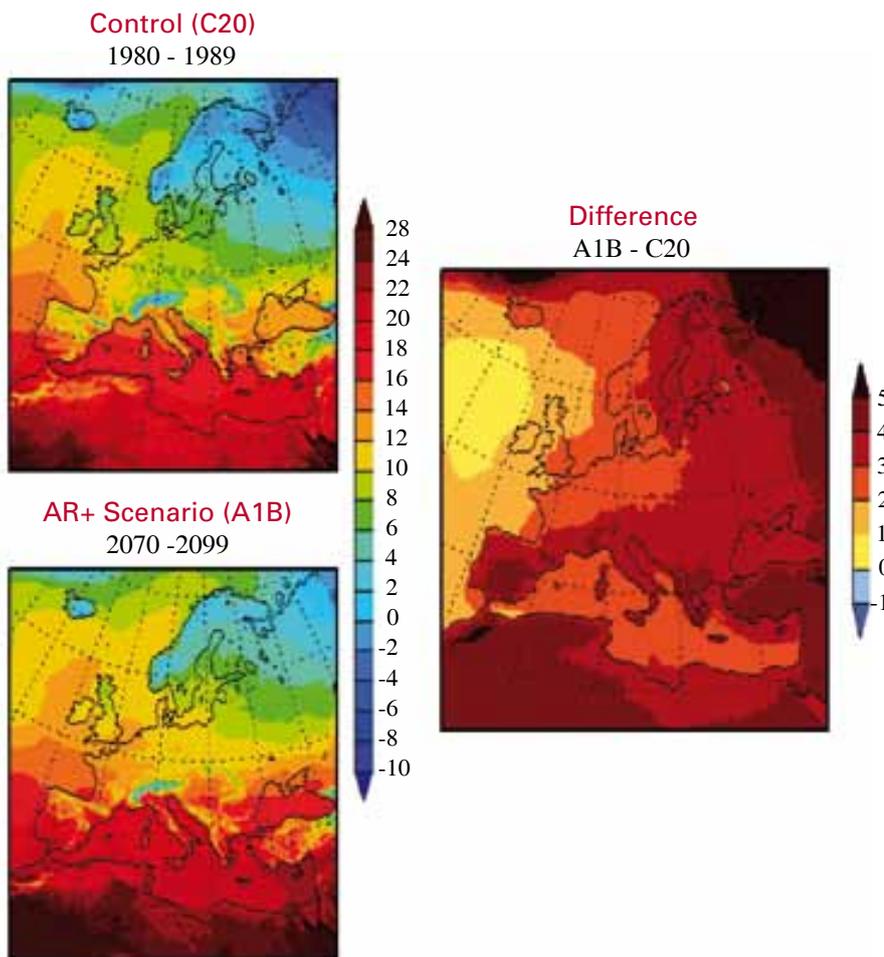


Johanna Leissner

## The Impact of Climate Change on Historic Buildings and Cultural Property

Figure 1: Annual mean of 2m temperature [°C] for the control, the scenario time slices and their difference



Climate change is one of the most critical global challenges of our time. However less certain information is available on how the changing climate affects mankind and its environment. Although considerable research has already been undertaken to explore the impact on biodiversity and agriculture or on fresh water availability, only little is known of how climate change impacts our cultural heritage. Heat waves, heavy rain falls, more or less humidity, changing radiation and frost cycles: on what scale will climate change affect Europe's historical buildings and their indoor climate? And what will that cost? In 2010 a multidisciplinary research team consisting of 27 partners from all over Europe and Egypt has started using innovative technologies and methodologies to make substantial contributions towards estimating the impacts of climate change on historic buildings. Within the 5 million euro EU funded project *Climate for Culture* running until 2014 numerous UNESCO sites and their vast collections in Europe and the Mediterranean are being investigated. More reliable assessments of the impact of climate change will lead to better prediction models, which in turn will enable preventive measures to be taken, thus reducing the consumption of energy and resources.

For this purpose and for the first time ever, the *Climate for Culture* project is connecting completely new high resolution climate change evolution scenarios with whole building simulation models to identify the most urgent risks for specific regions. The scientists want to find out how the indoor climate will develop in historic buildings up to the year 2100 in various climate zones and to what extent it will cause damages to the collections.

