

TOTAL DEPOSITION AT CLINGMANS DOME, TENNESSEE IN THE GREAT SMOKY MOUNTAINS NATIONAL PARK

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The CASTNET Mountain Acid Deposition Program (MADPRO) has been monitoring cloud water and its chemical constituents at Clingmans Dome, TN (CLD303) in the Great Smoky Mountains National Park since 1994. High-elevation (typically higher than 800 m) ecosystems are subject to substantial levels of acid deposition from clouds that originate in polluted areas and contain high concentrations of acidic dissolved ions. High levels of acid deposition result from frequent cloud immersion, orographically enhanced precipitation, high wind speeds, and the large leaf areas typical of mountain tree species.

Cloud chemistry data from such ecologically sensitive regions with complex terrain are sparse and have been collected from less than twenty mountains in the United States. Total deposition estimates are either lacking or calculated from dry, wet and cloud collection sites that are not collocated due to the constraints imposed by access and lack of power typical of mountaintop research station locations. The station at CLD303 is no exception and total deposition for this site has been estimated from precipitation collected at the NADP/NTN site (TN11) at Elkmont, TN, and filter pack measurements conducted at the GRS420 CASTNET site at Look Rock, TN. These sites are not only separated by distance from the CLD303 site but differ substantially in elevation as well. For example, the elevation difference between the CLD303 site and GRS420 site is 1,221 meters.

Even with distance and elevation differences between the three sites, estimation of total deposition for the CLD303 site shows some very interesting results. Cloud deposition is by far the most significant source of deposition at this site and most likely at other high elevation ecosystems as well. The impact of cloud deposition on complex high-elevation terrain should be investigated further, especially considering the model used for estimating cloud deposition at CLD303 assumes a 10-m tall, intact, homogeneous conifer canopy. Dry deposition model estimates are known to be reasonably accurate for flat terrain and also assume a homogeneous canopy, but are not so accurate for forests and are mostly untested in uneven terrain. This paper will investigate other methods of estimating total deposition than the current methodology and compare/contrast the results obtained by the various methods.

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