

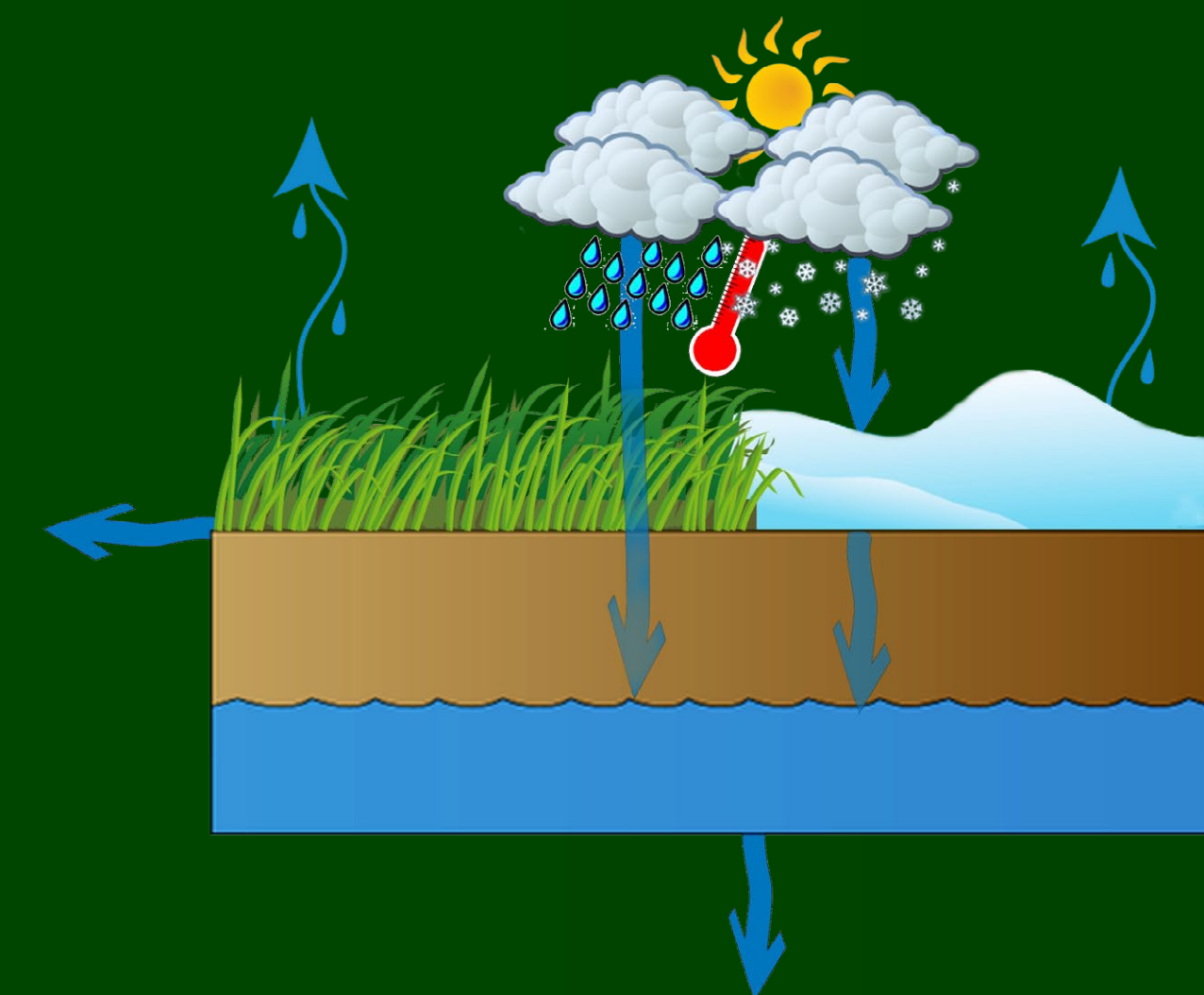
Future scenarios of soil water availability at managed grassland ecosystems in the Austrian Alps

