Calculated loss

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High year-to-year variability in mountain snow cover makes it difficult to distinguish between changes due to natural factors and those due to global warming. Estimating the temperature sensitivity of the spring snowpack circumvents the problem and reveals substantial warming-induced reductions in snow cover in the north-western US over recent years.

Joseph Casola, of the University of Washington, US, and colleagues estimate the amount of snow lost per °C increase in temperature in the Cascades Mountain range, US. Using four independent approaches — seasonal measurements of snow water content, daily measurements of precipitation and temperature, geometric considerations of basin topography and simulation by a hydrological model — they show that spring snow cover declines by 16% per °C increase in temperature when warming-induced increases in precipitation are taken into account. They use this value, together with estimates of regional temperature change, to determine the amount of snow lost to climate warming in the Cascades portion of the Puget Sound drainage basin. Over the past 30 years, the region has lost 8–16% of its snowpack due to warming.

The research suggests that the Cascades are likely to lose 11–21% of current snow cover by 2050.

Polar migration

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A suite of sediment cores reveals that the northern polar front hovered at about 40° N during the coldest episodes of the last glacial period. The polar front separates the warm, salty Atlantic waters from cold, low-salinity polar water.

Frédérique Eynaud of the Université Bordeaux and colleagues analysed indicators of sea surface conditions preserved in marine sediments collected between 36 and 42° N, along the Iberian margin. During the coldest periods, which were associated with periods of ice-sheet collapse, the shells of cold-loving zooplankton began appearing in the northernmost cores in abundances close to those observed near the polar front today. Additional evidence of ice-rafted grains and falling surface temperatures all indicate the intrusion of cold, polar waters.

The cold intrusion was associated with significant population shifts of plankton groups, and with a jump in productivity. However, these events were limited to times of ice-sheet collapse: the polar front remained closer to its present position throughout the summers of the last glacial maximum and during the Holocene 8.2 ka cooling.

Wind, not waves

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GSA

Large U- or V-shaped coastal bedforms called chevrons have been assumed to be the result of large tsunamis that were triggered by oceanic impacts. Numerical modelling and a comparison with similar features further inland, however, suggest that tsunamis probably had no role in the generation of chevrons.

Joanne Bourgeois of the University of Washington, Seattle, and Robert Weiss of Texas A&M University, College Station, evaluated whether tsunamis could have generated the chevrons found in southern Madagascar, which lie at a low angle to the coast. The researchers' simulations suggest that this orientation is inconsistent with a tsunami origin. In addition, according to the calculations, tsunamis do not lead to the specific conditions of sediment transport that are required to maintain chevrons.

Bedforms with a similar shape are commonly observed in wind-deposited sediments, suggesting that chevrons may have formed through the influence of wind instead of waves.

Sulphur from the mines

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Acidic drainage from coal mines can supply large quantities of sulphur to river systems and influence regional and even global sulphur budgets, according to a recent analysis. Acid sourced from coal mines enhances chemical weathering and can influence cycles of other elements, such as silica and carbon.

Peter Raymond, of the Yale School of Forestry and Environmental Studies, and Neung-Hwan Oh, of the University of California at Davis, analysed long-term records of coal production and river chemistry in central Pennsylvania. As coal production in this region decreased dramatically during the second half of the twentieth century, so did the influx of sulphur into the rivers. Their calculations suggest that a substantial portion of the decrease can be attributed to reduced influx from the mines, attesting to the influence of coal mining on the regional sulphur budget.

If these results are globally applicable, sulphur resulting from coal production could amount to as much as 40% of the mass deposited from the atmosphere as a result of human activities.

Ancient residue

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Early in the Earth's history, crystallization and solidification of a planet-wide magma ocean probably led to an accumulation of melt-loving elements in a separate mantle reservoir. Isotopic data suggest that remnants of this reservoir may be preserved in the mantle roots of ancient continental regions.

Dewashish Upadhyay and colleagues at the University of Münster, Germany, analysed the neodymium isotopic composition of ~1.5 billion-year-old igneous rocks from the edge of the Bastar Craton of southeastern India. Some of the rocks show unusually low $^{142}Nd/^{144}Nd$ values, consistent with contributions from enriched material dating back to the first few hundred million years after the Earth's formation.

The chemical composition of these igneous rocks points to an origin in the mantle root of this continental region, suggesting that the root must also host traces of the ancient enriched reservoir. Such roots may resist convective mixing into the deeper mantle for billions of years, and are thus capable of preserving ancient enriched material.