



Summer storms wreak havoc in alpine lakes

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Topics: Ecosystems

Clear mountain lakes could change with ever greater frequency into milky soup in the future. Climate change is the guilty agent. This has been shown by a new study led by the University of Lausanne in collaboration with Eawag and the French National Agricultural Research Institute using the example of a French mountain lake.

Weather capers will increase in our latitudes in the future; this is shown by climate models. Summer storms are among these and will probably sweep across the countryside increasingly often. How this will affect the ecosystems of the alpine lakes has been the subject of an investigation by a French-Swiss research team, among them Eawag aquatic physicist Damien Bouffard.

Lac de la Muzelle, a mountain lake in the French Alps, served as the object of research. During the course of three summer seasons, the researchers registered every rainstorm and windstorm. In addition, a weather station recorded the temperature and precipitation data, while special probes in the lake yielded regular temperature and oxygen profiles. The researchers have published the results recently in the professional journal "Global Change Biology".

During the period under investigation, ten storms took place. But only two of these turned the Lac de la Muzelle into a cloudy brew. The remaining storms stirred up the surface waters, to be sure, but after a week the lakes returned to their normal condition. On the other hand, during the so-called "turbid storms", large quantities of suspended particles from the glacial catchment area entered the water.

Light and nourishment are becoming scarce

The suspended particles are responsible for the fact that hardly any light penetrates to the deep waters. The algae lose the basis for photosynthesis and die. This leads to oxygen and nutrient depletion, which

eventually harms the fish. "It was impressive to see how a single storm of a few hours could completely disrupt the ecosystem for the whole rest of the summer," says Damien Bouffard. It is thus shown that for life in Alpine lakes, long-term global warming is not the only role player; equally important is the frequency of extreme events.

The weather before the storm is decisive

The researchers were also astonished that neither the intensity nor the length of the weather antics determined whether a turbid or clear storm would grow out of them. Rather, "Decisive were the days and weeks before the storm," says Bouffard. If these are dry and hot, the probability for turbid storms is increased. Given that hot, dry periods will become more frequent as a result of climate change, it can be concluded that a literally murky future awaits the mountain lakes.



ure conditions might not be appropriately forecast by only climate change trends, i.e. warming, if extreme events have the potential to deflect their thermal and metabolic states from their seasonal ranges. We used high-frequency monitoring data over three open-water seasons with a one-dimensional hydrodynamic model of the high-altitude Lake Muzelle (France) to show that rainstorms or windstorms, notwithstanding their intensity, did not trigger long-lasting consequences to the lake characteristics when light penetration into the lake was not modified. In contrast, storms associated with high turbidity input from the watershed ("turbid storms") strongly modified the lacustrine hydrodynamics and metabolism for the rest of the open-water season through reduced light penetration. The long-lasting effects of turbid storms were related to the inputs and in-lake persistence of very light glacial suspensoids from the watershed. The occurrence of the observed turbid storms was not related to the wind or rain intensities during the events. Instead, the turbid storms occurred after dry and atypically warm spells, i.e. meteorological conditions expected to be more frequent in this alpine region in the upcoming decades. Consequently, storm events, notwithstanding their intensity, are expected to strongly imprint the future ecological status of alpine lakes under climate warming.' (1632 chars) serialnumber =>

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