Geophysical Research Abstracts
Vol. 19, EGU2017-15675, 2017
EGU General Assembly 2017

Enviro-HIRLAM/ HARMONIE Studies in ECMWF HPC EnviroAerosols Project

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The EnviroAerosols on ECMWF HPC project (2015-2017) “Enviro-HIRLAM/ HARMONIE model research and development for online integrated meteorology-chemistry-aerosols feedbacks and interactions in weather and atmospheric composition forecasting” is aimed at analysis of importance of the meteorology-chemistry/aerosols interactions and to provide a way for development of efficient techniques for on-line coupling of numerical weather prediction and atmospheric chemical transport via process-oriented parameterizations and feedback algorithms, which will improve both the numerical weather prediction and atmospheric composition forecasts. Two main application areas of the on-line integrated modelling are considered: (i) improved numerical weather prediction with short-term feedbacks of aerosols and chemistry on formation and development of meteorological variables, and (ii) improved atmospheric composition forecasting with on-line integrated meteorological forecast and two-way feedbacks between aerosols/chemistry and meteorology.

During 2015-2016 several research projects were realized. At first, the study on “On-line Meteorology-Chemistry/Aerosols Modelling and Integration for Risk Assessment: Case Studies” focused on assessment of scenarios with accidental and continuous emissions of sulphur dioxide for case studies for Atyrau (Kazakhstan) near the northern part of the Caspian Sea and metallurgical enterprises on the Kola Peninsula (Russia), with GIS integration of modelling results into the RANDOM (Risk Assessment of Nature Detriment due to Oil spill Migration) system. At second, the studies on “The sensitivity of precipitation simulations to the soot aerosol presence” & “The precipitation forecast sensitivity to data assimilation on a very high resolution domain” focused on sensitivity and changes in precipitation life-cycle under black carbon polluted conditions over Scandinavia. At third, studies on "Aerosol effects over China investigated with a high resolution convection permitting weather model" & “Meteorological and chemical urban scale modelling for Shanghai metropolitan area” with focus on aerosol effects and influence of urban areas in China at regional-subregional-urban scales. At fourth, study on “Direct variational data assimilation algorithm for atmospheric chemistry data with transport and transformation model” with focus on testing chemical data assimilation algorithm of in situ concentration measurements on real data scenario. At firth, study on "Aerosol influence on High Resolution NWP HARMONIE Operational Forecasts" with focus on impact of sea salt aerosols on numerical weather prediction during low precipitation events. And finally, study on “Impact of regional afforestation on climatic conditions in metropolitan areas: case study of Copenhagen” with focus on impact of forest and land-cover change on formation and development of temperature regimes in the Copenhagen metropolitan area of Denmark. Selected results and findings will be presented and discussed.