PERMAFROST

Mercury multiplied

Geophys. Res. Lett. http://doi.org/ckbk (2018)

Credit: Steve Morgan/Alamy Stock Photo

Warming of the Arctic and its permafrost regions will result in the release of carbon as soils thaw. Whilst estimates have been made of the greenhouse gas emissions from the permafrost thaw, other elements currently locked away will also be released, with implications for their global elemental cycles. One such example is mercury (Hg), which in certain forms can be highly toxic.

To calculate the potential mercury inventory, Paul Schuster of the US Geological Survey, Boulder, Colorado and collaborators analysed 13 permafrost soil cores from a 500 km Alaskan north–south transect. Calculating the Hg-to-carbon ratio gave a median value of 1.6 ± 0.9 micrograms Hg per gram C. This ratio, along with known soil carbon maps, can be extrapolated to calculate that the Northern Hemisphere permafrost stores $1{,}656 \pm 962$ gigagrams Hg. This is double the amount found in all other sources combined.

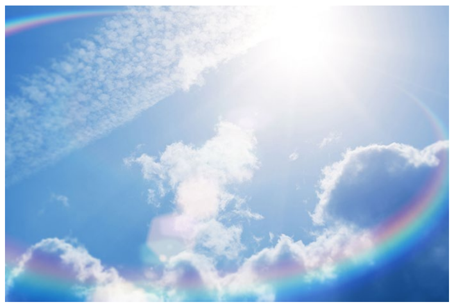
This large store of Hg is currently locked away as the low temperatures prevent microbial activity from liberating it. However, warming and increased microbial activity could alter this, but currently the timescale and consequences for the environment and food webs are unknown. *BW*

https://doi.org/10.1038/s41558-018-0112-2

ATMOSPHERIC CHEMISTRY

Decreasing ozone

Atmos. Chem. Phys. **18**, 1379–1394 (2018)



Credit: Sunshine Pictures/Alamy Stock Photo

The Montreal Protocol came into effect in 1989, limiting multiple ozone-depleting substances. Evidence suggests total column ozone has stabilized since the late 1990s, but has not increased as predicted by chemistry–climate models. To better understand the lack of total recovery, William Ball, from the Physikalisch–Meterologisches Observatorium Davos World Radiation Center, and colleagues combine multiple satellite measurements to quantify changes in total column ozone contributed by changes in the troposphere, and upper, middle, and lower stratosphere.

They show upper stratospheric ozone has increased in almost all latitude bands between 60° S and 60° N since 1998, while lower stratospheric ozone has decreased. Stability in total column ozone is attributed to increases in tropospheric ozone counteracting the overall downward trend in stratospheric ozone. Current models do not reproduce the lower stratospheric ozone decrease. The authors posit several explanations for why, including climate change impacts on the Brewer–Dobson Circulation and the effects of unaccounted-for very-short-lived substances containing chlorine or bromine. Given the importance of ozone restoration for human health, a better understanding of the drivers of declining lower stratospheric ozone is needed. *AY*

https://doi.org/10.1038/s41558-018-0113-1

OCEAN CURRENTS

Agulhas variability

J. Clim. http://doi.org/ckgt (2018)

The Agulhas Current (AC) — the western boundary current of the South Indian Ocean — flows south along the east coast of Africa. Model results suggest the AC has intensified in response to strengthened westerly winds, a manifestation of the positive trend in the Southern Annular Mode (SAM). However, observational support for this SAM-driven AC intensification is lacking. Using a satellite altimetry and in-situ-derived proxy for AC transport, Shane Elipot and Lisa Beal from the University of Miami, USA, investigate the atmospheric drivers of interannual AC variability and their relationship to longer-term trends.

On interannual timescales, AC transport is found to be most strongly related to climate forcings originating in the tropical Indo-Pacific, namely the El Niño–Southern Oscillation. By contrast, the SAM is shown to have a weak influence. Consequently, the positive trend in the SAM is expected to have a minor impact on longer-term AC variability. As the proxy time-series for AC transport also reveals insignificant trends, it is argued that the SAM is unlikely to have intensified the AC as models indicate. Thus, more work is required to resolve western boundary currents in climate models to minimize such discrepancies. *GS*

https://doi.org/10.1038/s41558-018-0111-3

ECOLOGICAL FORECASTING

Winding back the horizon

Proc. Natl Acad. Sci. USA **115**, 1424–1432 (2018)

Global environmental change, and perhaps climate change in particular, has fundamentally altered the way we look at the future, with past experience becoming an increasingly poor guide to what is to come. A dynamic future combined with multiple, severe and interacting environmental pressures has begun to move many ecologists from undertaking primarily descriptive work to a focus on understanding and anticipating change in order to inform management interventions.

Michael Dietze from Boston University and co-authors argue that there is currently a temporal mismatch between most ecological forecasts, which are predominantly focused on climate change responses over multi-decadal timescales, and environmental decision-making, which tends to operate on near-term — daily to decadal — timescales. The authors argue that a much greater focus on iterative, near-term ecological forecasts is needed. Not only can these forecasts be more easily operationalized into decision-making, but they can also be continually tested and updated with new observational data. Several key areas are identified for development if near-term forecasting opportunities are to be maximized. Improvements are needed in data interoperability, latency and uncertainty quantification and in forecast-specific theory, methods, and cyber-infrastructure. To facilitate these developments, changes in scientific training, culture, and supporting institutions will also be required. *AB*

https://doi.org/10.1038/s41558-018-0110-4

Alastair Brown, Graham Simpkins, Bronwyn Wake and Adam Yeeles