Albin Hammerle^{1*}, Perluigi Calanca², Matthias Themeßl³, Andreas Gobiet³ & Georg Wohlfahrt¹

(1) University of Innsbruck, Institute of Ecology, Innsbruck, Austria (* albin.hammerle@uibk.ac.at)
(2) Forschungsanstalt Agroscope Reckenholz-Tänikon ART, Zürich, Switzerland
(3) Wegener Zentrum für Klima und Globalen Wandel, Karl-Franzens-Universität Graz, Austria

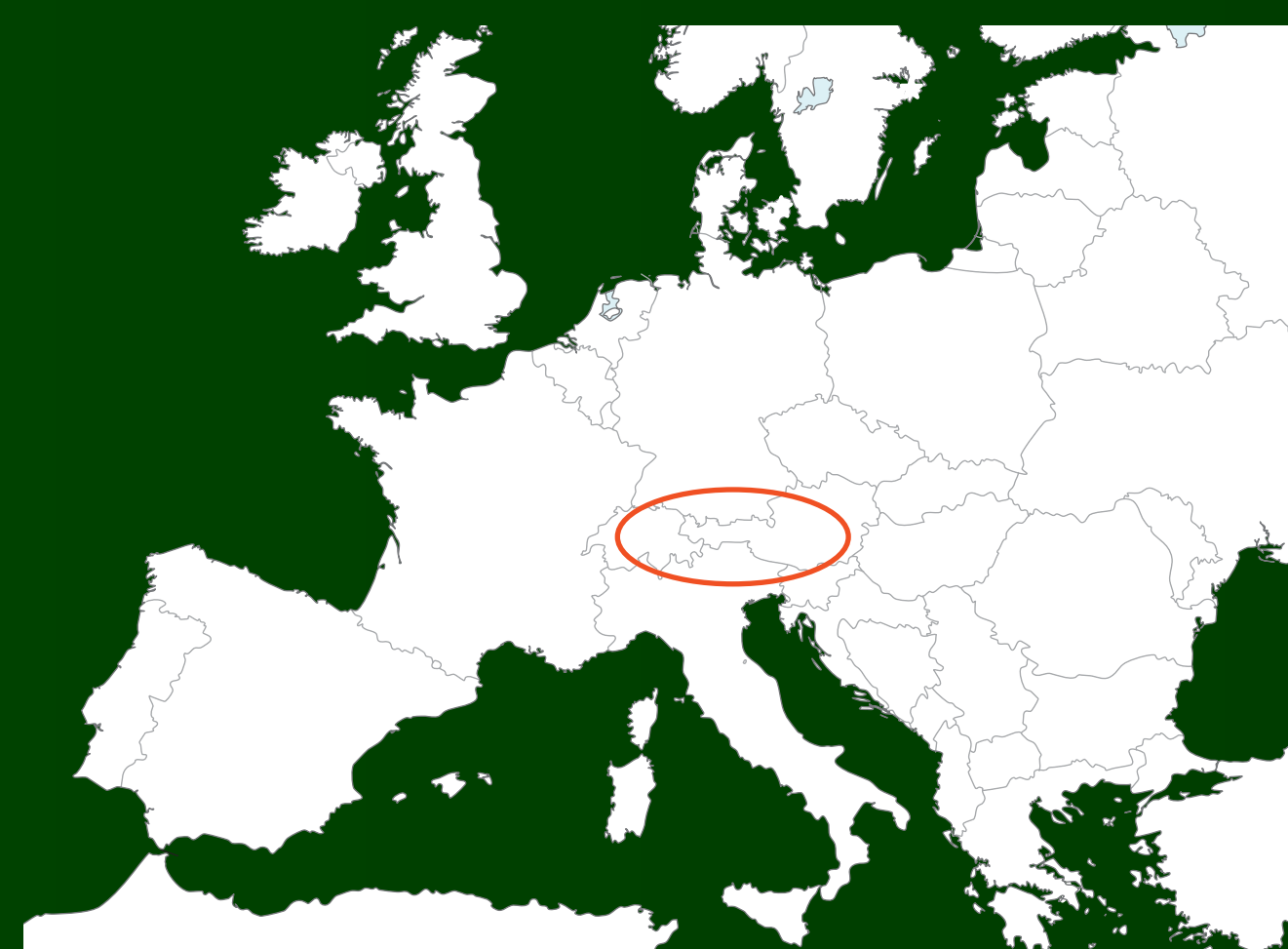
(1) We took ...

