New software package for agroclimatological utilisation

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Abstract. The aim of the contribution is to present available software packals for evaluation of agroclimatological conditions, which can be applied both at local scale as well as in large scale studies. Four tools are introduced (SoilClim, AgriClim, FenoClim, snowMAUS) and some case studies and result examples are shown within the agriculture landscape.

Introduction

The basic assumption for successful agricultural output (production) is better understanding of meteorological and climatological elements of growth and development on field crops. Newly developed specialized software allows easily assess tens of agroclimatological parameters, indices or generally conditions and that not only in short-term (week, month) but also in long-term (year, decades) aspect. Software picks up on generally accepted work in the field of evapotranspiration, modeling of soil moisture (water) content, levels and water volume of snow etc. The output should be applied in science, research, consultancy but also in common agricultural working experience. The basic components are four separate parts called AgriClim, SoilClim, FenoClim and snowMAUS.

Data and methods

In order estimate soil moisture and temperature regime at a given site, or within a selected region, a software SoilClim was developed, tested, and applied in two markedly different regions of the Northern Hemisphere (Hlavinka et al., 2009). SoilClim is based on an enhanced daily water balance model that incorporates interactions between the soil and atmosphere through a dynamic module of vegetation cover. In addition, a snow cover effect on the water balance (through freezing and thawing), as well as on the soil temperatures, is taken into account through the incorporation of a snow cover simulator.

AgriClim (Trnka et al., 2008) is a tool including set of agroclimatological indices capturing drought and other extreme events (e.g. late or early frost) with special relevance for agriculture. It also includes range of dynamic models representing e.g. snow cover, soil water balance, phenology and crop growth that are aimed to assess the overall suitability and agroclimatic limiting factors in a given site/region/area. The tool was develop with a special focus on the speed and flexibility over time and spatial domains.

FenoClim was developed for detail analysis of phenological data in combination with climate predictors. Minimum, maximum and average temperatures, precipitation sum and solar radiation, compose a minimum dataset together with observed phenological dates. The software allows easy determination of meteorological drivers of particular phenophases and finding the optimum combination of thresholds (or e.g. degree day sums) through repetitive iterations. FenoClim then provides user with complete range of statistical parameters allowing for easy final pick of the most suitable parameters to be used in subsequent phenological modeling.

The core algorithm used in the snow cover model for agrometeorological use (snowMAUS) was proposed by Running and Coughlan (1988). The algorithm was modified and tested in Central Europe by Trnka *et al.*, (2009). It relies on daily maximum and minimum air temperature (T_{max}, T_{min}) and precipitation (*Precip*) values as predictors of snow cover. We chose to modify this very simple formulation as the basis of our snowpack model in order to maintain its independence from the radiation and humidity data. Radiation and humidity are two variables that are usually included in more sophisticated snowpack models. Similarly, modeling techniques are rarely based on hourly data or on multiple temperature observations per day, due to the poor availability of data. The present version of snowMAUS operates with a daily time step, with seven key parameters governing snow accumulation and melting.

Results

The whole system (four tools) was programmed within Delphi and the user interface is user friendly and is designed to operate with large quantites of data in automated regime (e.g. outputs from RCM model runs). Examples of one of the presented softares tools (SoilClim) its modul structure, interface and easy validation experiment for reference evapotranspiration at Žabčice experiment location are shown in Figs.1 – 3.

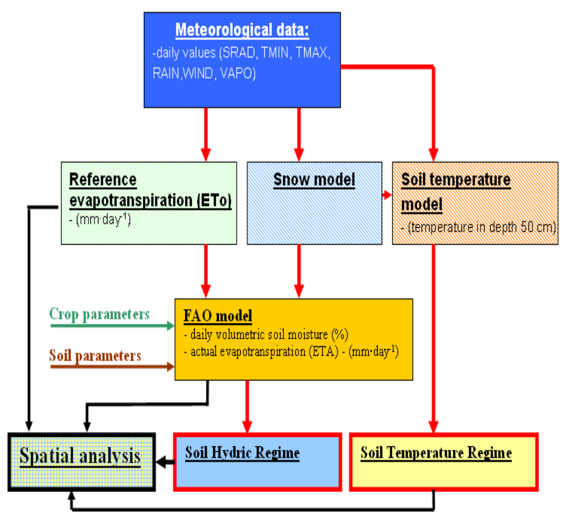

Figure 1. Scheme of SoilClim software tool

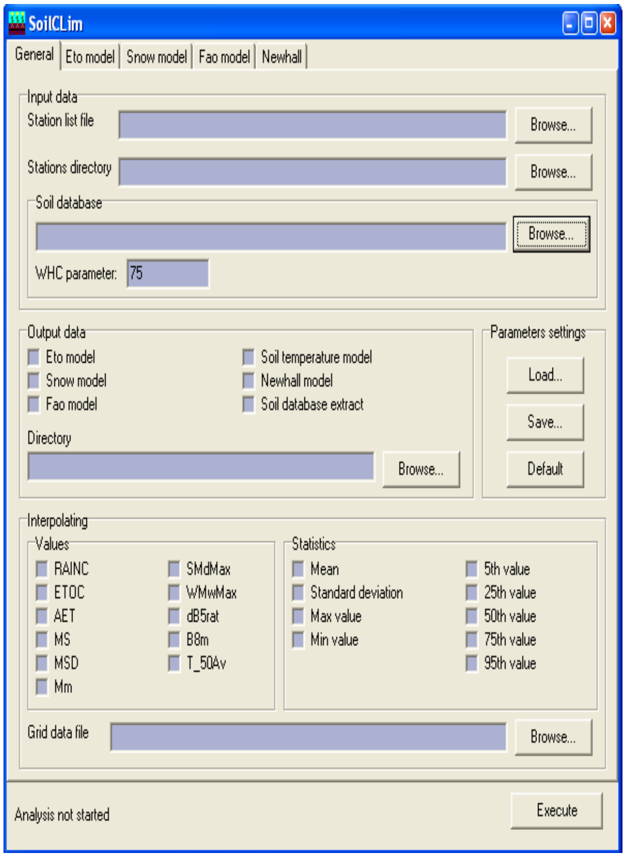

Figure 2. Structure of SoilClim software interface.

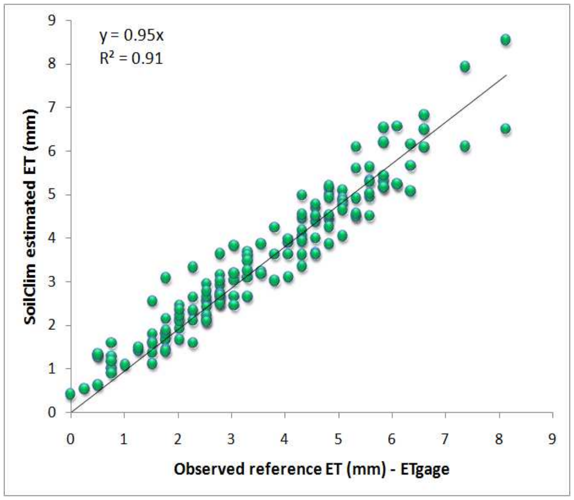

Figure 3. Reference evapotranspiration - Example of SoilClim validation vs. ETgage measurement

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