Klimapolis: Joint Laboratory on Urban Climate, Air Pollution and Water - Modelling, Planning, Monitoring, Social learning

The Klimapolis Laboratory is a joint Brazilian German multidisciplinary research program that, through sustained dialogues with different stakeholders, environmental literacy and social learning, contribute to the development of environmentally resilient cities in Brazil. Klimapolis has a special focus on the relation between climate, air pollution, water and societal actors. Based on this multidisciplinary research approach, Klimapolis co-design with city officials and other urban actors approaches towards the development of sustained cities and improved governance structures. For this, the consortium supporting the project includes several German and Brazilian institutions. German partners bring a unique combination of expertise in global and regional climate modeling, multi-scale air quality analysis and prediction, impact assessment and governance. Institutions in Brazil are covering the aspects of climate and air quality modeling, urban planning and design, governance, and vulnerabilities due to weather extremes.

The Environmental Modeling Group of Max Planck Institute for Meteorology (MPI-M) integrates the Klimapolis project as the responsible for setting up a multi-model system focused on Brazilian air-quality. This multi-model system integrates regional and localscale models, and enables high-resolution analysis of population exposure to multiple compounds, and also air-quality forecast. In both regional and local-scale simulations, physical and chemical interactions are considered. This is particularly innovative, notably in the local scale, as Klimapolis uses the only model that currently simulates the physical and chemical interactions in the street-level. The air quality models used in Klimapolis will be set up for the Sao Paulo city, the most populous city in Brazil, the Americas, the Western Hemisphere and the Southern Hemisphere. Particularly, Sao Paulo present high concentrations of pollutants, and this atmospheric pollution causes around 11,000 deaths per year. These high concentrations are observed mostly near streets, due to an important contribution of road-traffic emissions. The models are established over Sao Paulo region using the best-available input emission data, estimated using local data, and considering the specific chemical speciation of Brazilian gasoline. The concentrations obtained are then evaluated using local observational data-sets.

The Environmental Modeling Group of MPI-M will perform the first multi-scale simulations in Sao Paulo city capable of representing the chemical and physical interactions of gas and particulate-phase pollutants, from the regional scale to the high resolution streetlevel. Different aspects will be analyzed: (i) the validation of pollutant concentrations and chemical compositions, based on local observations, (ii) the population exposure to multiple pollutants, including regulated and non-regulated pollutants, (iii) the influence of gasoline chemical composition in the chemical and physical interactions in the streets, and the consequent influence on population exposure to multiple pollutants, (iv) the influence of low-emission zones on population exposure. The simulation period will cover a complete year, to take into account different meteorological conditions.