HIGH LATITUDE VOLCANIC ERUPTIONS AND CLIMATE: FILLING THE GAPS
Lecture Series
Wednesday, Nov. 5 Arrhenius building, MISU, C609

Bolin Centre for Climate Research

Stockholm University

Beginning on Wednesday, until Friday morning, we will be hosting six special guests who are active in volcano's volcano's impact on climate and/or climate dynamics research. On Wednesday and Thursday morning there will be a series of lectures and in the afternoon we will have round-tables to on current and proposed volcano research

Our invited guests will present the following lectures, all are welcome.

Wednesday, Nov. 5

09:30-09:45 Welcoming and introduction to the workshop

09:45-10:15 High Latitude Volcanic Eruptions and Climate

Alan Robock

Rutgers University, Department of Environmental Sciences, New Brunswick, NJ

Large volcanic eruptions inject sulfur gases into the stratosphere, which convert to sulfate aerosols with an e-folding residence time of about one year. The radiative and chemical effects of this aerosol cloud produce responses in the climate system. Using examples from major eruptions of the past and results from experiments with numerical models of the climate system, this talk illustrates the major impacts. Volcanic eruptions produce global cooling, and are an important natural cause of inter-decadal and interannual climate change.

One of the most interesting volcanic effects is the "winter warming" of Northern Hemisphere continents following major tropical eruptions. During the winter in the Northern Hemisphere following every large tropical eruption of the past century, surface air temperatures over North America, Europe, and East Asia were warmer than normal, while they were colder over Greenland and the Middle East. This pattern and the coincident atmospheric circulation correspond to the positive phase of the Arctic Oscillation. High latitude eruptions in the Northern Hemisphere, while also producing global cooling, do not have the same impact on atmospheric dynamics. While high-latitude eruption clouds have a shorter atmospheric residence time than tropical ones, large high latitude eruptions can weaken the Indian and African summer monsoon, and the effects can be seen in past records of flow in the Nile and Niger Rivers. In fact we can use records of the Nile River flow to provide an improved date for the Eldgjá eruption in Iceland, which we now date at 939 A.D. Since the Mt. Pinatubo eruption in the Philippines in 1991, there have been no large eruptions that affected climate, but the cumulative effects of small eruptions over the past decade had a small effect on global temperature trends.

10:15-10:45 Effects of Laki on cloud microphysical properites/climate and risks for human health

Anja Schmidt

University of Leeds, Institute for Climate and Atmospheric Science, Leeds

The eruptions of Eyjafjallajökull in 2010 and Grimsvötn in 2011 in Iceland were stark reminders that society is very vulnerable to volcanic hazards. In this talk I will assess the effects of the 1783-1784 AD Laki eruption on cloud condensation nuclei number concentrations and the subsequent aerosol indirect effects on climate using a state-of-the-art global aerosol microphysics model (GLOMAP). I will also assess the potential impacts of a future Icelandic Laki-type eruption on air quality and human health by combining atmospheric modelling, volcanological data sets, and epidemiology. Depending on the duration of such an eruption, I show that air quality could be degraded for weeks or months to a degree that visibility across Europe may be noticeably reduced and public health is at risk. In excess of 100,000 fatalities could occur in Europe due to such an eruption, depending on the length of exposure of individuals to fine particles.

10:45-11:15 ---------- Coffee break----------

11:15-11:45 Climate effects of large volcanic eruptions on high latitudes

Kirstin Krueger

University of Oslo, Department of Geosciences, Oslo

Large tropical volcanic eruptions have a significant influence on the atmospheric large-scale circulation patterns of the Northern (NH) and Southern Hemisphere, through mechanisms related to the radiative effects of volcanic sulfate aerosols resulting from the direct injection of SO2 into the stratosphere. Of particular interest is the response on the polar winter stratosphere, which also impacts surface climate via dynamical feedbacks. In this study, I will highlight changes of the stratospheric polar vortex, the Brewer Dobson Circulation and the Annular Modes based on comprehensive global aerosol climate and Earth system models simulations. Finally, an outlook will be given for climate effects of large NH extratropical eruptions on high latitudes compared with the effect of tropical eruptions

13:00-17:00 Open Discussion ----------

Contact: Francesco S.R. Pausata: francesco.pausata@misu.su.se for further information or to attend the workshop on Wednesday and Thursday afternoon.