Impact of rainfall reaches to roots of mountains

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The erosion caused by rainfall directly affects the movement of continental plates beneath mountain ranges, says a University of Toronto geophysicist — the first time science has raised the possibility that human-induced climate change could affect the deep workings of the planet.

“In geology, we have this idea that erosion’s going to affect merely the surface,” says Russell Pysklywec, a professor of geology who creates computer models where he can control how a range of natural processes can create and modify mountains over millions of years. Pysklywec conducts field research in the Southern Alps of New Zealand, where the mountains are high and geologically “young.”

He found that when mountains are exposed to New Zealand-type rainfall (which causes one centimetre of erosion per year) compared to southern California-type rainfall (which erodes one-tenth of a centimetre or less), it profoundly changes the behaviour of the tectonic plates beneath the mountains.

“These are tiny, tiny changes on the surface, but integrating them over geologic time scales affects the roots of the mountains, as opposed to just the top of them,” says Pysklywec. “It goes right down to the mantle thermal engine — the thing that’s actually driving plate tectonics. It’s fairly surprising — it hasn’t been shown before.”

It takes a supercomputer several days to run one of Pysklywec’s models,

which reveal the inner workings of the Earth to hundreds of kilometres below the surface, where the temperature can reach 1,500 degrees Celsius. In extreme conditions, he says, the erosion effect can even cause the underlying plate to reverse direction. “As a concept, imagine blanketing the European Alps with a huge network of ordinary garden sprinklers. The results suggest that the subtle surface weathering caused by the light watering have the potential to shift the tectonic plates, although you would have to keep the water on for several million years.” In the long run, says Pysklywec, it raises the question of whether human activity, which is affecting climate, could ultimately influence deep Earth processes. “That’s what these findings suggest,” he says. “We’re talking millions of years, but it’s one more example of how all these natural systems are interrelated.”

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Source: University of Toronto