

**Seasonal variation of precipitation water sources over Indian and East Asian
summer monsoon regions investigated by colored moisture analysis**
(色水解析法を用いた夏季インドモンスーンおよび東アジアモンスーン地域における
降水起源の季節変化)

北海道大学大学院 環境科学院
環境起学専攻 人間・生態システムコース
Zhang Xing

Among the increasing disasters occurred recently over the world, flood is the most crucial issue that causes vast damage to human society especially over southern and southeast Asia, where monsoon is the dominant system affecting the seasonal and interannual variation of precipitation. These arouse great attention to the study of water circulation over these regions. This study investigated the seasonal, interannual and spatial variations of the monsoon precipitation and its water sources over Indian summer monsoon (ISM) and East Asia summer monsoon (EASM) regions. A moisture visualization method called colored moisture analysis (CMA) based on a global water transport model is applied. The CMA uses 3-hourly water budget components derived from JRA55 reanalysis data, including evapotranspiration, precipitation, zonal and meridional water vapor fluxes, and precipitable water. Bias in evapotranspiration and precipitation was corrected by GPCP precipitation data and MODIS evapotranspiration data. Validation of water vapor composition at two cities is carried out to verify the feasibility and credibility of CMA. The moisture source properties are consistent with the former research of CMA.

CMA was conducted during May to October from 1958 to 2015. In terms of climatological moisture source variations. The CMA reveals as the followings. 1) The monsoon onset date of Dhaka and Delhi in ISM region correspond well with the variations of moisture source from Bay of Bengal and Arabian Sea, respectively. Meanwhile, the monsoon onset dates of Shanghai and Fukuoka in EASM region are likely to have correlation with moisture source from South China Sea and sum of the moisture sources from South China Sea and southern China, respectively. 2) In Fukuoka and Shanghai, monsoon rainfall increased in mid-summer which respectively correspond with the increase of moisture from northwestern North Pacific and sum of North Pacific and East China Sea. In ISM region, however, there shows no connection with variation of other moisture sources. 3) There is no significant correlation between precipitation and water sources in Sapporo and other cities outside of the Asian monsoon regions.

The multiple years of CMA at Shanghai shows that two moisture composition patterns are dominant when heavy precipitation events occur during monsoon season. The main moisture south are southern China before July and North Pacific after July around the end of local Meiyu season.

The results indicate that the seasonal monsoon rainfall variation of several cities in ISM and EASM regions correspond well with the change in fraction of specific moisture sources, which imply that composition of water sources could be a rainfall indicator during monsoon season. According to the multiple year CMA, we may connect heavy rainfall events with a characteristic water sources composition pattern during monsoon rainfall season corresponding with temporal variation of meteorological phenomenon.