Preface

Once again, for the third time, in 2009, the Serbian Academy of Sciences and Arts organized an international symposium on the occasion of the birth anniversary of Milutin Milankovitch. As in 2004, the 2009 symposium was held under the patronage of the United Nations Educational, Scientific and Cultural Organization (UNESCO). What were the motives, supported by UNESCO, that led the Academy to organize another Milankovitch symposium 5 years after the second one? Several considerations were behind this move.

Paleoclimate, with its records of numerous drastic climatic changes, is a rich reservoir of real-world information on the patterns of change in the earth's climate system. While in 2004 there were some people skeptical about global warming and also of it being a phenomenon caused by man's activities, in 2009 there were not many left of either kind. Thus, understanding paleoclimate, following in the footsteps of Milankovitch, not only adds to our basic knowledge of the history of the world we live in, but it also adds to our abilities to anticipate future climate changes as the emission of greenhouse gasses by the increasing world population continues with little abatement in sight.

This last point was brought into focus recently by the work of James Hansen and collaborators who pointed out that the information on which way the earth's climate is going should best rely on three sources: observations, results of numerical models, and paleoclimate data. This is because the former two sources have limitations: observations are obtained from the earth's climate system which is now not in equilibrium, and numerical models include processes that are insufficiently understood and thus contain errors, and in their most advanced forms cannot be run for as long as one would wish. Paleoclimate data, on the other hand, are obtained from the time when the earth's climate system was close to equilibrium, such as the time of the maximum extent of the last ice age, and the time when there was no ice cover on the earth, some 40 million years ago.

With this new awareness of the significance of paleoclimate in the context of the climate change in progress, it seemed appropriate to open the 2009 symposium with a brief review of the present climate change situation, especially in view of the post 2007 Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report (AR4). Given that the proceedings are being printed about 2 years after the symposium was held, the review paper by Richard Somerville included here has been updated so as to contain information on global climate during the 2 years following the symposium: 2009 and 2010.

The review of the present climatic condition is followed by invited presentations reporting the progress made in the field of paleoclimate science. The session on paleoclimate started on Tuesday, 22 September and ended on Thursday, 24

September, and included 12 papers. The session was subdivided into two main parts. The first one was on glacial–interglacial cycles and the second on modeling the Last Glacial Maximum and the Holocene. Then, additional papers discuss Milankovitch's contribution to the understanding of climate evolution (Aleksandar Petrović), the feedbacks in the climate system (Ray Bates), and the snowball Earth (David Spiegel). Brief remarks on the contributions of Milankovitch made by André Berger in his presentation have been expanded into a full-length paper on the history of the astronomical theory of climate change.

In the first part, Peter Ditlevsen indicates the dynamic origin of the Mid-Pleistocene transition from the 41-ka world to the 100-ka one, and the role of the internal stochastic noise in the period prior to the last five glacial cycles. Andrey Ganopolski and Reinhard Calov apply the model Climber-2 to simulate the last eight glacial–interglacial cycles forced by variations in the astronomical parameters and in the concentration of the major greenhouse gases. André Berger and Qiuzhen Yin discuss the climate associated with the peaks of the interglacials of the last one million years, stressing the difference between the interglacials before and after the Mid-Brunhes Event. Slobodan Marković explains the role of loess sediments in reconstructing the climatic variations in Serbia. Qiuzhen Yin discusses the origin of the strong East Asian summer monsoon seen in the loess of China during MIS-13.

Four papers in the second part demonstrate the power of models in simulating past climates. Bette Otto-Bliesner stresses the role of the astronomical parameters in shaping the last interglacial using experiments with the NCAR Community climate system model. Didier Roche shows the importance of the different forcings in simulating the last deglaciation, whereas André Paul proposes ways to reduce the uncertainty pertaining to the Atlantic meridional overturning circulation of the Last Glacial Maximum by employing paleo-data assimilation techniques.

Several papers address the impact of climate change on hydrologic ecosystems and on regional watershed issues. Possible effects of climate change on the aquatic vegetation in river and floodplain habitats are described by Georg Janauer. He also discusses sensible solutions to problems envisaged, so as to include ecohydrology principles and mediating between diverging stakeholder interests. The analysis presented in the paper by Musić and coauthors addresses the challenging task of evaluating the uncertainties associated with the projection of climate change impact on hydrological regimes at the watershed scale. Dejan Dimkić and Jovan Despotović analyze the expected changes in stream flows in Serbia by looking at flows of previous years of under and above average temperature and precipitation in available records, and trends projected by the IPCC AR4 report.

