

The natural "Himalayan aerosol factory" can affect climate

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Pristine locations like the Himalayas are useful when trying to understand the natural atmospheric conditions before the industrialization. Credit: Federico Bianchi

Large amounts of new particles can form in the valleys of the Himalayas from naturally emitted gases and can be transported to high altitudes by the mountain winds and injected into the upper atmosphere.

The emitted particles may eventually affect climate by acting as nuclei for cloud condensation. These new findings about particle formation and sources will contribute to a better understanding of past and [future climate](#).

"To understand how the climate has changed over the last century we need to know as reliably as possible the natural atmospheric conditions before the industrialization," says Associate Professor Federico Bianchi from the University of Helsinki's Institute for Atmospheric and Earth System Research (INAR).

In order to do that scientists are looking for pristine locations around the world where human influence is minimal. An international group of researchers has now completed a comprehensive study at the Nepal Climate Observatory at Pyramid station, located in the proximity of the Everest base camp at 5050 m above sea level. There, they were able to investigate the formation of atmospheric particles far from human activities. The results were published today in the prestigious journal *Nature Geoscience*.

Particles from natural origin

The study shows that up-valley winds bring vapors emitted by vegetation at the Himalayan foothills to higher altitudes. During this transport, these gases are transformed by [photochemical reactions](#) into compounds of very low volatility, which rapidly form a large number of new aerosol particles. These are then transported into the free troposphere, a region of the atmosphere with very low human influence.

"You can think of the whole Himalayas as an 'aerosol factory' that continuously produces a large amount of particles and then directly injects them high up into the atmosphere above the Everest," says Bianchi. We calculate from these measurements that the transport of particles may increase present-day particle concentration above the Himalayas by a factor of up to two or more.

It's the first time the scientists consider mountain venting as a big potential source of atmospheric particles in the free troposphere.

Additionally, the freshly formed particles have natural origin with little evidence of the involvement of anthropogenic pollutants. This process is therefore likely to be essentially unchanged since the pre-industrial period, and may have been one of the major sources contributing to the [upper atmosphere](#) aerosol population during that time. These new observations are therefore important to better estimate the pre-industrial baseline of aerosol concentrations in this large region. The inclusion of such processes in climate models may improve the understanding of climate change and predictions of future [climate](#).

Future studies shall focus on a better quantification of this phenomenon and investigate it also in other high mountain regions.

More information: Bianchi, F., Junninen, H., Bigi, A. et al. Biogenic particles formed in the Himalaya as an important source of free tropospheric aerosols. *Nat. Geosci.* (2020).

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