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Modeling canopy interception after fog, mixed precipitation and rainfall with the Gash analytical model: possibilities and challenges

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Gash analytical model was designed to model rainfall interception (Gash, 1979), was modified to include sparse vegetation and is used nowadays alone or couple with other models. It has been proved to work well for different forest ecosystems from narrow to broad leaves forest type and even after disruptive events like fires. The special case of water interception in cloud forests presents challenges due to the presence of rainfall only, mixed precipitation (rainfall and fog) and fog events in cloud forest ecosystems. Hereby, the author presents the contribution of the different water inputs to the cloud forest including the influence of wind on the measurements, possibilities and challenges of modeling fog, mixed precipitation and rainfall with the Gash analytical model.
The case study of Jelima (Spain) as located between 1090 and 1300 m elevation was used in this study. Rainfall inputs and fog incidence above the canopy, as well as throughfall were measured using automatic raingauges couple with a fog collector and funnels for one year. The analytical model of rainfall interception advanced by Gash (1979) and revised by Gash et al. (1995) was applied to predict canopy interception during times of rainfall- only and during times of fog-only and mixed precipitation. The model partitions individual events into three stages: wetting up, saturation and evaporation after the event ceases. Thus, the model does rely on the assumption of a dry canopy after the event. To validate this assumption during fog is challenging and therefore mixed precipitation (rainfall and fog occurring the same day) had to be discretized as event. This was possible with high resolution and continuous water-balance calculation. This allowed to determine the dry/wet canopy frequency.
The presently obtained results showed that the analytical model predicted measured amounts of throughfall associated with rainfall-only events quite well. Furthermore, the calibrated model for days with fog-only indicated that actual amounts of fog stripped by the canopy of the ridge-top forest were 13% (on average) of the potential fog deposition as measured above the canopy (DFc) whereas for mixed precipitation events optimized actual amounts of captured fog was 20% of DFc. The possibilities and challenges of modeling fog, mixed precipitation and rainfall with the Gash analytical model will be presented.