Given that an overview of climate change was the symposium's main topic and that it is not only a scientific but also a societal need to understand regional changes that could be expected, regional climate modeling was looked into at some length by a number of invited and contributed papers. Basic issues such as what can be done by running regional climate models (RCMs) and other not fully understood problems are extensively reviewed by René Laprise and collaborators, in a paper presented by Dragana Kornić. The paper by Fedor Mesinger and coauthors discusses the issues of the domain size and lateral boundary conditions in view of the possible desirability of attempting to improve the RCMs on a large scale. They include a summary of the very recent results obtained by Katarina Veljovic, as well as the earlier results of Michael Fennessy and Eric Altshuler, arguing that if a small improvement on a large

scale were to be achieved, a still greater improvement on a small scale should be expected. How well a specific polar region problem, that of open water, can be dealt with is looked into by Sandra Morelli and Flavio Parmiggiani. Finally, of the papers included here, one that focuses on the climate changes to be expected in the region of Southern Europe and the Mediterranean, thus including the symposium venue, is that of Aleksandra Kržič and collaborators.

The 17 papers published in this volume were, of course, typically submitted some months and, in some cases, even up to more than a year after the symposium itself, and all have gone through a customary peer-review process. Thus, it is expected that they contain "added value" compared to the actual presentations at the symposium. The editors hope that having the collection in one volume will be appreciated by the readers.

As to the symposium itself, at the opening session, the participants were addressed by the Serbian Vice Premier and Minister for Science and Technology, Božidar Đelić; by the President of the Academy, academician Nikola Hajdin; by Dr. Patricio Bernal, Assistant Director-General of UNESCO for the Intergovernmental Oceanographic Commission, on behalf of the UNESCO, that extended its patronage to the symposium; and finally by Professor André Berger, Chairman of the International Scientific Committee. The following evening participants enjoyed a very nice reception at the City Hall, hosted by Dragan Đilas; on the penultimate day, they were received by Their Royal Highnesses Crown Prince Alexander and Crown Princess Katherine, at the White Palace, located on the outskirts of Belgrade on a plateau offering a view of the city; all three of these events were accompanied either by fine music performed by acclaimed Belgrade musicians, or, at the White Palace reception, by a colorful traditional Serbian folk dance group. The symposium dinner, on the last evening, organized on a ship cruising the rivers Sava and Danube, offering a night view of downtown Belgrade, its Kalimegdan Park and Fortress, with its walls and towers reflecting off the waters of the two rivers, provided a fitting conclusion for the Belgrade part of the program.

On the last day of the program, Saturday, 26 September, the participants visited the Milankovitch family home in Dalj, Croatia, which is an impressively refurbished building made into a Milankovitch Science Center. An afternoon session was held, with several talks and a concluding discussion. At the final coffee break with refreshments served in the renovated garden of the Milankovitch family home, on the bank of Danube, the participants enjoyed the colorful view of the Danube with a wide vista of the plains to its north, and many places mentioned in Milankovitch's entertaining and inspiring autobiographical writings.

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April 2012

André Berger
Fedor Mesinger
Djordje Šijački

Participants who gave presentation or addressed the Milankovitch Anniversary Symposium:

(1) Richard C. J. Somerville
(2) Fedor Mesinger
(3) Vladimir Janković
(4) Silvio Gualdi
(5) Didier M. Roche
(6) Sandra Morelli
(7) J. Ray Bates
(8) Sylvie Joussaume
(9) André Berger
(10) Nikola Hajdin
(11) Zoran Knežević
(12) Patricio Bernal
(13) Aleksandar Petrović
(14) Peter Ditlevsen
(15) Bette Otto-Blisner
(16) Qiuzhen Yin
(17) Slobodan Marković
(18) Dragana Kornić
(19) Biljana Radojević
(20) Antonio Navarra
(21) Andrey Ganopolski
(22) André Paul
(23) Dave Spiegel
(24) Georg A. Janauer
(25) Emanuela Bruno
(26) Krešo Pandžić
(27) Milka Radojević
(28) Dejan Dimkić
(29) Stefan Rahmstorf
(30) Claudine P. Dereczynski
(31) Biljana Musić
(32) Sin Chan Chou
(33) Aleksandra Kržič
(34) Carlos Nobre.

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