StratoClim

# FactSheet 2

# Asian Monsoon Aircraft Campaign


**StratoClim is a project funded by the European Union under Project No. 603557 within the 7th Research Framework Programme. StratoClim is an acronym for Stratospheric and upper tropospheric processes for better climate predictions.**

The project aims to produce more reliable projections of climate change and stratospheric ozone by a better understanding the representation of key processes in the Upper Troposphere and Stratosphere (UTS). This will be achieved by an integrated approach bridging observations from dedicated field activities, process modelling on all scales, and global modelling with a suite of chemistry climate models (CCMs) and Earth system models (ESMs). At present, complex interactions and feedbacks are inadequately represented in global models with respect to natural and anthropogenic emissions of greenhouse gases, aerosol precursors and other important trace gases, the atmospheric dynamics affecting transport into and through the UTS, and chemical and microphysical processes governing the chemistry and the radiative properties of the UTS.

Atmospheric processes, eco-systems and climate change
ENV.2013.6.1-2 grant agreement no. 603557

SEVENTH FRAMEWORK PROGRAMME


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StratoClim will:

- Improve the understanding of the microphysical, chemical and dynamical processes that determine the composition of the UTS, such as the formation, loss and redistribution of aerosol, ozone and water vapour, and how these processes will be affected by climate change.

- Implement these processes and fully include the interactive feedback from UTS ozone and aerosol on surface climate in CCMs and ESMs.

The improved climate models will be used to make more robust and accurate predictions of surface climate and stratospheric ozone, both with a view to the protection of life on Earth. Socioeconomic implications will be assessed and policy relevant information will be communicated to policy makers and the public through a dedicated office for communication, stakeholder contact and international co- operation.


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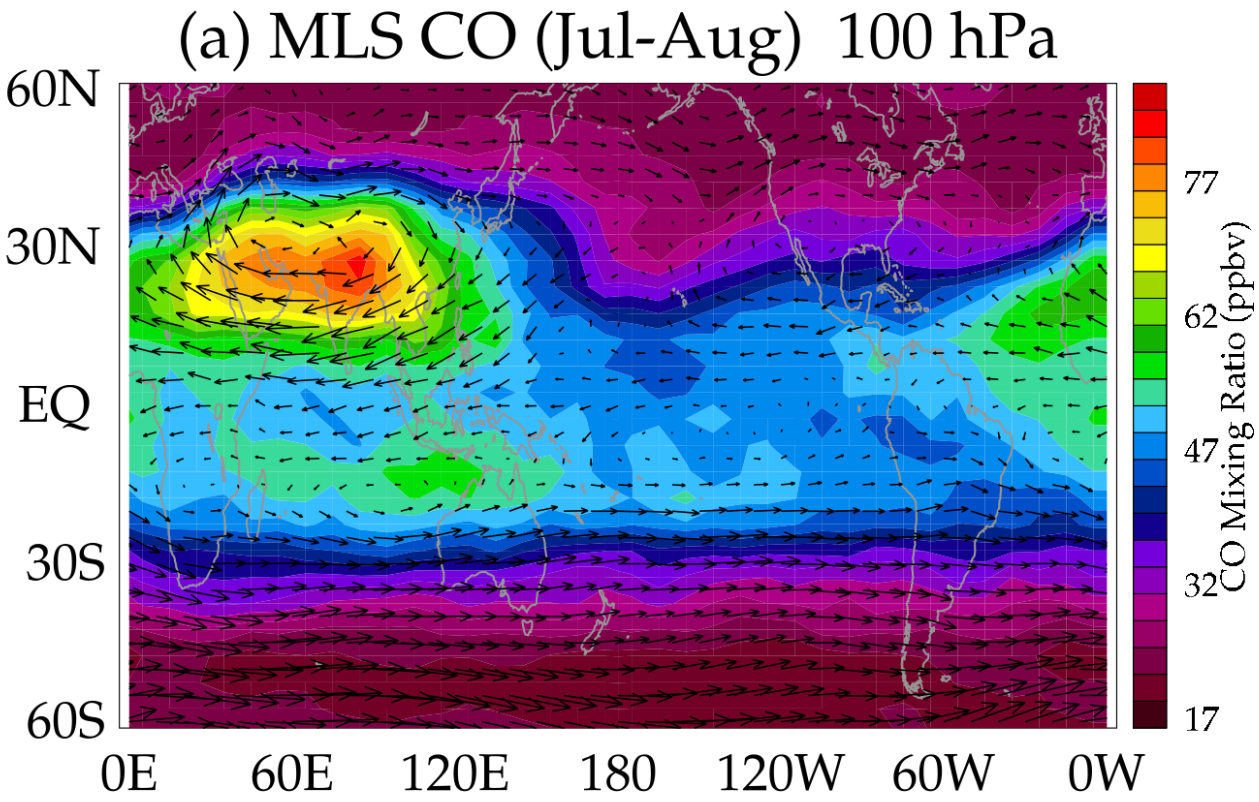
## The StratoClim Aircraft Field Campaign




