Preface

The COST 719 European research program (*"The use of GIS in climatology and meteorology"*) began in 2001 and ended in 2006. 20 European countries participated. Its main objective was to establish interfaces between GIS and data in climatology and meteorology and in order to reach this objective, three working groups were defined:

– working group 1 on "Data access and data availability";

– working group 2 on "Spatial interpolation";

– working group 3 on "GIS applications".

Most of the applications have focused on three climate parameters: temperature, precipitation and energy balance in the fields of climatology, meteorology and environmental sciences.

This book is the proceedings of most of the presentations made during the final conference of the COST 719 action (Grenoble, July 2006). It comprises four parts, each one introduced by a keynote speaker.

Part 1 is devoted to GIS use in meteorology and climatology. It is introduced by a text underlining that GIS is a mature technology to integrate, analyze and display spatial data but is still scarcely used in most Meteorological Services, partly due to the lack of an atmospheric data model (meteorology has its own operational infrastructure). A major concern is the share of terrain data in Europe (INSPIRE initiative) and the definition of a common metadata standard.

Four other contributions complete this first part.

– SIGMA is a currently running GIS (in Brazil) dedicated to real-time information (precipitation, temperature, lightning, NDVI, ozone, etc.) and alerts.

– A paper on webmapping of climatological and meteorological data compares ARC-IMS, open standards and Scalable Vector Graphics approaches.

– MISH (*Meteorological Interpolation method*) has been developed in Hungary. Geostatistical methods are based on one realization whereas MISH incorporates, in order to model the statistical parameters, climatic spatio-temporal information.

– A simple GIS study of the northern French Alps meteorological network shows that its statistical robustness is not evenly distributed, so that the sample should be stratified and the uncertainty regionalized.

Part 2 is dedicated to the spatial interpolation of climatological parameters. It is introduced by a chapter showing the developments in spatialization of meteorological and climatological parameters. Interpolation methods, which are present in most GIS, make it possible to combine numerous layers to derive estimates of parameters for any place at any time.

– The first application, in Poland, tests several methods for interpolating air temperatures, precipitation and cloudiness. The results for the temperature are correct, whereas the two other ones are in fact much more complicated to interpolate.

– Two following applications deal with the spatialization of (mean or average) temperatures in the northern parts of the French Alps. The measuring network is dense but still not dense enough to derive very good estimates for any place at any time (especially with anticyclonic weather).

– The last application discusses several methods for the spatialization of the radiation balance. It also examines the possibility to derive land surface albedo from satellite images.

Part 3 is devoted to demonstration projects. It is introduced by an overview of ready-to-use demos. The chapter insists on the need for relevant meteorological and climatological data for environmental users, presenting links and connections between simulation models developed by ecologists and hydrologists on the one hand, applications by meteorologists and climatologists on the other hand.

– The first demo deals with daily fire risk mapping in Portugal, combining structural elements (number of fires, burnt areas, vegetation, biomass accumulation, climatic variables) with weather forecasts for the next 24 and 48 hours.

– The second demo compares, in Spain, a high resolution precipitation database with one created by dynamic downscaling; the statistical analysis shows a good similarity in terms of spatiotemporal distribution and total precipitation.

– The third demo is devoted to simulating drought sensitivity in southern Hungary under the hypothesis of climate change and assessing that damages will depend more on vulnerability than on events themselves.

– The fourth demo presents the ALP-IMP project where the monthly temperature fields of the Greater Alpine Region were calculated back to 1760. In the new ECSN-HRT-GAR project, monthly climatology fields are modeled according to quality checked normals for about 1,700 stations. In its final stage, monthly grids (1 km^2 pixels) will be produced.

– The fifth demo presents the RWIS (Road Weather Information System) for the winter maintenance of roads. Road weather forecasts use sensors, sky view factor analysis and mesoscale weather forecasts. An energy balance model (IceMiser) has been tested on 12,000 locations of 6 roads in England.

Part 4 is dedicated to environmental problems, which are strongly related to climate. It is introduced by a chapter presenting the challenges in fine scale applications, with examples in agrometeorology and urban climatology.

– In regions (like Brittany) with an intensive agriculture, transfer of pollutants into water resources partly depends on land use management during winter (bare or cultivated soils). A predictive model at the piece of land scale, based on the Dezert-Smarandache theory, proved an 82% success rate.

– The DEMETER project has been set up to facilitate the water management (quantity and quality) for irrigated farming in southern Europe. Pilot studies have been carried out using agricultural surveys, satellite images and weather and climate data, showing the possible improved management of cultures in Mediterranean areas.

– Olfactive nuisances around landfill sites are usually associated with certain meteorological situations. To evaluate the population exposure, a metamodel has been built, combining a local meteorological model (ARPS with nested domains), terrain data and a specific Eulerian dispersion model.

– The last application deals with the estimated disaggregation of N_2O fluxes due to agricultural soils in Italy (N_2O has a warming potential 275 times greater than CO_2 and has a very long life). The disaggregation procedure was conducted with land use, environment and climate data.

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