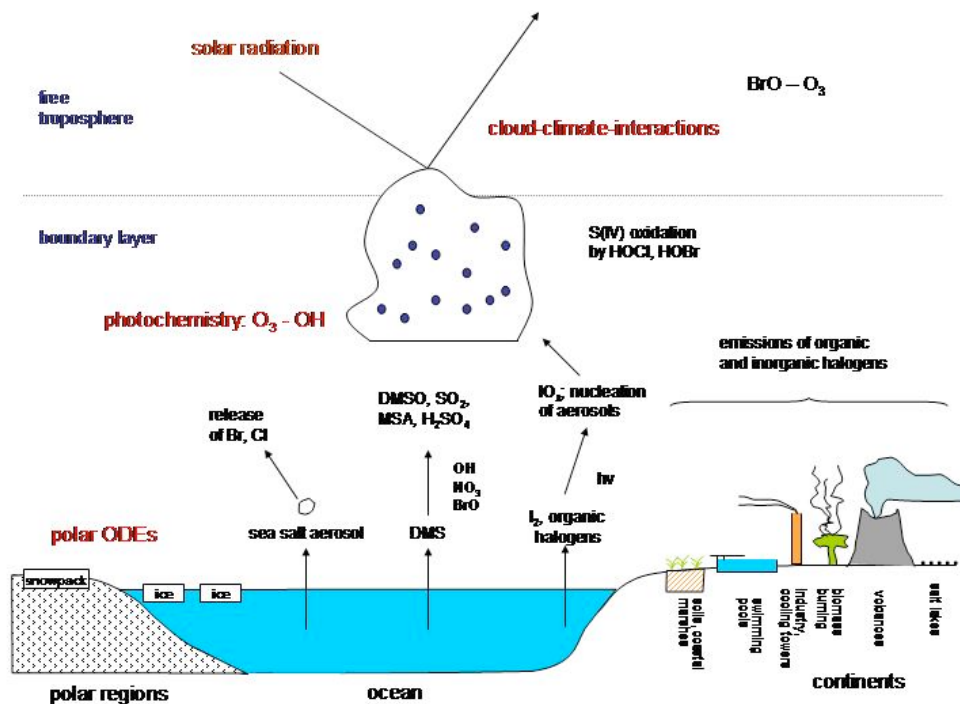


Halogens in the Troposphere (HitT)

The primary objective of the project HitT is to determine the importance of reactive halogen compounds (RHCs) in tropospheric chemistry and climate forcing. Key themes are the influence of RHC on the oxidative capacity of the atmosphere, the ozone budget on regional and global scales, aerosol nucleation and growth. As the product of an expert workshop held in Heidelberg, Germany in May 2004 a White Paper is being finalized which has also undergone a phase of open discussion in the scientific community. This article summarizes the main ideas behind HitT and the envisioned implementation steps. Tropospheric halogen chemistry, its sources and atmospheric impacts is a very interdisciplinary field that involves disciplines like chemistry, physics, meteorology, and (micro-) biology.

Reactive halogen compounds (X, XO, X₂, XY, OXO, HOX, XONO₂, XNO₂, where X, Y=Cl, Br, I) – in particular halogen oxides - are present in various domains throughout the troposphere (see Figure). Characterization, quantification, and understanding their abundance and cycles has already begun in many of the domains. However, beyond the present, pioneering and explorative efforts a comprehensive approach is needed, which is beyond the national scope and requires international and interdisciplinary cooperation..



A major section of the HitT White Paper is devoted to listing the current knowledge regarding halogens in the troposphere and raises the main open questions. The following topics were suggested to receive priority in the next years:

1) Sources and distribution of RHCs:

Determine the emission fluxes of and key release processes for RHCs and their precursors from the open and coastal oceans, polar regions, land surfaces, volcanoes, and urban-industrial areas. In order to achieve this goal existing techniques have to be refined and new faster and more sensitive methods for measuring RHCs have to be developed.

2) Transformation and transport of RHCs:

Develop a detailed understanding of the multiphase chemical processes that determine the distribution of RHCs and their precursors at different spatial and temporal scales throughout the troposphere and the physical processes including aerosol- and cloud-microphysics and transport. This effort should ultimately lead to a realistic representation in numerical models.

3) Implications of RHCs:

Integrate different measurement techniques and models to determine the regional and global role of RHCs in a series of physico-chemical processes in the troposphere, including: tropospheric oxidation processes (esp. of sulfur species), the ozone budget, HO_x and NO_x radical cycles, and aerosol nucleation and evolution.

Key to extending our knowledge are field campaigns and long-term observations, which will be accompanied by and closely coordinated with laboratory and modeling studies. We plan HitT activities over the next 9 years, divided into three 3-year phases. Each phase should comprise **main field campaigns** in areas (i.e. domains) where we know that RHCs are present. The goal of these campaigns is to provide all relevant informations to comprehensively address the research questions from all perspectives. Suited for this are, for example, the polar regions (esp. during the International Polar Year 2007/2008), salt lakes (esp. Dead Sea with its special topography), coastal regions (Mace Head, Bay of Maine, Brittany, or other coastal regions with known presence of iodine chemistry; the EU-funded MAP project started in October 2005), upwelling regions, and the open ocean.

In each phase several **pilot studies** should be made at promising sites, where no previous halogen measurements were taken before in order to identify locations suitable for large future campaigns. They should preferably be designed as “add-ons” to other field campaigns so that other measurements are available which can be helpful for a better understanding of the underlying processes. Possible locations include coastal regions other than the previously studied locations like Mace Head and Appledore Island to investigate how widespread coastal halogen chemistry is, Megacities (both coastal and non-coastal), the tropics, and the free troposphere (airborne).

In addition to the field campaigns, long term observatories are necessary to study temporal trends. These are especially valuable for the polar regions and the free troposphere. At some observatories halogen measurements are already being made, other sites could be supplemented by a suite of RHC measurements. These long term observatories include ground stations but satellites and measurement packages aboard commercial aircraft (CARIBIC II, IAGOS (=“MOZAIC IV”)) are also highly desirable.

The key research questions of HitT are fundamental topics also addressed in the sponsoring research activities IGAC and SOLAS. Close collaboration is envisioned with existing international tasks. The next step for HitT is an implementation workshop which will be advertised shortly.

Please contact the co-chairs for further information:

Uli Platt (Ulrich.Platt@iup.uni-heidelberg.de)

Roland von Glasow (Roland.von.Glasow@iup.uni-heidelberg.de)