The StratoClim Aircraft Field Campaign sets out to characterise major processes dominating particle and trace gas transport in the UTS Asian Monsoon (AM) Anticyclone which forms annually over a huge region of SE Asia as obvious in Fig. 1. These processes are key for understanding the climate feedback mechanisms of this atmospheric domain which is one of the major input regions of tropospheric air masses into the lowermost and possibly global stratosphere.

To properly model the injection of pollutants and natural compounds including H2O into the UTS, the transport pathways of air masses from the free troposphere through the UTS into the stratosphere and their chemical and microphysical transformations need to be known. However, only insufficient well resolved observations are available for the regions of interest such as the AM region. The proposed field campaign will close this gap by providing spatially highly resolved measurements of an almost complete set of relevant species throughout the UTS. These data will be used to validate and improve process models and ultimately ESMs/CCMs but also satellite observations.

For the measurements as well as data interpretation close cooperations with lead scientists from the countries involved have been or will be established in order to make use of the local expertise and foster international scientific cooperation.

# The Aircraft


**The Payload**

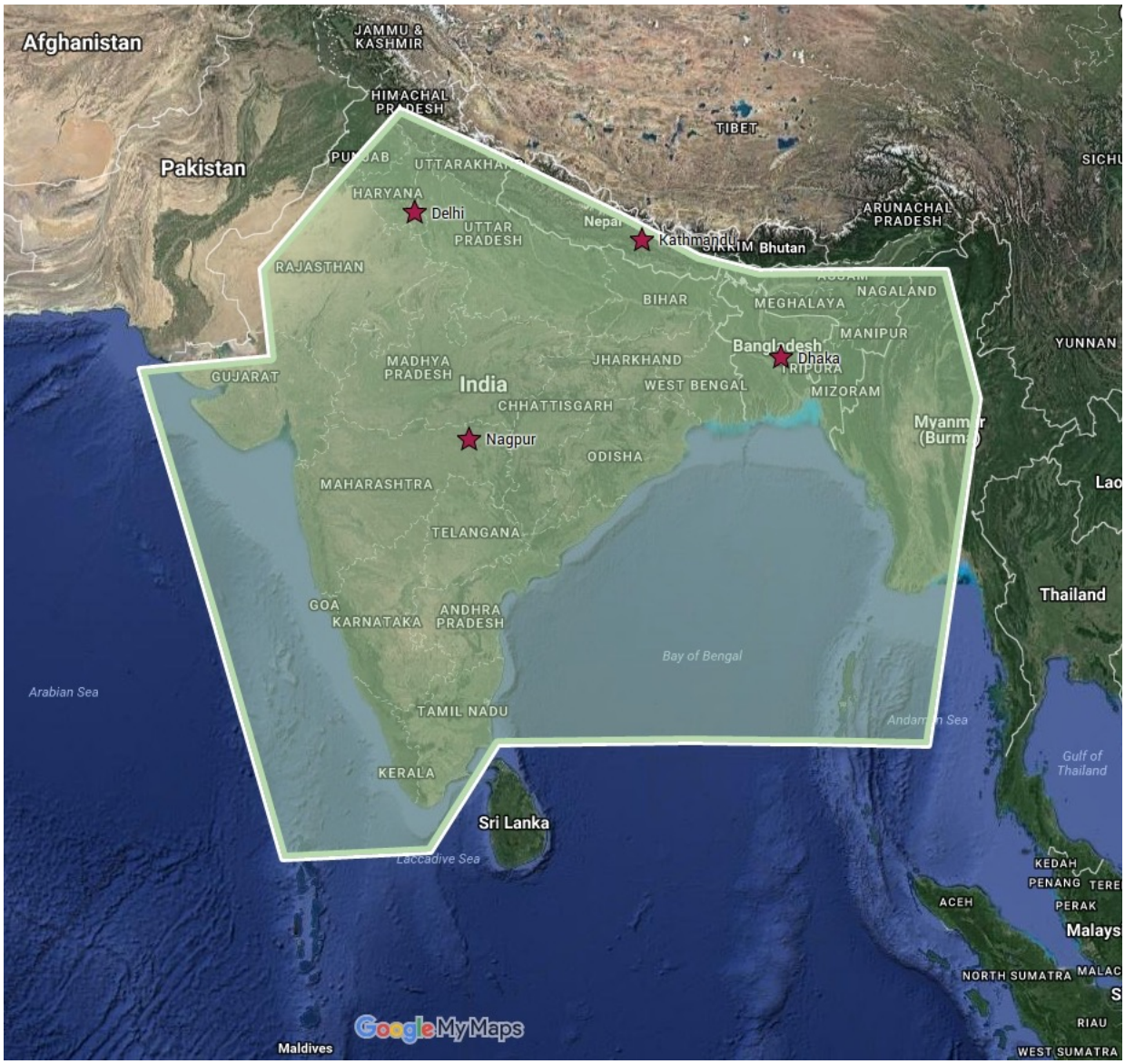
**For this project M55 Geophysica will be equipped with a state-of-the-art instrument suite in order to measure an almost complete set of trace species, physical parameters, and particle properties relevant for StratoClim. They employ specialised in-situ and remote-sensing techniques for sensitive and accurate measurements. The payload exclusively performs atmospheric measurements in altitudes between about 5 km and ceiling altitude around 20km. No instruments for ground observations are onboard. A number of new instruments (in-situ as well as remote-sensing) has been integrated recently: A SO2/H2SO4 mass spectrometer, a water vapour isotopologues cavity enhanced absorption spectrometer (CEAS), a second dual channel CEAS for OCS, CO, and HCN, and a combined aerosol mass spectrometer probing single particle as well as bulk phase chemical composition. The instruments are operated by a consortium of 15 well renowned research institutes.**

