The role of Ice Nuclei in clouds and their effect on climate change in the Mediterranean region

Final Report

The objective of our research is to better understand the role of ice nuclei (IN) in the formation of rain in Central Europe (Germany) and in the Mediterranean region. This study is highly relevant to the climate of the Mediterranean because changes that could occur to the hydrological cycle due to the effects of pollution on rainfall could be devastating to this region, which is already of dire need for water.

Purpose of the visit:

The purpose of the visit to Germany was the transfer of ice nuclei analysis by the Frrankfurt Ice nuclei Deposition freezing Experiment (FRIDGE) to our lab at Tel Aviv University. The FRIDGE is a system, which can be used to study the properties of atmospheric aerosols to act as ice nuclei under different conditions of relative humidity and supercooling.

Description of the work carried out during the visit:

My work was carried out in Dr. Heinz Bingemer's laboratory at the Institute for Atmosphere and Environment, at the University of Frankfurt. During this month I studied the prototype of FRIDGE and helped in the completion of a refined version of the instrument, which will be operated by my self at Tel Aviv to measure ice nuclei in samples of Mediterranean air.

The work was partly done by analyzing ice nucleation (ice formation under different conditions of relative humidity) in environmental samples and laboratory test dust samples in the FRIDGE chamber. This helped us improve the FRIDGE.

Unfortunately, some of the parts of the modified version of the FRIDGE arrived a little late and I decided to extend my stay by 10 more days, until October 7 in order to complete the work. At the end of this period, the new FRIDGE has been completed.

Description of the main results obtained

The FRIDGE instrument for Tel Aviv has been assembled. The programming of the LABVIEW environment for control of all instrumental parameters and counting of ice

nuclei was adapted to the new instrument. The whole system was tested by analyzing environmental samples. Figure 1 is an example of small ice crystals growing in the new FRIDGE chamber.

The FRIDGE has now been packed and will be shipped to Israel in the coming few days.

In addition to working with the FRIDGE, I participated in the Ice Nuclei (ICIS) workshop at the Institute for Meteorology and Climate Research, Forschungszentrum Karlsruhe. This workshop exposed me to other people from other countries that are operating other instruments for measuring ice nuclei in the atmosphere. The workshop made it possible for us to compare the results from the FRIDGE with the other instruments.

Future collaboration with host institution

The future plan is to conduct measurements in Israel and in Germany on the same aerosol samples. The collaboration will involve comparison of analysis of ice nuclei activity as well as identifying the chemical composition of the effective ice nuclei. Furthermore, both teams in Frankfurt and Tel Aviv will attempt to study the role of bio-aerosols in ice formation in clouds, especially Mediterranean type clouds, those that are affected by dust.

Future publications:

Any future publications will acknowledge the support of ESF in my visit to the University of Frankfurt. The researchers from both teams will be involved in these publications.

Summary

I stayed in Germany for 37 days (5 weeks and 2 days). I know that this experience will benefit my work as I return to Israel. The work with the German team was very rewarding and highly important to my understanding of ice nucleation and of the operations of the ice nuclei chamber. Having two FRIDGE chambers in Israel and Frankfurt will help us coordinate our measurements. It will definitely improve our understating of the role of ice nuclei in precipitation development in the

Mediterranean. The fact that similar aerosols samples will be analyzed in both chambers is a proof of the close cooperation that we have with our colleagues in Frankfurt. This collaboration will only improve with time, as we collect more data and prepare to write scientific papers and reports.

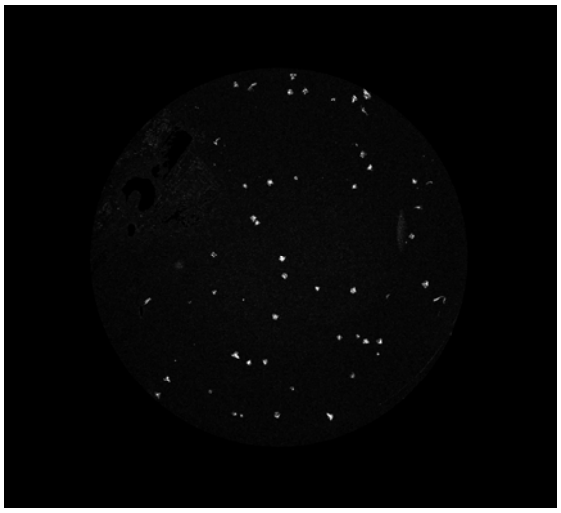

Figure 1: ice crystal created on the filter at –15 at 18% ice saturation (dust particle)