... a simple but efficient soil bucket model ...



Data requirements (daily):

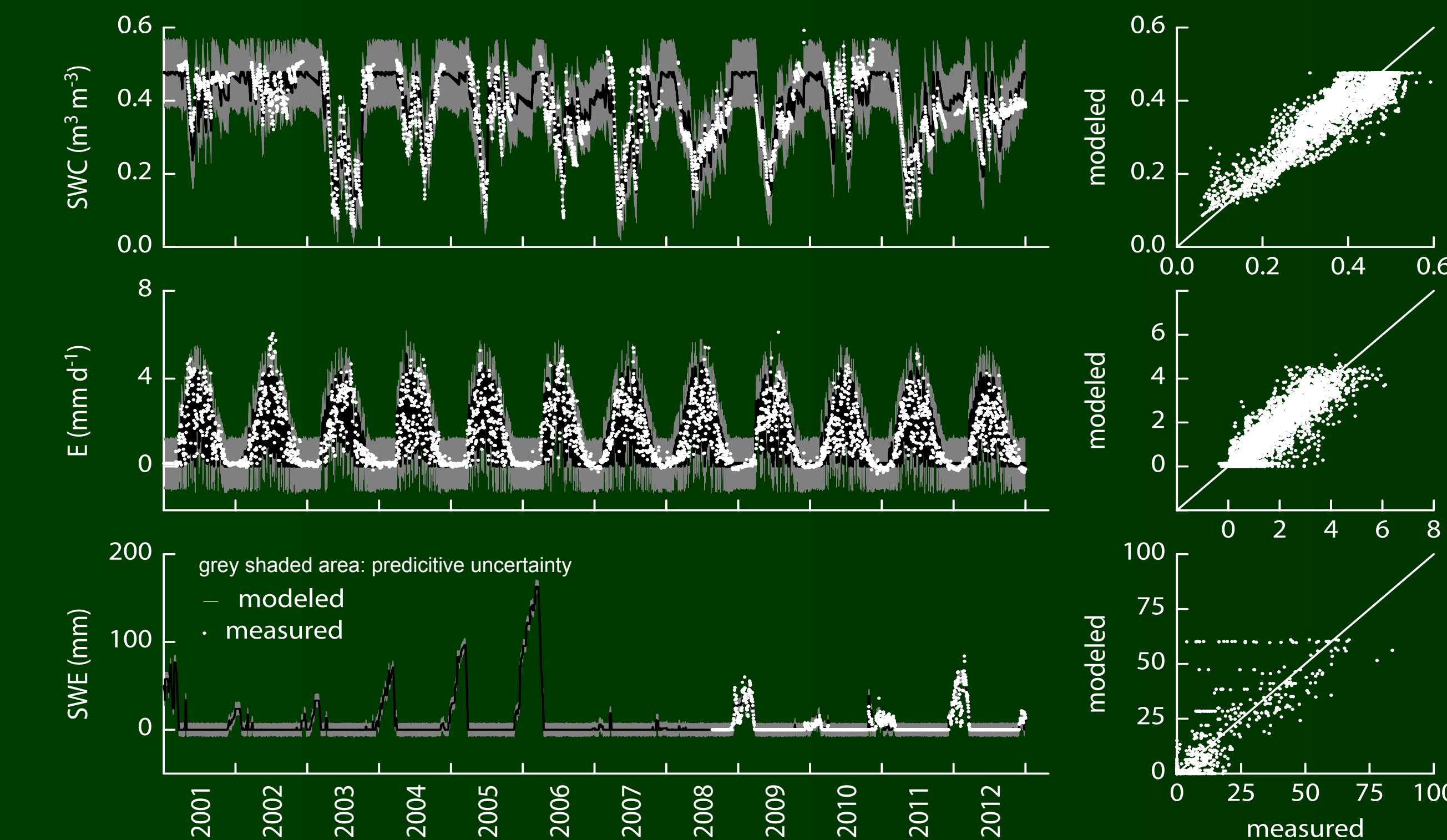
... and 22 site-years of data from 10 grassland sites in the Austrian Alps.