The Russian high-altitude aircraft M55 Geophysica has a ceiling altitude slightly above 20km and is one of the few research aircrafts worldwide able to probe the UTS region of interest. The operator is the Russian company Myasishchev Design Bureau (MDB) a former state-owned company. Since 1996 Geophysica has been deployed very successfully in many, mostly EU funded, large-scale international measurement campaigns from high northern latitudes (Spitsbergen), tropical and subtropical locations in Brazil, Australia, and West Africa to high southern latitudes (Antarctica). Over the last years the aircraft has been modernised in order to provide all security systems required for operation in international airspace.

A specialty of this aircraft is its registration as a so-called “experimental aircraft” which is uncommon outside Russia. This means it is neither a civil nor a state (or military) aircraft and the call sign therefore is 55402 (neither RF... nor RA...). This status and the fact that the aircraft operator has to apply for flight permits in foreign countries via the Russian Foreign Ministry often leads to the misconception that M55 Geophysica is a Russian state aircraft which, however, is not the case.

## Asian Monsoon Aircraft Field Campaign Outline

A major aircraft campaign is planned in the most active region of the Asian Summer Monsoon on the Indian subcontinent (ISC) during the July/August time frame in 2017. Climatologies and trajectory studies indicate that mid to northern regions of the ISC are best suited to probe the boundary and central region of the AMA. About 8-10 local measurement flights in Nepalese, Indian, Bangladeshi and Myanmar airspace are envisaged. Possible main campaign bases are Kathmandu, Nepal or Nagpur, India. Un-instrumented transfer flights from and back to the home base of the aircraft in Zhukovsky, Russia, are planned. Instrument up- and download to the aircraft will occur at the main base. To extend the range of the aircraft, intermediate landings at relay airports (e.g. Dhaka) can be scheduled (t.b.d.).



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For the detailed planning of the measurement flights, several forecasting tools will be provided to make best use of the individual deployments. State-of-the-art flight planning tools will be available. Dedicated flight strategies for optimal characterisation of relevant processes will be developed and followed. Additional support, especially with respect to meteorology, will be rendered in the frame of local cooperations by specialists at the campaign base(s). Due to the need for reliable meteorological forecast data detailed flight plans can be submitted only about 1 to 2 days in advance of the deployment. Rough example flight templates can be provided earlier. For flight planning the support of local meteorology specialists will be extremely helpful.

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