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Image Analyses of Frost Heave Mechanisms Based on Freezing Tests with Free Access to Water

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ABSTRACT

A freezing test apparatus was supplemented with a camera to allow for recording and monitoring one-dimensional freezing tests to analyze the development of ice lenses via particle image velocimetry (PIV) in the laboratory. Two tests on disturbed, partially saturated samples of silt loam were conducted. Image recording and correlation analyses provided detailed information about frost front penetration and ice lens formation(s) under varying temperature boundary conditions. Thawing has also been regarded in further studies.

Results of the image analyses were compared to readings from conventional displacement measurements during the same test. Significant agreement between the results of image analyses and displacement measurements has been found. Test results were also used to establish a qualitative relationship between heat extraction and heave rates. Advantages and disadvantages of utilizing image analysis methods were discussed. Potential remedies for overcoming the drawbacks of using image analysis are suggested.

Image analysis is shown to be a viable method in further understanding of frost heave mechanisms.

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