- mean air temperature (T)
- precipitation sum (P)
- solar radiation sum (SR)

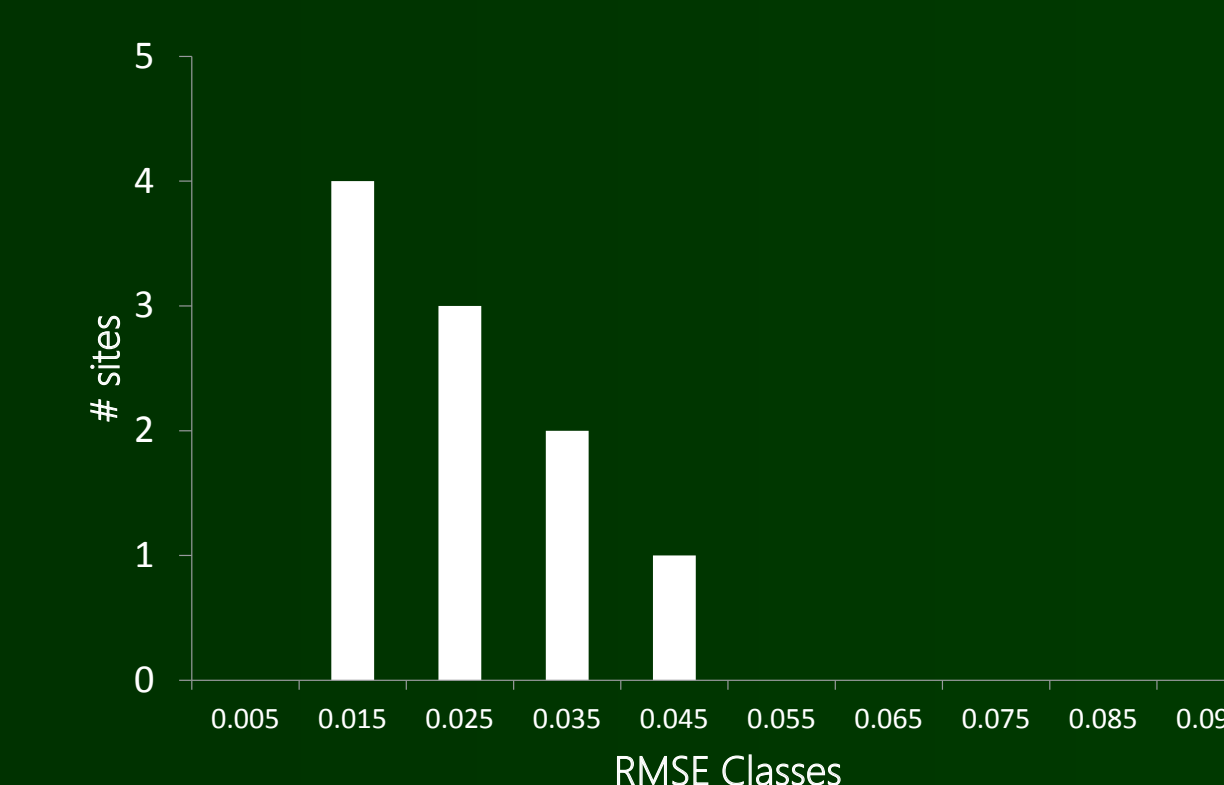
(2) Calibrated the model ...

