

Field-scale estimation of precipitation by cosmic rays

Robert H. Erskine^{1,2}, Timothy R. Green², Trenton E. Franz³, and Darin Desilets⁴

¹Department of Civil and Environmental Engineering, Colorado State University

²USDA-Agricultural Research Service, Water Management and Systems Research Unit, Fort Collins, CO

³School of Natural Resources, University of Nebraska-Lincoln, Lincoln, Nebraska, USA

⁴Hydroinnova LLC, Albuquerque, New Mexico, USA

Abstract. Precipitation is a vital component to land surface processes and, therefore, its measurement is key for understanding these processes. However, precipitation measurement provides many challenges in both accuracy and scale (spatial and temporal). A Cosmic Ray Probe (CRP) is used on an agricultural field in northeastern Colorado to passively detect scattering of background cosmic-ray neutrons as an indirect measure of water on or near the land surface. Short-term changes in these measurements are attributed to precipitation at this 109 ha field. This field also contains a network of 29 precipitation gages, including weighing-recording, tipping buckets, and manual gages, which are located throughout the field. Two snow surveys, measuring snow depth and snow water equivalent, were also completed for two separate snow events. Analyses of multiple precipitation events (predominantly rain) provide information on the spatial and temporal variability of precipitation at the site, as well as a comparison of various methods of point measurements. These data are also used to evaluate areal estimations of precipitation by the CRP and determine a footprint for this method.