

Periodic phenomena occurring in the tropical atmosphere at different timescales are an important factor modulating local and global weather and climate. Massive amounts of latent heat released in this area drive global atmospheric circulation. Convection processes, meaning vertical air movement, along with the formation of thunderclouds, play a crucial role in this process.

This research project focuses on the Maritime Continent – a region of seas and islands straddling the equator between Australia and Southeast Asia. This region is characterized by high sea surface temperatures and high precipitation. The daily rainfall on the Maritime Continent is 10 mm on average, and local extremes can trigger weather-driven hazards. Extreme rainfall and floods, as its consequences, are relatively common in this area and disrupt communities well-being. Moreover, despite the average high precipitation, seasonal droughts do occur.

People living on the Maritime Continent are relatively poor and thus less able to predict and adapt to adverse meteorological and climate conditions. They are also less protected (e.g. by insurance) against adverse effects of extreme weather phenomena. Forecasts indicate that along with the climate change and the widespread human impact on the natural environment, extreme meteorological phenomena will become more frequent, and their adverse socioeconomic effects will intensify.

Thunderstorm clouds, organized into so-called tropical waves are associated with, among others, pressure, wind, convection and precipitation changes. Strong interactions between these weather systems and others (of smaller or larger spatiotemporal scales) are critical to weather-related hazards, such as extreme rainfall, floods and droughts. However, key physical mechanisms of those interactions remain unknown.

The main purpose of this project is to deepen our understanding of mechanisms triggering extreme weather events. The project focuses on the interaction between the water vapor content over the Eastern Indian Ocean and thunderstorm systems, organized in so-called tropical waves. The project will utilize various types of data (satellite, GPS, in-situ data, meteorological reanalysis) and develop the database of tropical waves activity to understand the occurrence of weather extremes better: meaning anomalously rainy and dry periods that favor floods or droughts development.

The project includes novel research in the field of atmospheric physics. The scope of the project, its hypothesis and goals are in the area of interest of the international community. Research in this project will be conducted in cooperation with scientists from the USA, France, Singapore and Indonesia, as part of the international research program Years of the Maritime Continent. Identification of physical mechanisms responsible for extreme weather events will benefit not only people living on the Maritime Continent region, but, through global teleconnections, also other regions of the world, including Europe.