... for each site using a Bayesian inversion approach (SWC: soil water content; E: evapotranspiration; SWE: snow water equivalent)



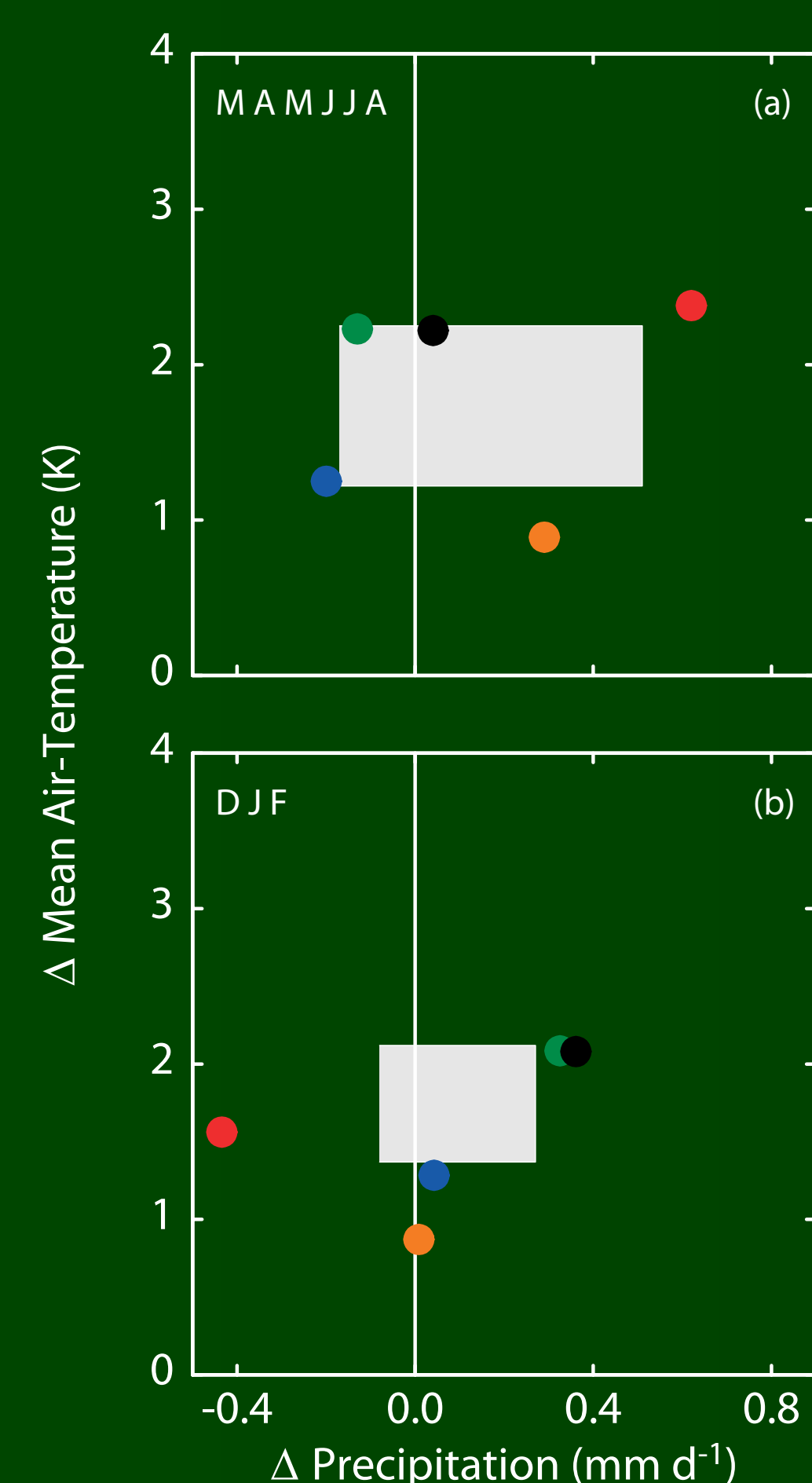
(3) And came up with ...

