

## NEW PARTICLE FORMATION IN GREECE DURING SUMMER

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## ABSTRACT

Homogeneous nucleation is an important source of new particles in the atmosphere worldwide. The resulting newly formed stable nuclei can grow to larger sizes and affect air quality <sup>[1]</sup> and climate <sup>[2]</sup>. Unexpected significant spatial variability of the nucleation frequency has been observed in Greece in the only previous study with very high frequency in Thessaloniki, intermediate in Eastern Crete and low in Patras <sup>[3]</sup>. Our hypothesis is that Greece may be an excellent natural laboratory to investigate the factors affecting nucleation and to understand the reasons behind this surprising variability. Extensive continuous aerosol size distribution measurements took place during two summers (2020 and 2021) in the frame of the PANACEA project in 11 different locations: Patras, Xanthi, Ioannina, Finokalia, Athens, Thessaloniki, Sifnos, Chania, Costa Navarino, Lesvos and Mt. Helmos. The instrumentation used included a number of scanning mobility particle sizers (SMPS) for the measurement of the particles and a suite of gas monitors for measuring SO<sub>2</sub>, NO<sub>x</sub>, NH<sub>3</sub> and CO. A particle size magnifier (PSM) was deployed in the Patras site during the 2021 campaign providing valuable information regarding nanoparticles with diameter down to 1 nm. The observations suggest that indeed the nucleation frequency varies from close to zero in the southwestern part of the country to more than 80% in the northern central and eastern regions. The detailed analysis of the measurements in Patras suggests that nucleation was infrequent in this location, but particles that were formed a few hours earlier over central Greece are often transported to this area after they have grown to sizes of 20-30 nm. Air mass history analysis was performed to understand the areas in which new particles are formed and also the sources that contribute the chemical components that form the original stable clusters.

**KEYWORDS:** New particle formation, climate change, atmospheric pollution.

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