

## **Continuation application: 1/2012-4/2012**

### **Simulation and predictability of present day climate**

#### **Project No.: shk00018**

Mojib Latif, Vladimir Semenov, Wonsun Park, Jan Harlaß, Ralf Hand, Jennifer Mecking, Nour-Eddine Omrani, and Wan-Ling Tseng

Institut für Meereswissenschaften an der Universität Kiel

Over the last century, a considerable increase in global, hemispheric and regional average surface temperatures has been observed, along with trends in meteorological extremes. The first decade of the 21st century was globally the warmest in the instrumental temperature record and has brought a number of remarkable weather and climate extremes to which had considerable impacts on society and ecosystems. Among the most recent of these extreme events are the European cold winters of 2006 and 2010, the heat waves of 2003 and 2010, the flooding in Central Europe in 2010. Based on a broad assessment [International Panel of Climate Change 4<sup>th</sup> Assessment Report], the global warming will proceed and weather and climate extremes may become more frequent and more intense in many regions including Europe, in particular highly vulnerable coastal zone of the northern Germany. The major task of this project is to understand mechanisms of climate variability and change and to provide a basis for improved climate change scenarios, in particular on decadal to multi-decadal time scale. The strong internal climate variability in the North Atlantic is of particular importance for decadal climate prediction for northern Europe and Germany.

The most advanced approach to address the outlined problems is numerical climate modelling, which is at the heart of this project. A suite of state-of-the-art models will be used to study

various problems related to climate variability and predictability. This work relies heavily on high performance computing, and the resources made available at HLRN are indispensable to our activities. This type of work, which involves model development and testing, also requires long-term availability of stable high performance computing resources. Thus, we envisage this project to have an indefinite term, for which resources will be applied for on a yearly basis, together with a progress report.

The work we propose here is supported by several national and international funding programs, and thus, has been externally reviewed. Based on simulations proposed in frame of this project and performed at the HLRN, a considerable number of peer-reviewed articles have been published in the last three years (including 8 publications in 2011).

In 2012 we will continue our investigation of the mechanisms and impacts of decadal climate variability, study origin of model biases and analyze extreme weather and climate events. We will put more effort on high-resolution simulations with the KCM that is currently serving the researches of climate variability and climate changes in Kiel. Our work will be focused in the following areas:

- Climate variability and changes in a high-resolution of coupled model
- Evolution of meteorological extreme events and their scaling properties as a function of atmospheric GCM resolution
- Case studies of observed high impact meteorological extremes in the recent years
- Mechanisms for Atlantic Multidecadal variability and its impact on European climate
- Studying model bias in the Tropical Atlantic SST
- High resolution simulations of the Madden-Julian Oscillation
- North Pacific Decadal Variability and its connection to AMV

In 2012, we will dedicate significant effort to use the HLRN platform for long simulations with high-resolution versions of Kiel Climate Model. This is required to address ambitious scientific tasks of understanding present day climate variability and improving model performance, and will require considerable increase of CPU recourses in comparison to those requested in 2011.