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An alternative look at new particle formation: Undefined days and the effect of source area

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The presence of the EU project PEGASOS in the SMEAR II field station, Hyytiälä, Southern Finland, during the months of May and June 2013 was aimed at elucidating the synergetic processes between atmospheric chemistry, boundary layer micrometeorology and aerosol particle formation. However, it must be noted that during the two spring months, the Hyytiälä ground station while we recognize 22 'event days' (days with new particle formation occurring, NPF), 30 days where left as 'undefined', that is, a day which was not successfully classified as either presenting NPF or not (nonevent day). The ratio of unclassified days to event and nonevent days leaves a great portion of the data untouched.

A previous study specifically investigated the undefined days using an 11-year time series (1996 to 2006) from Hyytiälä station. The results showed that undefined days could highlight intermediate or incomplete conditions when compared to a day presenting NPF: relative humidity, condensation sink and radiation values lay precisely in between event and nonevent values. A sub-classification of undefined days into a 'failed events' class allows for the possibility of days that are to a degree truncated or advected event days, and which show parameters closer in value to event than to nonevent days. By including undefined days in the analysis of the spring 2013 data, we look for the micrometeorology process that could help explain the 'failed events' day conditions, and thus shed more light on NPF dynamics.

Furthermore we propose that NPF need not be at a regional scale as previously thought, but rather, specific local sources could bring about NPF, captured at the ground station with the right wind conditions. To analyze for possible local versus regional sources for NPF, we aim to correlate micrometeorological parameters, including boundary layer stability, wind vectors and air chemistry, in order to capture what is happening when one variable changes, scanning each day as opposed to averaging the day as a whole. Preliminary results have divided nucleation mode particles (3–25 nm) to westerly winds during event days, easterly winds for nonevent days, and intermediate winds (east, west) for the undefined days. Coupling ground measurements to airborne data including the PEGASOS campaign aboard a Zeppelin will allow for a wider view of NPF dynamics across the boundary layer, help identify possible local sources of NPF, and shed more light on the 'failed events' subclass.