Environmental Simulations

Environmental Simulations is one of the research groups of the Computer Applications in Science and Engineering (CASE) Department. The mission of CASE is to develop new computational strategies to simulate complex problems capable of running efficiently on modern supercomputers. The parallel codes resulting from this research activity can be applied in the realms of Computational Engineering and Physics and Computational Societies. Collaborative projects with industry and scientific groups are the main motivation underlying all development undertaken in CASE.

Objectives

1. **Meteorological modelling**
    1. Mesoscale Numerical Weather Prediction (NWP)
    2. Micro-scale high-resolution wind field modelling in complex terrains using CFD RANS models for the atmospheric boundary layer with thermal coupling (ALYA green)
    3. Data assimilation and downscaling from mesoscale to microscale
2. **Wind energy**
    1. Collaboration with sector world leading industry (Iberdrola Renovables)
    2. Modelling of onshore and offshore wind farms considering all aspects affecting surface layer atmospheric flows such as topographic variations, heterogeneities in the roughness of the terrain, and the downwind wake effects of rotors
    3. Modelling of wind turbines using actuator disks models with local mesh refinements
    4. Wind resource assessment
    5. Forecast of short-term wind farm power production

6. Tailored modelling postprocess using GoogleEarth to facilitate visualization and standard data interchange

3. **Atmospheric transport modelling**
    1. Atmospheric transport at urban-scale
    2. Volcanic ash transport modelling (FALL3D model), including model validation, ensemble forecast, operational implementation and estimation of impact on civil aviation
    3. Development of theoretical models for ash aggregation, dynamics of volcanic plumes, gravity currents, and resuspension of ash by wind
    4. Assessment of hazard and impact of volcanic ash fallout on local communities and of volcanic ash clouds on civil aviation
    5. Study aerosol feedback effects of on regional meteorology
    6. Code optimisation. Implementation of transport models in multi-purpose frameworks and porting of parallel software to different architectures

Barcelona Supercomputing Center - Centro Nacional de Supercomputación

---