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Long-term observations of new particle formation in Eastern Mediterranean atmosphere

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New particle formation (NPF) is a frequent phenomenon in the marine boundary layer (MBL) atmosphere. So far, for the Mediterranean region, NPF events have been reported in the literature but this is the first time that long-term continuous measurements are used to identify and characterize NPF events.
We analyzed continuous measurements from the environmental research station of University of Crete at Finokalia, Crete, Greece (35˚20´N, 25˚40´E, 250m a.s.l). The site has been reported to be representative for the eastern Mediterranean MBL atmosphere. Number size distributions of particles in the size range 8 to 848 nm were measured using scanning mobility particle sizer (SMPS) since 2008 (with additional data available for 2004 and 2005). Particle growth rates up to the diameter of 25 nm were calculated as well as the condensational sink Additionally, mobility distributions of air ions were measured using an Air Ion Spectrometer (AIS) in the mobility range between 3.2 and 0.0013 $cm^2V^{-1}s^{-1}$ (0.8-42 nm) for the periods April 2008-April 2009 and December 2012-December 2013. During the NPF event days, the formation and growth rates of sub-3 nm ions could be calculated from AIS data.
We found for the Eastern Mediterranean MBL, 22% of the available days could be identified as event days. Although Finokalia is a sub-tropical site with intense photochemistry leading to the production of high concentrations of sulfuric acid, the necessary compound for triggering atmospheric nucleation, NPF at Finokalia has been found to be less frequent than in other locations across Europe. However, NPF takes place all year long indicating that the necessary precursors are available throughout the year. The probability of an event to take place was greatly dependent on the condensational sink, which was two times lower on event than non-event days. The growth rates of the fresh particles presented an annual cycle with maximum values in summer and the average growth rate to 25 nm for all the events was 4.9 $\pm$0.7 nm h^{-1}. Using air ion mobility distributions for the two periods we calculated average growth rate of 2.9 nm h^{-1} for the diameters 1.5 -3 nm.