Sparkling Ideas in the new Emmy Noether Junior Research Group on "Fire in the Earth System" at MPI-M

On 1 February 2011 the new Emmy Noether Junior Research Group on "Fire in the Earth System" began its work at the Max Planck Institute for Meteorology (MPI-M). The junior research group is led by Dr. Silvia Kloster and closely collaborates with the department "The Land in the Earth System" (led by Prof. Dr. Martin Claussen).

Natural fire is a process within the Earth system that is influenced by our climate and in turn does influence our climate. If and when fires occur depend on the one hand on the moisture of the vegetation, but also on the predominating vegetation type and plant productivity. On the other hand, biomass burning emissions – such as emissions of greenhouse gases, chemically active trace gases and aerosols into the atmosphere – and changes in the surface albedo (changes in the Earth's surface reflection abilities) affect the climate. Thus, fire as a feedback process in the Earth system can either amplify or dampen regional and global climate change.

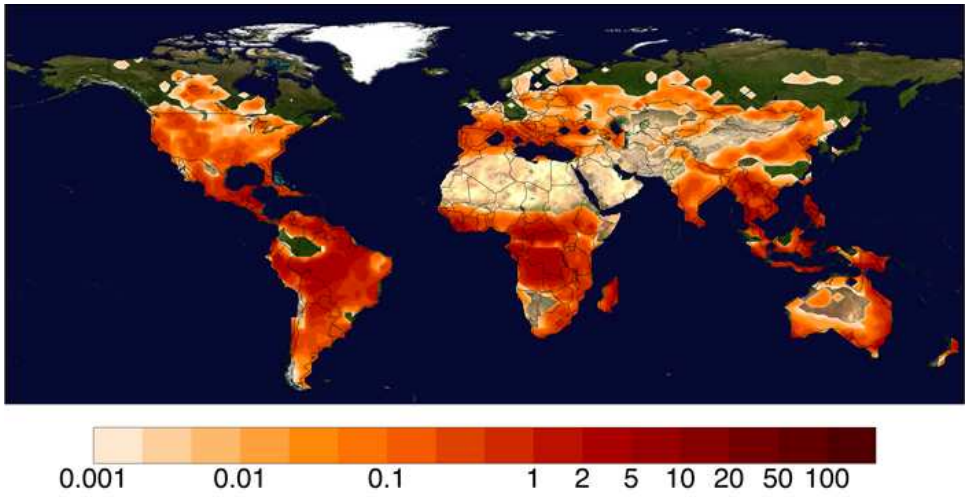

*Fig.: Simulated mean annual fire emissions averaged over 1990 – 1999 in g (C) m^{-2} $s^{-1.}$ The contour map in overlaid on a Blue Marble Next generation image (NASA's Earth Observatory, Visible Earth (*http://visibleearth.nasa.gov*).*

One task of the newly founded Emmy Noether Junior Research Group is to better understand these feedbacks and to determine to what extent they influence changes in climate. Some individual processes are well known already: it is known, for example, that particles ("aerosols") emitted into the atmosphere from biomass burning, alter our climate through a direct interaction with solar radiation. Furthermore, changes in albedo can be derived from measurements and the impact single fires have on our climate can be determined. Other processes – such as the influence of soot which deposits on snow-covered surfaces and as a result alters the snow's melting rate – have been poorly studied so far. Quantifying the fire-climate feedback in its complexity will pose a great challenge for the scientists.

The Emmy Noether Junior Research Group on “Fire in the Earth System“ closely collaborates with the MPI-M department “The Land in the Earth System”. To study feedback processes caused by fires in an Earth system model, first the model has to account for fire as a process being controlled by climate. Therefore, a mechanistic fire model will be integrated into the JSBACH module (**J**ena **S**cheme for **B**iosphere-**A**tmosphere **C**oupling in **H**amburg) and thus into the existing Earth system model MPI-ESM. For the mechanistic model, already existing fire models Silvia Kloster worked with during her Klaus Hasselmann Fellowship will be refined. The Earth system model will then allow for studying the climate processes influenced by fires between the individual components of the Earth system such as atmosphere, ocean and cryosphere.

For modelling fires, worldwide fire observations – mainly collected by satellites - are of great help to the scientists around Silvia Kloster. In the visible range, satellite data allow for determining the burned area through the fire caused altered albedo. Furthermore, fires can be detected by the energy shown in the infrared range. Up to now, existing data sets span more than 10 years and clearly reflect strong yearly variations in global fire activities.

In addition to natural fires, fires caused by humans also play an important role. In the past, fires were set for hunting or land clearing through burning to gain agricultural or pasture land. Nowadays, deforestation fires are still used to gain land; thereby economical factors such as the market price of agricultural products play a fundamental role. If fires are really an efficient tool to gain agricultural land, is in turn strongly controlled by our climate. In some regions deforestation is a dominant source for fires which also affect naturally caused forest fires. The junior research group will study besides naturally caused fires these deforestation fires. The underlying processes are thereby fundamentally different – but both types of fires are influenced by climate.

The Emmy Noether Junior Research Group currently consists of Dr. Silvia Kloster as group leader, Dr. Gitta Lasslop (postdoc) and Stiig Wilkenskjeld as scientific programmer. Two PhD students are going to join the group in the future. The new group also offers some interesting topics for bachelor and master theses: presently, Jessica Engels is working on her diploma thesis and is studying the seasonality of deforestation fires. Andreas Krause from the University of Wuerzburg supported the group as a student assistant for two months and now plans to return to work on his diploma thesis. Within the CCI project of the European Space Agency (http://www.cci-cmug.org/) the group cooperates with MPI’s remote sensing group, led by Dr. Alexander Loew. Here, the postdoc Dr. Iryna Khlystova works on the integration of burned areas, derived from satellite observations, into the dynamic vegetation model JSBACH.

Dr. Silvia Kloster is very well known at MPI-M. She received her PhD from MPI-M and the University of Hamburg with the grade “summa cum laude” and was awarded the Otto Hahn Medal of the Max Planck Society for outstanding scientific research in 2007. After her PhD she worked at the Joint Research Centre (DG Environment, Climate Change Unit) in Ispra/Italy and at the Cornell University (Earth and Atmospheric Sciences) in Ithaca, NY, USA. In 2009 she received the first Klaus Hasselmann Fellowship in the department “The Land in the Earth System”. As a Klaus Hasselmann Fellow she was already focussing on fires in the Earth system. The fellowship is awarded for three years and is assigned to one of the three departments of the MPI-M to conduct research independently and creatively.

The group is supported through the Emmy Noether Programme of the Deutsche Forschungsgemeinschaft (DFG). The Emmy Noether Programme supports young researchers in achieving independence at an early stage of their scientific careers. Young postdocs gain the qualifications required for a university teaching career during a DFG-funded period, usually lasting five years, in which they lead their own independent junior research group.

The group's webpage:
http://www.mpimet.mpg.de/en/science/the-land-in-the-earth-system/fire-in-the-earth-system.html

DFG's Emmy Noether Programme:
http://www.dfg.de/en/research_funding/programmes/individual/emmy_noether/index.html

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