The PHOCUS project – particle interactions in the polar summer mesosphere

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The PHOCUS project (Particles, Hydrogen and Oxygen Chemistry in the Upper Summer mesosphere) will study mesospheric particles and their interaction with their neutral and charged environment. Starting out from first ideas in 2005, PHOCUS has developed into a comprehensive venture that connects to a number of new and renewed scientific questions. Interactions of interest comprise the charging and nucleation of particles, the relationship between meteoric smoke and ice, and the influence of these particles on gas-phase chemistry. In particular, the role of meteoric particles as condensation nuclei for mesospheric ice particles has recently been challenged. New challenges also concern our understanding of charging mechanisms in the mesospheric D-region. The possible redistribution of water vapour by mesospheric ice raises questions about local supersaturation and gas-phase \(\text{O}_x/\text{HO}_x\) chemistry. A more controversial topic is the idea of heterogeneous surface chemistry on mesospheric particles.

PHOCUS is currently being prepared as a comprehensive summer campaign from Esrange. Backbone is a major rocket payload carrying 17 instruments from 8 scientific groups in Sweden, Norway, Germany, Austria and the USA. Atmospheric composition and ice particle properties are probed by a set of optical instruments from Stockholm University, in collaboration with the University in Trondheim. Exciting new instrument developments concern microwave radiometers for in situ measurements of water vapour at 183 and 558 GHz by Chalmers University of Technology. Charged particles are probed by impact detectors from the University of Colorado, the University of Tromsø and the Leibniz Institute of Atmospheric Physics (IAP), complemented by direct particle sampling from Stockholm University. The neutral and charged background state of the atmosphere are quantified by the Technical University Graz, IAP, and the Norwegian Defence Research Establishment. Important ground-based instrumentation includes the Esrange lidar, the ESRAD MST radar and the SkiYMET meteor radar.