Hessisches Kompetenzzentrum
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High Resolution Coupled Climate Simulations Over Europe and the Mediterranean

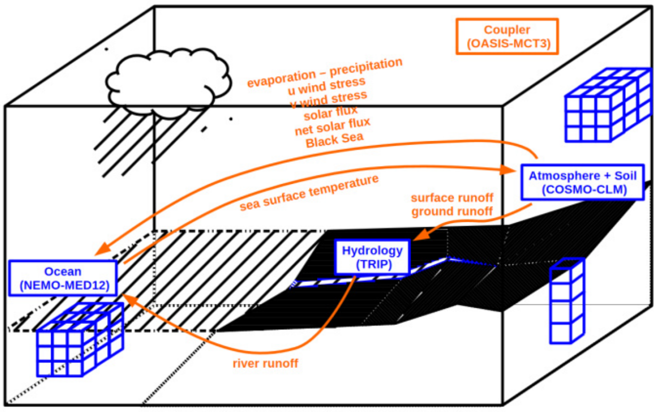

Figure 1: Coupled modelling System.

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Project Term
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Project Areas
Atmospheric Science, Oceanography and Climate Research

Clusters
Lichtenberg Cluster Darmstadt

Additional Software
COSMO-CLM, NEMO-Med12, TRIP, OASIS-MCT3, CDO, NCO, NCVIEW, R

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Introduction

The Mediterranean area will probably experience a strong impact of climate change. Due to the diverse topography of the land surrounding the Mediterranean Sea with islands, coasts, and mountain ranges it is difficult to simulate climate change in that area with global climate models and hence simulations with sophisticated high-resolution models on high performance computers are needed for accurate estimation of projected climate change under various emission scenarios.

Ocean plays a vital role in modulating the atmosphere. Hence we expect Mediterranean Sea to play a dominating role in governing the future climate around the southern part of Europe. Hence to replicate the interactions between ocean and atmosphere, a high resolution coupled climate system model is necessary. Such high resolution simulations are really necessary for the Mediterranean Area for future climate predictions of the 21st century. We are one of the groups conducting high resolution simulations for these areas. Our simulations will be a part of future ensemble simulation runs for Europe. These projections help the society by providing information about the future scenario's which assist is developing various strategies for adaptation and mitigation.

We aim to simulate the years 1949 to 2100 in a continuous simulation with a climate scenario that assumes the emissions continue to rise through out the 21st century (RCP 8.5) and a high resolution.

Methods

We use a coupled regional climate model which includes the atmosphere model COSMO-CLM in the Mediterranean Area and continental Europe, the ocean model NEMO-MED12 for the Mediterranean Sea, and the hydrological model TRIP in Europe. This system allows for closure of the Mediterranean basin water cycle (including the Danube catchment). All three models communicate with each other through a coupler (OASIS-MCT3) every hour. The simulations need to be done on a high performace computer, because only HPCs are capable of handling many calculations in parallel and can handle the large amount of input and output data.

Results

In the first year of the project, we simulated the climate over the Mediterranean Area from 1949 to 2035. The years until 2100 will be simulated in the near future. All results will be made available in the Earth System Grid Federation (ESGF) data base.

Discussion

We conducted basic evaluation of the model results with observations for the river run off model, the ocean deep water formation. We compared our model runs with observations available from in situ-satellite data. The results suggest that the river runoff at the river mouths at ocean show realistic seasonal cycle as in observations. The deep water formation is also realistically captured at the Gulf of Lions in the north west part of the Mediterranean Sea.

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