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Article

A high-resolution 1961–1990 monthly temperature climatology for the greater Alpine region

JOHANN HIEBL[1*], INGEBORG AUER[1], REINHARD BÖHM[1], WOLFGANG SCHÖNER[1], MAURIZIO MAUGERI[2], GIANLUCA LENTINI[2], JONATHAN SPINONI[2], MICHELE BRUNETTI[3], TERESA NANNI[3], MELITA PERČEC TADIĆ[4], ZITA BIHARI[5], MOJCA DOLINAR[6] and GERHARD MÜLLER-WESTERMEIER[7]

[1]Central Institute for Meteorology and Geodynamics (ZAMG), Vienna, Austria
[2]University of Milan, Department of Physics, Milan, Italy
[3]Institute of Atmospheric Sciences and Climate, Italian National Research Council (ISAC-CNR), Bologna, Italy
[4]Meteorological and Hydrological Service of Croatia (DHMZ), Zagreb, Croatia
[5]Hungarian Meteorological Service (OMSZ), Budapest, Hungary
[6]Environmental Agency of the Republic of Slovenia (ARSO), Ljubljana, Slovenia
[7]German Meteorological Service (DWD), Offenbach, Germany

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Abstract

The main object of the presented study was the creation of a high-resolution monthly temperature climatology for the greater Alpine region (GAR). This climatology, which is determined from observational averages for the period 1961–1990, necessitated a multinational, high-quality temperature dataset, in which especially inhomogeneities due to different methods of means estimation had to be regarded. Based on multilinear regression techniques and regionalisation, significant model improvements could be reached by adjusting for mesoscale effects in cold air pools, coastal and lakeshore belts, urban areas and slopes. The final 1x1 km grids allowing temperature description of the orographically complex Alpine terrain with an accuracy of 1 °C have been made available for further applications at the web pages of the Central Institute for Meteorology and Geodynamics.

Zusammenfassung

Die vorliegende Arbeit beschreibt Lösungswege zur Erstellung einer räumlich hoch auflösenden, monatlichen Temperaturklimatologie für den erweiterten Alpenraum (GAR). Als Voraussetzung für diese Klimatologie, die sich auf beobachtete Mittelwerte des Zeitraumes 1961–1990 bezieht, musste ein internationaler, qualitätsgeprüfter Temperaturdatensatz geschaffen werden, unter besonderer Rücksichtnahme auf durch unterschiedliche Mittelungsmethoden verursachte Inhomogenitäten. Ausgehend von multiplen linearen Regressionen und Regionalisierung konnten durch die Anbringung von Anpassungsfaktoren für Geländeeffekte in Kaltluftseen, Küsten- und Seeuferstreifen, Städten und Hanglagen deutliche Modellverbesserungen erzielt werden. Die fertigen 1x1 km-Felder, die die Temperaturverteilung im orografisch schwierigen alpinen Gelände mit einer Genauigkeit von 1 °C erfassen, stehen der Forschungsgemeinschaft auf den Internetseiten der Zentralanstalt für Meteorologie und Geodynamik zur Verfügung.

1 Introduction

High-resolution air temperature and precipitation climatologies have proved increasingly important in the recent past, and they are likely to become even more important in the future. They are used in a variety of models and decision support tools in a wide spectrum of fields such as, just to cite a few, agriculture, engineering, hydrology, ecology and natural resource conservation (DALY, 2006; DALY et al., 2002). In order to provide sound estimations over areas with poor station coverage like high-elevation sites in the Alpine range, the climatology has to be constructed on the basis of the widest possible dataset and by means of procedures allowing the most realistic representation of the major factors affecting the spatial climate patterns (DALY et al., 2008).

For the region of the European Alps, such gridded high-resolution climatological information have been available for precipitation some years ago (FREI and SCHÄR, 1998; SCHWARB, 2000). On the contrary, no comparable Alpine comprehensive dataset has been developed for temperature, even though a number of countries did set up national or sub-national temperature climatologies (e.g. AUER et al., 2001b for Austria; BRUNETTI et al., 2009 for Northern Italy; CEGNAR, 1995 for Slovenia; ENDERS, 1996 for Bavaria; KIRCHHOFER, 1982 for Switzerland; LUBW, 2006 for Baden-Württemberg; MERCALLI, 2003 for the Aosta Valley; MÉTÉO-FRANCE, 1999 for France; TOLASZ et al., 2007 for the Czech Republic; PERČEC TADIĆ, 2008 for Croatia). Inevitably, significant discontinuities appear at the

*Corresponding author: Johann Hiebl, Zentralanstalt für Meteorologie und Geodynamik, Hohe Warte 38, 1190 Wien, Austria, e-mail: johann.hiebl@zamg.ac.at

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