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Physics-dynamics aspects of the AROME model and its coupling with NEMO and WW3 ocean/wave model

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AROME is a Limited Area Model (LAM) designed for mesoscale “Convection Permitting” applications.
It is the result of the coupling between the ALADIN dynamical core and the MésoNH Physics.

As the IFS, the Aladin DynCore is semi-Lagrangian with a spectral semi-implicit solver and hybrid hydrostatic pressure levels (more than 50% of the code of the dynamics is shared with the IFS). The non-hydrostatic (NH) option has been developed by the ALADIN consortium and is now shared with the IFS.
The Arome dynamics and data assimilation benefits from IFS developments (and the other way around).

The mesoscale convection permitting physics of AROME is shared with the Research community model MésoNH: TKE scheme, shallow convection, 1 moment Bulk microphysics, radiation.
The coupling with the surface is driven by the SURFEX platform and the description of the land covers comes from ECOCLIMAP. Four different types of surfaces are treated separately by SURFEX: land, town, lake and sea. On sea tiles, SURFEX allows the coupling with a 1D ocean mixed layer (OML) scheme or a 3D Ocean Models and a wave model.
The Arome physics and surface interactions benefit from scientific and technical developments of a large University and Research community (and the other way around).

AROME-Western Europe is operational from 2008. It currently runs at a horizontal resolution of 1.3km and 90 levels in the vertical. The initial condition of AROME-Western Europe comes from a 3DVAR data assimilation cycle and the lateral boundary conditions come from ARPEGE global forecasts. An ensemble with 16 members at a resolution of 2.5km documents the predictability of the mesoscale forecast over the France domain .

AROME is also running operationnaly over 5 overseas domains at a resolution of 2.5 km. The AROME-overseas run as a downscaling at a convection permitting resolution of the HRES IFS. As all oversea domains may be hit by tropical cyclones, the coupling with a prognostic 1D OML is activated. The initial conditions of the OML come from MECRATOR-OCEAN products. So far, the downscaling approach gives better results than the 3DVAR data assimilation in tropical regions covered with little observations. The development of an ensemble for AROME-Overseas is work in progress.

In order to improve the forecast of tropical cyclones but also of medicanes and polar lows, the AROME community is working on the ocean-atmosphere interactions.
- improve surface flux parametrisation for strong winds: coupling with a wave model, sea spays.
- improve of the feedbacks between the atmosphere and the ocean: coupling with the 3D ocean model NEMO.

A research effort is made in parallel to improve the representation of clouds.
- One moment versus 2 moments microphysics
- Aerosol/microphysics interactions (also involves coupling with a wave model)

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