

A method to measure winter precipitation and sublimation under global warming conditions

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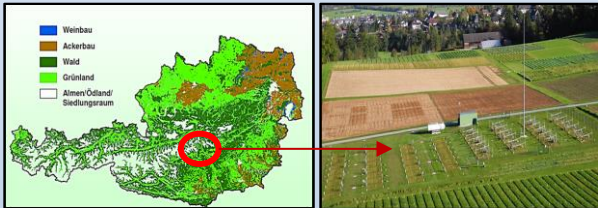
MOTIVATION

In alpine areas, the quantification of winter precipitation and snow sublimation are fundamental components for a correct alpine moisture budget.

Alpine regions react very sensitive on the predicted climate change involving increasing CO₂ concentrations and increasing temperatures. A change in the importance and magnitude of the water balance parameters, precipitation and sublimation, will be expected.

LYSIMETER

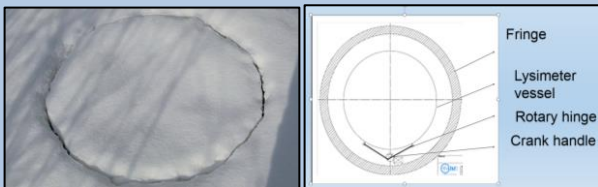
To determine winter precipitation and sublimation under global warming conditions, a lysimeter-facility, including six monolithic weighable lysimeters, enclosed in an open field climatic manipulation experiment was established in 2015 at AREC Raumberg-Gumpenstein.



The lysimeters in winter are exposed to two different climatic combinations. Three lysimeters are exposed to a +3°C scenario and the other three to ambient conditions.

SNOW ROTATION SYSTEM

The lysimeters are equipped with a snow rotation system which separates the snow cover above the lysimeter automatically from the surrounding snow cover.

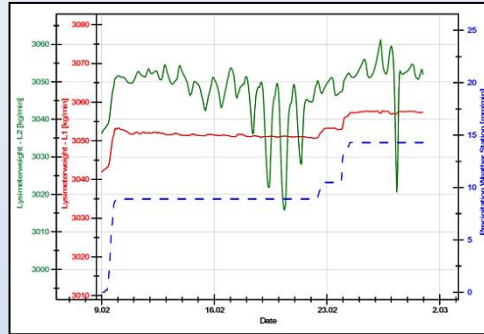


The snow rotation system were installed in winter 2014/15 and the lysimeter weight fluctuations were proved both in the snow accumulation and snow sublimation phase in the period 15/01/2015 to 30/04/2015 as well in the period 01/01/2016 to 30/04/2016.

Additionally the results were compared with other measurement systems and usually used models.

LYSIMETER WEIGHT UNDER SNOW COVER

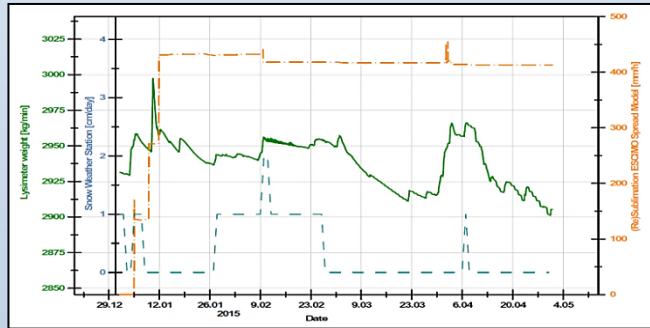
a.) LYSIMETER WEIGHT FLUCTUATIONS



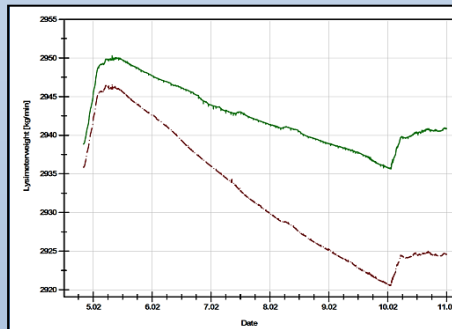
Lysimeter 1:
With snow rotation system

Lysimeter 2:
Without snow rotation system

b.) WINTER PRECIPITATION AND SUBLIMATION COMPARED WITH ESCIMO SPREAD MODEL (Strasser et al. 2010)



c.) WINTER PRECIPITATION AND SUBLIMATION UNDER GLOBAL WARMING CONDITIONS



Lysimeter:
Reference plot

Lysimeter:
Heated plot

RESULTS

First results over two snow event periods showed that the weighable lysimeters can measure very accurately winter precipitation and sublimation. Also first trends confirm that higher winter temperatures may affect the water balance parameters as well as the snow water equivalent. With more data during the next years it is possible to quantify precisely the influence of global warming conditions on snow accumulation and sublimation phases.

LITERATURE: STRASSER, U. & MARKE, T. (2010): ESCIMO.spread - a spreadsheet-based point snow surface energy balance model to calculate hourly snow water equivalent and melt rates for historical and changing climate conditions, Geosci. Model Dev., 3, 643-652

