among the main sources of greenhouse gas emissions per kilogram of product, with rice emissions much more relevant because of the large presence of rice in Indian cuisine and the resultant large-scale production.

This suggests that a change in culinary customs and agricultural production decisions could have a significant impact on the emissions level. For example, a hypothetical reduction of rice production by 50% — compensated for with a corresponding increase of other cereals, such as wheat — could reduce the greenhouse gas emissions by around 17%. The application of these findings could lead to mitigation policies that are compatible with increasing food demands in India. *MG*

CLIMATE DYNAMICS

Shifting ocean interactions

J. Clim. **30,** 1971–1983 (2017)

Historically, patterns of decadal sea-surface temperature (SST) variability in the Indian and Pacific Oceans have been strongly connected. This is because warm anomalies in the Pacific Ocean (positive phase of the interdecadal Pacific oscillation, IPO) force warmth in the Indian Ocean (positive phase of the Indian Ocean basin mode, IOB) through coupled air–sea interactions. However, since 1985, this relationship has broken down, the cause of which is not well understood.

Lu Dong and Michael McPhaden from the NOAA Pacific Marine Environmental Laboratory, USA, investigate the factors causing this change in SST relationships using observations and coupled climate model simulations. They demonstrate that the perturbed IPO–IOB association can largely be attributed to increased external forcing by greenhouse gases. Specifically, they find that greenhouse gas forcing has warmed the Indian Ocean, overwhelming changes that would have arisen from the IPO, and thus weakening dynamical links between the two ocean basins. Indeed, in the absence of anthropogenic forcing, model simulations suggest that IOB evolution would have remained strongly connected to the IPO. These shifting ocean interactions have implications for understanding regional sea-level rise and the global warming 'hiatus', emphasizing the need to further examine inter-basin interactions under climatic change. *GS*

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