Effect of surface and weather conditions on subsurface water flow and heat transport

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Nowadays, advanced technologies, such as drip irrigation systems, allows one to improve water use efficiency in farmland. However, evaporation from soil surface is still one of the main factors of water loss especially in water limited arid or semi-arid areas. To further improve water use efficiency, it is important to understand the effect of external factors, such as surface condition, on water, both liquid and vapor, flow and heat transport in the soil. The main objective of this study is therefore to experimentally investigate the effect of surface condition on soil water and thermal regimes. In this study, we have conducted field monitoring experiments at a experimental field of Tokyo University of Agriculture and Technology, where artificial ridges, aligned either east-west or north-south, of about 5-m long were created. In addition to soil moisture sensors and thermo-couples, several heat pulse probes were also installed to monitor changes in soil water content, temperature, and water vapor fluxes. Incoming and outgoing thermal radiations as well as sky cloudiness were also monitored.

Standard metrological data, such as precipitation, air temperature, humidity, and wind speed, have been collected from a nearby Japan Meteorological Agency weather station. Preliminary data show that daily and seasonal changes of soil water content and temperature clearly depend on the direction of the ridge aligned and weather condition. For example, soil temperature near the surface of the slope facing west slowly increases compared to that near the surface of the slope facing east on a sunny day, while such effect is less on a cloudy day. We will further summarize and analyze the effect of surface and weather conditions on soil water and temperature regimes.

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