Session: C31 Poster: W141B

Assessment of precipitation recycling in the Amazon basin using bulk recycling models

Chantuu Gandush[†];
[†] Geospatial Technology Transfer LLC, USA
Leading author: gandush_c@yahoo.com

Precipitation recycling is defined as the contribution of evaporation within a land region to precipitation in that same region. Studying precipitation recycling over land areas provides useful information on the possible interactions between atmosphere-surface in hydrology and climate. Estimates of precipitation recycling, even though they are based on observational data, inevitably involve some underlying assumptions and limitations, referred to as a "recycling model." An efficient method for precipitation recycling calculations based on the general bulk recycling model is developed and applied to the Amazon basin region (4^{o}N-16^{o}S, 50^{o}W-76^{o}W). The monthly mean vertically integrated moisture fluxes, surface evaporation, and total precipitation datasets, which are derived from the Data Assimilation Office (DAO) at NASA Goddard Space Flight Center (GSFC), over the period from 1981 to 1993, were used in this study. Spatial distributions of the local recycling ratio for different months of the year, obtained as an output of the numerical model. Although the spatial patterns of recycling over the region are different in season, some features are common to all the year-round. During all the year the contribution of local evaporation to precipitation increases from east to southwest in most of the region, so that the maximal recycling ratios are found over the south-western corner of the basin. However, the magnitude of the spatial gradient of the recycling ratio and relation between its east-west and north-south components are different in different seasons. The calculated annual regional recycling ratio in the Amazon basin is 0.31. The annual cycle of the regional recycling ratio is shown that it stays low, below 0.30, between April and September while it rises during the spring (October and November) and stays high throughout the summer months (from December to March). The largest recycling ratio is found in November (0.38). The results of the estimation of precipitation recycling are compared with the estimates provided by simplified recycling models, and with the estimations obtained in other studies. Despite the similarity to other studies, differences in the results of recycling ratio in seasonal variability can be explained by differences in methodology and datasets that have been used for the estimation of recycling ratio. In addition to the bulk recycling model, the numerical procedure is adjusted to the modified recycling model incorporating some effects of incomplete vertical mixing of water in the tropospheric column. The modified numerical model is also applied to the basin region and the results are compared with those from the unmodified model. It is seen from the results that the effects related to an incomplete vertical mixing produce significant change in the level and distribution of precipitation recycling. The annual regional recycling ratio for the Amazon basin estimated by the modified general model is 0.45 that is significantly higher than the value 0.31 provided by the unmodified model. The seasonal dynamics of the regional recycling in the modified and unmodified models results also differs - both in the tendencies and in the level of the recycling ratio variability.