... reasonable up to very good model performances at the 10 sites investigated. Shown here are (regression) statistics of modeled vs. measured data.



(4) We chose 5 general circulation models ...

... based on the A1B scenario. The five models covered a broad range of temperature increases and covered precipitation increases as well as decreases between the two investigated periods 1961-1990 (P1) and 2021-2050 (P2). Downscaling to the regional scale was done using the Quantile Mapping method.

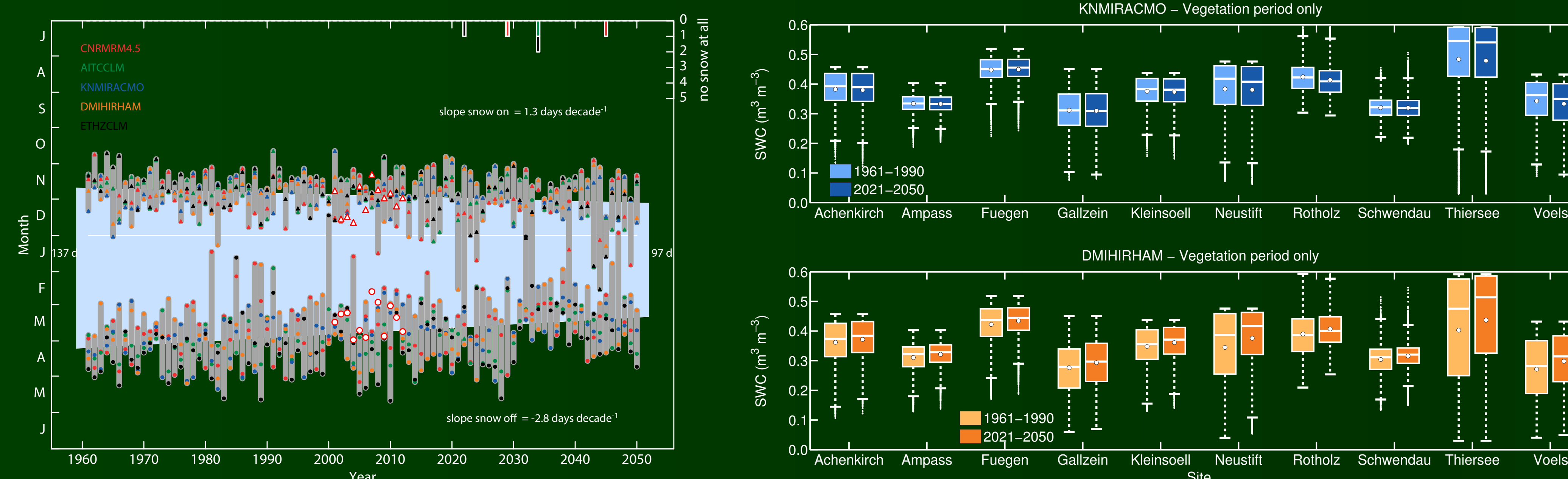


S1: CNRM-RM4.5
S2: AIT-CCLM
S3: KNMI-RACMO2
S4: DMI-HIRHAM5
S5: ETHZ-CLM

grey area:
IQR of all available GCMs

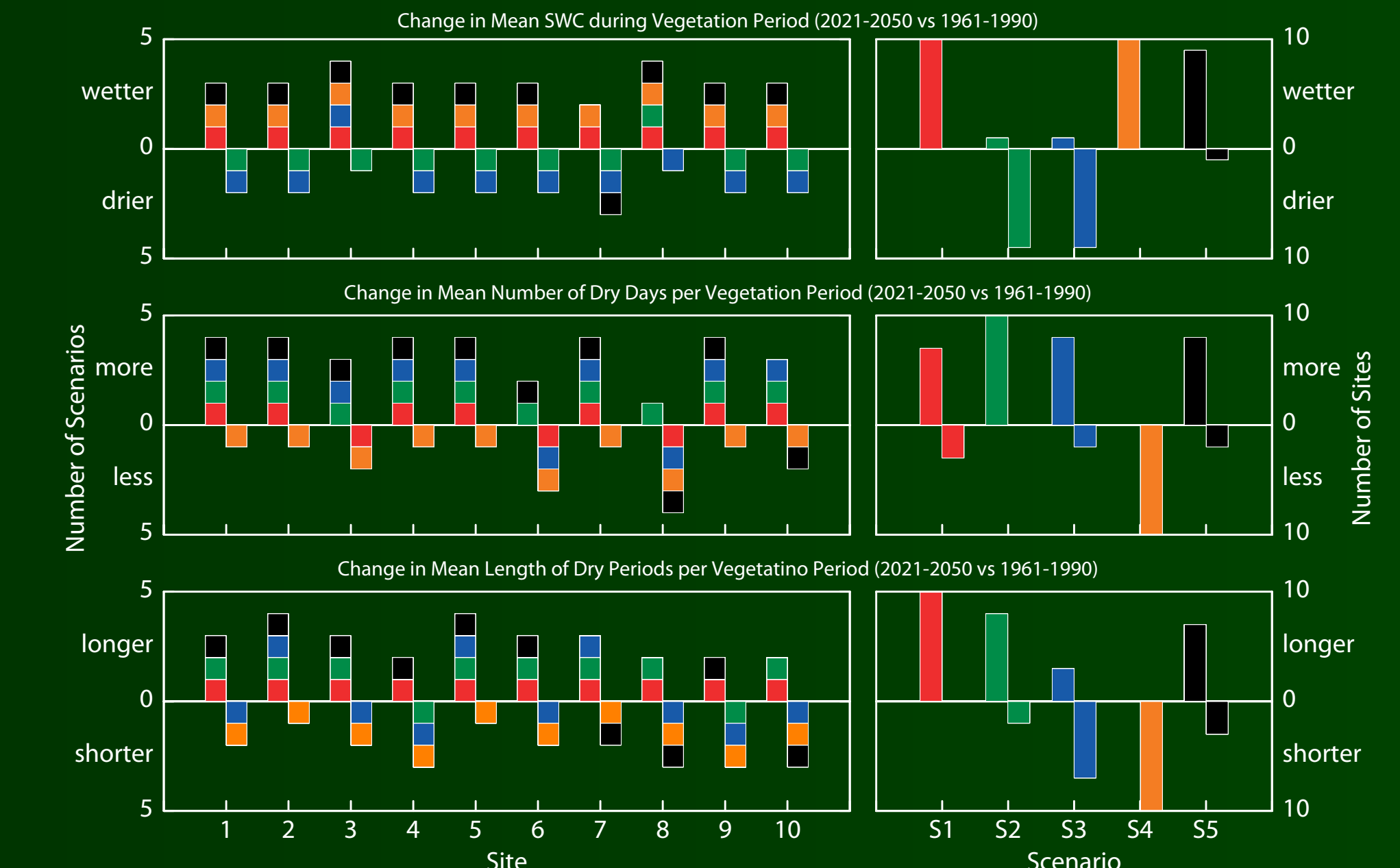
(5) And ran the calibrated models ...

... with the 5 climate scenarios (S1-S5) and compared the results of the two periods investigated (1961-1990 & 2021-2050), which resulted in ...



... a later onset of the permanent snowcover (blue area) and earlier thawing, leading to a longer vegetation period (VP) (+40 days). Site: Neustift. Open symbols: observed dates.

... hardly any changes in average soil water content (SWC) during the VP, or to wetter conditions on average for the two most „extreme“ scenarios S3 and S4, respectively.



... (i) more scenarios tending to wetter conditions on average, but (ii) more frequent dry periods, and (iii) possibly longer dry periods on average during the VP.

(6) Thus we conclude ...

... that the simple soil bucket model proved to be efficient and well performing, allowing for a broad range of applications.

... that there is no clear trend concerning average SWC conditions, but the majority of scenarios lead to wetter conditions on average, while frequency and duration of dry periods may increase, going along with a distinct extension of the vegetation period.