



New particle formation around the globe: From laboratory experiments to the Everest Base Camp (Arne Richter Award for Outstanding ECSs Lecture)

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Atmospheric aerosols affect the climate directly by absorbing or scattering incoming radiation and also indirectly by acting as cloud condensation nuclei (CCN) changing therefore the cloud albedo. A major fraction of these CCN comes from gas to particle conversion (nucleation). During the last decade, several nucleation studies have been published based on field observations, however most of them in the planetary boundary layer (PBL). Therefore, only little information is available about the free troposphere. The aim of this lecture is to elucidate the last findings about what species contribute to new particle formation (NPF) in the free troposphere.

In the last years, we used a number of state-of-the-art instruments, first at the Swiss high alpine research station Jungfraujoch (3580 m asl) and then at the Himalayan Nepal Climate Observatory Pyramid (NCO-P) site on the southern slope of the Himalayas, not far from Everest base camp (5079 m asl). Previous studies have already showed that at both of these locations NPF takes place frequently. However, no chemical information of the vapours was retrieved.

At the Nepal Climate Observatory Pyramid, we deployed an atmospheric pressure interface time-of-flight mass spectrometer (APi-TOF), a particle size magnifier (PSM) and a neutral cluster and air ion spectrometer (NAIS). The APi-TOF measured the chemical composition of either the positive or negative ions during many of the nucleation events and when equipped with a chemical ionization source (CI-APi-TOF) it provided information on the chemical composition of the neutral species.

In this medal lecture, in addition to present the results of these two studies, I will also compare them with other locations as the boreal forest (Hyytiälä) and polluted area as Shanghai but also with laboratory experiments (i.e. CLOUD experiment at CERN). I will present a detailed analysis of the particles evolution during nucleation and also the chemical composition of the small clusters measured with these advanced mass spectrometers. I will also show that these processes are potentially very interesting in order to understand the aerosol conditions in the pre-industrial era where information are really scarce. At the end of the lecture I will also give some insight regarding future projects above the Amazon and as well above the Alps.