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Estimation of path-averaged rainfall and evapotranspiration using a single instrument

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The water flux at the land-atmosphere interface is extremely important in both hydrology and meteorology, and many instruments have been developed to measure either precipitation or evapotranspiration at a point in space. It would be useful if a single instrument could be used to measure both fluxes in a path averaged fashion. A microwave link could potentially be used for this purpose.

A microwave link consists of a transmitter and a receiver, between which an electromagnetic wave ($\lambda \sim 1$ cm) propagates through the atmosphere. In the case of rainfall, this propagation is hampered by raindrops in the signal path. The attenuation of the microwave signal (dB km^{-1}) is nearly proportional to the rainfall intensity (mm h^{-1}). In the case of evapotranspiration the propagation is affected by turbulence in the atmospheric boundary layer, from which the evapotranspiration can be estimated.

A microwave link signal was analyzed for several rainfall events and dry periods, and compared to measurements made by other instruments. Several rain gauges were used to measure the rainfall, and the evapotranspiration was estimated using an energy balance method. The results are optimistic, but more research and testing is needed before the instrument can be used operationally to measure both components of the water flux.