Therefore a survey with a specially designed, virtual questionnaire was performed to set up a range of case studies from all over Europe and Egypt. Parameters like type of building, specific site-related factors, available indoor and

outdoor climate data and observed damages have been collected. The list of case study buildings will be continuously updated and further extended. In several case studies in situ investigations of existing problems are carried out which will then be used for the projection of future challenging issues using whole building simulation models and different situ monitoring technologies. In situ measurements by laser speckle interferometry and 3D microscopy have been already successfully applied at the test site in Holzkirchen (Germany) and show good complementarity. Further investigations by glass dosimeters to assess the impact of indoor and outdoor conditions at cultural heritage sites throughout Europe will allow a much more precise and integrated assessment of the real damage impact of climate change on cultural heritage at regional scale. In terms of climatization of historic buildings a survey of the state of the art has been finalized and will be used to develop appropriate mitigation/adaptation strategies with special emphasis on energy efficiency. All these results will be finally incorporated into the assessment of the economic costs and impacts – for the first time economists will calculate the impact of climate change on the maintenance costs of Cultural Heritage sites. The thusly identified risks and the economic consequences for European Cultural Heritage will be communicated to policy makers, together with possible mitigation strategies to be included in future IPCC Reports.

More information available at [www.climateforculture.eu](http://www.climateforculture.eu)

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Figure 2: Number of frost days per month for the periods of 1960 to 1989 (control), 2070 to 2099 (scenario) and their relative difference, [%]

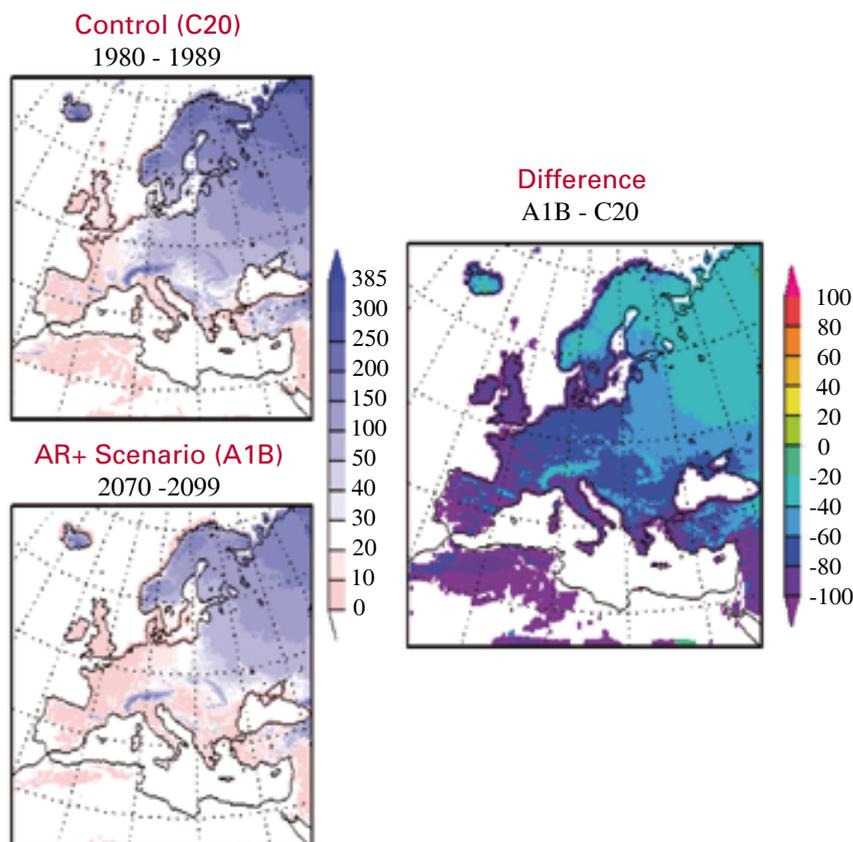


Figure 3: Picture and screenshot of the computer model of the exemplary church

