HYDROLOGY

Amazon flooding

Environ. Res. Lett. **11,** 014013 (2016)

Significant droughts in the Amazon rainforest have raised concerns about the ecological implications of climate change in the region. An increase in the occurrence and severity of drought is not the only potential climate impact, however: as well as regional warming, climate models project precipitation that is increasingly seasonal.

Zed Zulkafli from Imperial College London, UK, and co-workers use a land-surface model to investigate the potential impact of changes in regional precipitation on the hydrological regime of the upper Amazon River. Hindcasts and projections of annual minimum, mean and maximum river flows were simulated for a range of return periods and across a range of greenhouse gas concentration pathways.

They find that the representative concentration pathway (RCP) 4.5 and 8.5 scenarios of climate change project an increase in severity of wet season flood pulse of 7.5% and 12% respectively, for 100 year return floods. Changes in the flood pulse such as these could impact the reproductive success of river species as well as the wider swamp forest ecology and the socio-economy of the floodplain. *AB*

PRECIPITATION

Recent US trends

J. Clim. http://doi.org/bcd8 (2016)

Observations of rainfall have shown an increase in heavy precipitation events in the northern and eastern United States over the past few decades. It is unknown whether these increases are being driven by natural climate variability or human influence; climate models have varying success at simulating precipitation, particularly on a regional scale.

To investigate the cause, Martin Hoerling from NOAA Earth System Research Laboratory, USA, and colleagues analysed heavy precipitation observational time series from the beginning of the twentieth century to 2013. They then used climate model simulations to investigate human influence since 1979 by comparing the signal from external forcing to that of natural variability in the ocean and atmosphere.

Fluctuations in sea surface temperature, mostly related to natural internal variability, was found to be the main influence on the precipitation increases for both the summer and winter seasons. Anthropogenic influence was found to be a smaller contributor to the observed trends for the study period; however, its influence is expected to increase into the future. *BW*

ENERGY MODELLING

Environmental impact

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The EU plans to almost entirely decarbonize its electricity generation system by 2050. That means building lots more renewable energy generation with new storage and transmission capabilities, or developing fossil fuel plants with integrated carbon capture and storage (CCS) technology. These technologies cut greenhouse gas emissions, but they also affect the environment in different ways.

To investigate how the environmental impacts of such decarbonization would differ depending on which technology is favoured, Peter Berrill from the Norwegian University of Science and Technology and colleagues combine a least-cost model of the power system that ensures projected demand is met in 2050 with a life-cycle assessment model. They find that the emissions reduction benefit of a renewables-based system outweighs any minor environmental impact it may have. Renewables do have a greater impact on mineral resource depletion than the CCS-based scenarios, but have a much lesser impact on water toxicity and nutrient levels, particulate matter formation and land occupation.

The modelling calms fears that ramping up renewables could cause unintended environmental harm that counters the benefits of transitioning to a low-carbon energy system. *MH*

GEOENGINEERING

Ship wake brightening

J. Geophys. Res. http://doi.org/bcd7 (2016)

Solar radiation management schemes can contribute to reducing climate change by decreasing the amount of light reaching the Earth's surface. One such scheme proposes to brighten the ocean surface by increasing the number of microbubbles in ship wakes, resulting in more light being reflected back to the atmosphere. But the extent to which current shipping lanes could contribute to this effect is unclear.

Julie A. Crook from the University of Leeds, UK, and colleagues examine how existing shipping wakes would need to be modified in order to have a significant impact on surface temperatures. They use a global climate model to simulate brightening wakes and find that global-mean surface temperature could potentially be reduced by 0.5 °C by 2070 (0.9 °C in the Northern Hemisphere). But this requires increasing the bubble lifetime from minutes to days, which can only be achieved by the addition of an as-yet undetermined amount of surfactant — a substance that helps stabilize microbubbles.

Using only the current shipping lanes for wake brightening could potentially reduce climate change, but with an effect mainly in the Northern Hemisphere. The wider implications of adding surfactant to the ocean are also not fully understood and should be considered before such geoengineering proposals are adopted. *ET*

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