

## **Abstract**

Stable isotope ratios in rainwater and water vapor act as tracers of the hydrological cycle. The data on stable isotopic composition in rainwater and water vapor are limited due to the lack of observational studies across the Indian subcontinent and over the ocean. These present day observations are important database to deduce the paleoclimatic condition from geological archives. In majority of the cases, isotopic records are translated into physical factors with the present background knowledge where relationships with physical variables are well established. In case of tropical region, the primary controlling factor identified behind the stable isotopic variations is the amount of rainfall. However recent observations contradict such relationships challenging the role of amount effect and identified source moisture effect on stable isotope ratios in rainwater at Indian stations.

The thesis investigated the amount effect relationship of isotopes at seasonal time scales. The long period observation covering 4 years, where daily time interval rainwater samples collected were used for our study. We used two different station locations; Thiruvananthapuram and Bangalore, where monsoonal rainfall is received for Southwest and Northeast periods. The role of mesoscale and synoptic convection and rainout along the transport pathways were found responsible for the isotopic variance. The role of moisture source regions, rainout over the advection pathways, high rainfall producing systems such as depression and cyclones, and continental recycling of water on rainwater and water isotopes ratios were major findings of the thesis work which are detailed in the chapters. Upon knowing the atmospheric and oceanic condition at the moisture source

region based on satellite data and reanalysis data set we modeled our observations using the governing equations of isotope fractionation and well accepted Rayleigh's distillation model. The observations on rainwater and water vapor isotope ratios in oceanic region are extremely limited due to difficulties in conducting sampling. Water vapor and rainwater observations over the Southern Ocean during the expedition of 2013 and estimation of the moisture recycling across the latitudes over the oceanic regions is a novel work in this thesis.