Contribution ID: **65** Type: **Sessions contributions**

Modelling the impact of climate change on the air quality of Bulgaria using the Grid environment

Tuesday, 20 May 2014 12:00 (15 minutes)

The main goal of the joint research by scientists from the NIMH and IICT was to determine climatic values for the most important meteorological variables and to estimate the impact of climate changes on air quality at several key points. The computational work was carried out via Grid-based workflow. Three different scenarios were investigated: 1960-2000 (Control Run, CR), 2020-2050 (Near Future, NF) and 2070-2100 (Far Future, FF), following the IPCC scenario A1B. The calculations were data and compute intensive and required the use of substantial Grid resources from NGI_BG. Using the climatic version of the operational weather forecast model ALADIN, the team created a meteorological database at resolution of 10 km for all 3 periods. These data were used as input for the US EPA Models-3 System (MM5, CMAQ and SMOKE). Utilizing the TNO emission inventory for 2000, the workflow computations attempted to determine the impact of climate change, abstracting out the variability in emissions, which are difficult to predict at the current stage. AUT-Greece provided the chemical boundary conditions for Bulgaria. The dispersion calculations were made for the last 10-year periods for CR, NF and FF, and are presented and discussed, drawing conclusions about the expected climate change impact under the internationally recognized scenario. The computations produced high amount of data for each Grid job and used MPI. This work was supported by EGI-InSPIRE and SuperCA++ projects.

Wider impact and conclusions

There is growing interest in the estimation of climate change impacts and vulnerability assessment in targeted areas of Central and Eastern Europe, with one of the main areas being air quality modeling. By leveraging the Grid resources for this computationally challenging investigation the team of researchers obtain numerical results with sufficient resolution and good consistency with measurements. The main effect that could be observed under the most popular climate change scenario is that of increasing differences between areas of high and low pollution levels, e.g., large cities vs mountain regions. These computations that could not be performed without large-scale usage of Grid resources provide information to policymakers to try and mitigate the effects of climate change on quality of life. In most cases the observed increases in pollution were in the range of 5-10%, which can be countered by decreasing the levels of emissions.

Description of work

The high amount of data that is processed for each run of the main computational task and the large length of the periods under consideration (3 10-year periods) motivate the use of Grid resources, mainly the clusters from the Bulgarian NGI in EGI. The meteorological database that used the ALADIN weather forecast model was produced at a pre-processing step and transferred to the Grid storage elements. The main computations are done using the MM5 and CMAQ applications, which were installed, and tested for scalability. Although the target clusters have high-performance InfiniBand interconnection, the optimal size of the jobs was determined to be either 16 or 32 processors (1 or 2 blade servers), taking into account that these computations do not require real-time capabilities. Some modifications to the torque bath system were introduced in order to avoid sharing of nodes with other application that can have negative performance impact. The results of the computations are in order of tens of Gigabytes, but for this study they were processed in order to extract only the most important indices. The results of the control run of the workflow were compared with actual measurements and validated the modelling workflow. By evaluating the differences between the current values and the results from the Near Future and Far Future scenarios, various interesting conclusions about the expected impact of climate change on the air quality in Bulgaria were drawn.

Primary author: ATANASSOV, Emanouil (IICT-BAS)

Co-authors: Prof. KARAIVANOVA, Aneta (IICT-BAS); Prof. SYRAKOV, Dimiter (NIMH-BAS); Mrs PRODANOVA, Maria (NIMH-BAS); GUROV, Todor (IICT-BAS)

Presenter: ATANASSOV, Emanouil (IICT-BAS)

Session Classification: Environmental science on grids and clouds

Track Classification: Success stories in using e-Infrastructures for research (Track Leaders: E. Katragkou, P. Castejon)