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Atmospheric applications on the European Grid

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The civil society and all public ask for certainties i.e. precise values with small error range as it concerns prediction at short, medium and long term in all Earth Science domains; but Science mainly answers only in terms of probability of occurrence. To improve the answer or/and decrease the uncertainties, (1) new observational instruments are deployed in order to have a better geographical coverage and more accurate measurements, (2) new algorithms and simulations have been developed. All that leads to intensive computing, addressed to a variety of architectures.
The European Grid with its large number of available processors has played a significant role to treat huge collections of non-parallel independent jobs in the following examples. In the first case aboard satellite the survey of ozone near the surface needs designing news instruments, IASI-NG and MAGEAQ-TIR, via OSSE (Observing System Simulation Experiments); at first to create millions of pseudo-observations used to test the new instrument performances. The second and third cases are focused on aerosols and clouds important to survey the earth radiative budget. EGI permits to reduce aerosol data from the PARASOL at full scale (6km) to be compared with data from CALIPSO and MODIS, and also to run 3D Monte Carlo simulation for a variety of Cirrus in order to study the cloud heterogeneities and to assess the limits of the operational cloud parameter algorithms.

Wider impact and conclusions

Grid is very well adapted to treat a huge collection of jobs in a relatively short time. In the first example, several millions of pseudo-observations from previous satellite instruments were provided by EGI in a few months in order to test performances of new designed instruments; huge database to cover at maximum all different situations, created in a short time to not delay the very detailed study of new instruments and then their launching. The second example pointed out the interest to treat aerosol data at full space resolution in order (1) to be compared and combined with other data with similar resolution and (2) to access the scientific interest (added value) of such a 6km space resolution in regards of the degraded 18km one for further instruments. In the third example, based on a 3D Monte-Carlo simulation, EGI permitted to study in details the heterogeneities of clouds observed by CALIPSO while in general clouds are assumed homogeneous due to a lack of compute resources.

Description of work

Pollution estimate in the low and middle troposphere are given from satellite sounders with a good spatial coverage and resolution. Future on-going satellite missions have to improve performances to monitor ozone near the surface where it acts as a pollutant. Two future satellite instruments were tested using OSSEs (Observing System Simulation Experiments): the IASI-NG instrument and the MAGEAQ-TIR instrument, a geostationary mission dedicated to air quality monitoring in Europe from a geostationary platform. The OSSE first step was with EGI to create a large database of pseudo-observations used for simulations of the new instrument performances.
The POLDER instrument onboard the PARASOL satellite measures atmospheric properties of clouds and aerosols. The operational processing is performed at a low resolution of 18 km. To study the sensitivity of the aerosol properties retrieved from PARASOL at the 6km native resolution, the whole PARASOL archive (five years of daily global data) was reprocessed at this 6km resolution. What would have taken 18 months with local resources could be performed in 3 months of processing with the EGI grid. It also made possible direct comparisons with other products at similar resolutions, such as aerosol products from CALIPSO (5 km) and MODIS (10 km).
Clouds are one of the main contributors of the Earth radiative budget. It is essential to follow their evolution and improve our knowledge, in particular in the current context of climate change. In order to analyze and obtain information from the radiative measurements made by IIR (Imaging Infrared Radiometer aboard CALIPSO), accurate and realistic simulations need to be performed; the model should be able to compute radiative transfer in a 3D atmosphere. The use of the grid made possible the use of a 3D Monte-Carlo radiative

transfer code to study the cloud heterogeneity effects of different cirrus for the three IIR wavelengths in a suitable time.

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