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Coupling FLEXPART to the AROME mesoscale operational model

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The Maïdo observatory is a high-altitude station (2200m asl) on the remote tropical island of La Réunion, located in the Southern Indian ocean. The observatory hosts various instruments that monitor the atmospheric composition of air with a characteristic marine background origin in this region. Recently, a PTR-MS has been deployed at the Maïdo observatory in the framework of the OCTAVE project in order to estimate fluxes of OVOCs from marine and biogenic sources in the tropics.

Atmospheric circulation at Reunion Island, and at Maïdo observatory in particular, is complex owing to land and sea breezes, canyons, and upslope transport. At night, air masses measured at the Maïdo observatory originate mostly from the free troposphere. During the day, upslope transport lifts oceanic boundary layer air along the surface to the observatory. This allows the measurement of compounds with oceanic, biogenic, geogenic and even anthropogenic origins at the station.

Lagrangian models are valuable tools to identify air mass origins and interpret time series of observations. However, local sources and sinks of measurements taken during daytime cannot be identified at Reunion island with a Lagrangian model coupled with a large scale operational global model such as ECMWF at a resolution of 10km or more.

We present a new Lagrangian tool obtained by coupling the FLEXPART dispersive model with the operational AROME mesoscale model available at 2.5x2.5km^2 resolution and 90 vertical model levels in the region. In particular, we implemented an alternative method to handle vertical turbulent motions, using AROME turbulent kinetic energy fields. By coupling FLEXPART with AROME, we are able to simulate particle transport around the island in a timely manner.

The performance of FLEXPART-AROME is evaluated by some numerical consistency tests as well as trying to reproduce the land and sea breeze. These tests will then be compared to the performance of the FLEXAROME-ECMWF configuration. Finally, backtrajectories originating from the Maïdo observatory, and the distribution of their surface sources using FLEXPART-AROME and FLEXPART-ECMWF are discussed.