A climate research database management software

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Abstract

During climate change research, from the agricultural point of view, for example, we need to have well-defined climatic conditions for each plant. This is one the most important investigations to be carried out by meteorological databases. Of course, more complex mathematical analyses are needed to determine mutual and cross-influences as well as internal relationships, but these approaches can also be based on a user-friendly data base management system. We required therefore a system that allows researchers from various disciplines to set up special databases for specific studies as well as having the capacity to filter and aggregate data from different perspectives. Once we have these databases, which are in self-determined format, structure, and size, we can apply advanced mathematical methods and use them as a launching database.

Key words: climate change, meteorological data, data management, weather indicators, agriculture

1 Introduction

The Department of Mathematics and Informatics of Corvinus University of Budapest can be considered one of the higher level Hungarian climate research centres. Current studies demand meteorological databases and large secondary databases (heterogeneous in content and structure and multi-disciplinary: agriculture, health, etc.). To collect, organize, manage and search databases for climate change research it was necessary to create a special data management system.

The system runs within the department's internal network. Each researcher logs in with an identification (number) and uses it to create a container (Access database), into which are entered his or her own filtering results in search table format.

2 Software description

2.1 Filtering daily and monthly meteorological data

The system offers 27 basic index examinations, all of which have been formulated and accepted at the international level. They are used for searching daily climatic data for indications of climate change.

2.2 Filtering insect population data base

Search can be related to trap code, insect species code, year and month. The filtered insect trap data can be placed in free-standing tables, from which it is possible to export in any desired format.

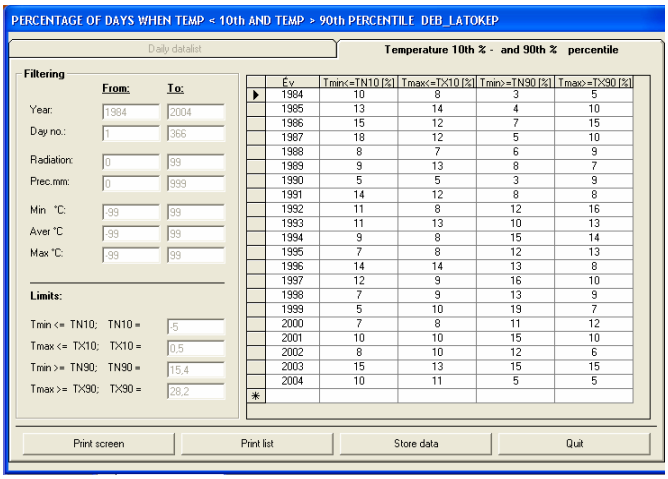

Fig. 1 Table of results for precipitation statistics with Tmin10p, Tmax10p, Tmin90p, and Tmax90p. The statistics show percentiles for days on which the minimum and maximum temperature was below 10% or above 90%. The reference levels appear on the left side of the screen once the calculations are completed. On the basis of the calculations the software then figures the percent values which will fall in the maximum and minimum 10% areas during the given year.

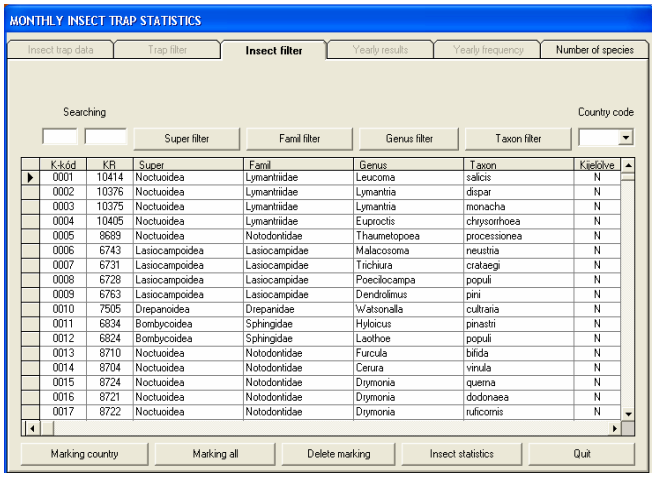

Fig 2 Insect data can be sorted by four data fields: trap code number, insect species code number, year, and months. Sorting is done simply by clicking on the title field of the specific column.

2.3 Weather indicator module and climate profile indicator module

The climatic needs of agricultural plants are fairly well documented in the literature. This module supports the search and analysis of special weather indicators of agricultural plants. It is capable of implementing the actual daily meteorological data as well as meteorological scenarios for 100 years.

Applying the so-called Climate Profile Indicator Module we can create new indicators by defining lower and upper boundary conditions regarding to daily as well as monthly data. It is also possible to combine temperature (minimum, average, maximum) as well as precipitation data of any time period. In the case of daily data, the system of conditions can be set up by day, while for making parameters for longer time periods (weeks, for example), linear interpolation can be applied, and this is done automatically by the software. The module makes it possible e.g. to define conditions for plant production demands or assess changes in spread of harmful insects. The software can survey and evaluate past and predicted future scenarios to monitor temperature and precipitation characteristics and helps to decide whether the examined variables (of the examined time series) indicate sufficient or not sufficient conditions, according to the profile indicators.

Reference

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