STAtistical and Regional dynamical Downscaling of EXtremes for European regions: some results from the STARDEX project

Clare Goodess*, Malcolm Haylock*, Christoph Frei, Phil Jones*, Torben Schmith & Andras Bardossy

*Climatic Research Unit, UEA, Norwich, UK

A project within the EC 5th Framework Programme
1 February 2002 to 31 July 2005

http://www.cru.uea.ac.uk/projects/stardex/
http://www.cru.uea.ac.uk/projects/mps/
## The STARDEX consortium

<table>
<thead>
<tr>
<th>Organisation name</th>
<th>Key persons</th>
</tr>
</thead>
<tbody>
<tr>
<td>University of East Anglia, UK</td>
<td>Clare Goodess&lt;br&gt;Malcolm Haylock&lt;br&gt;Gavin Cawley&lt;br&gt;Phil Jones</td>
</tr>
<tr>
<td>King’s College London, UK</td>
<td>Rob Wilby&lt;br&gt;Colin Harpham</td>
</tr>
<tr>
<td>Fundación para la Investigación del Clima, Spain</td>
<td>Jaime Ribalaygua&lt;br&gt;Rafael Borén&lt;br&gt;Manuel Blanco</td>
</tr>
<tr>
<td>University of Bern, Switzerland</td>
<td>Evi Schuepbach</td>
</tr>
<tr>
<td>Centre National de la Recherche Scientifique, France</td>
<td>Guy Plaut&lt;br&gt;Eric Simonnet</td>
</tr>
<tr>
<td>Servizio Meteorologico Regional, ARPA-Emilia Romagna, Italy</td>
<td>Carlo Cacclamani&lt;br&gt;Valentina Pavan&lt;br&gt;Rodica Tomozeiu</td>
</tr>
<tr>
<td>Atmospheric Dynamics Group, University of Bologna, Italy</td>
<td>Ennio Tosi</td>
</tr>
<tr>
<td>Danish Meteorological Institute, Denmark</td>
<td>Torben Schmith</td>
</tr>
<tr>
<td>Eidgenössische Technische Hochschule, Switzerland</td>
<td>Christoph Frei&lt;br&gt;Juerg Schmidli</td>
</tr>
<tr>
<td>Fachhochschule Stuttgart – Hochschule für Technik, Germany</td>
<td>Hans Caspary</td>
</tr>
<tr>
<td>Institut für Wasserbau, Germany</td>
<td>András Bárdossy&lt;br&gt;Yeshewatesfa Hundecha</td>
</tr>
<tr>
<td>University of Thessaloniki, Greece</td>
<td>Panagiots Maheras&lt;br&gt;Christina Anagnostopoulou</td>
</tr>
</tbody>
</table>

c.goodess@uea.ac.uk
STARDEX general objectives

• To rigorously & systematically inter-compare & evaluate statistical and dynamical downscaling methods for the reconstruction of observed extremes & the construction of scenarios of extremes for selected European regions & Europe as a whole

• To identify the more robust downscaling techniques & to apply them to provide reliable & plausible future scenarios of temperature & precipitation-based extremes
Consistent approach:

e.g., indices of extremes
STARDEX Diagnostic extremes indices software

• Fortran subroutine:
  – 19 temperature indices
  – 35 precipitation indices
  – least squares linear regression to fit linear trends & Kendall-Tau significance test

• Program that uses subroutine to process standard format station data

• User information document

http://www.cru.uea.ac.uk/projects/stardex/

c.goodess@uea.ac.uk
STARDEX core indices

- 90th percentile of rainday amounts (mm/day)
- greatest 5-day total rainfall
- simple daily intensity (rain per rainday)
- max no. consecutive dry days
- % of total rainfall from events > long-term P90
- no. events > long-term 90th percentile of raindays

- Tmax 90th percentile
- Tmin 10th percentile
- number of frost days Tmin < 0 degC
- heat wave duration

c.goodess@uea.ac.uk
1958-2000 trend in frost days

Days per year
Blue is increasing
1958-2000 trend in summer rain events > long-term 90th percentile

Scale is days/year
Blue is increasing
Investigation of causes, focusing on potential predictor variables

e.g., SLP, 500 hPa GP, RH, SST, NAO/blocking/cyclone indices, regional circulation indices
Winter R90N relationships with MSLP, Malcolm Haylock

R90N Canonical Pattern 1. Variance = 11.3%.

MSLP Canonical Pattern 1. Variance = 44.4%.
Analysis of GCM/RCM output & their ability to simulate extremes and predictor variables (and their relationships)

c.goodess@uea.ac.uk
Mean

**HadRM3**

Mean (mm per day) ALPS

90% quantile

**HIRHAM**

Mean (mm per day) ALPS

90% Quantile (mm per day) ALPS

Christoph Frei, ETH
Inter-comparison of improved downscaling methods with emphasis on extremes

c.goodess@uea.ac.uk
NW England, 90th percentile for DJF
Validation period: 1979-1993
Red: observations
Blue: predictors selected using stepwise regression, r=0.34
Black: predictors selected using compositing, r=0.24
At the end of the project (July 2005) we will have:

- Recommendations on the most robust downscaling methods for scenarios of extremes
- Downscaled scenarios of extremes for the end of the 21st century
- Summary of changes in extremes and comparison with past changes
- Assessment of uncertainties associated with the scenarios

c.goodess@uea.ac.uk