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Atmospheric CO_2 variability at the regional scale over Europe assessed from intensive airborne campaigns.

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Combustion of fossil fuel energies and land-use changes have led to an increase of atmospheric CO_2 of about 30% since the pre-industrial era, although the emissions have been about twice more : one half of the emissions has been absorbed by the planet. The sinks have been identified to be the continental biosphere and the oceans of the Northern hemisphere, for roughly the same order. However, the uncertainties on the continental sinks are very large, reaching 100% at the regional scale ($<$1000 km). Indeed, CO_2 shows a high spatial and temporal variability over continents. A better determination of regional fluxes calls for recording more measurements that can reveal this variability. Because aircrafts can span a large space in a reduced time, airborne campaigns are very well suited to the study of CO_2 regional budget. Our aim is to carry out one campaign per season in order to catch the seasonal variability of CO_2. The fluxes determination also requires to discriminate between the biospheric signal and the anthropogenic one. Since these latter are enriched in CO, we do simultaneous in-situ measurements of CO_2 and CO. The instruments are integrated onboard a Piper-Aztec aircraft. Our study is focused on Western Europe. For now, two campaigns have been carried out during spring 2003 and spring 2004, and one at the fall 2004, over France and Spain. In order to assess the spatial representativeness of ground measurements, we flew above the surrounding ground observatories. In the work presented, we will describe the instrumentation and the campaigns. A comparison between airborne measurements and ground stations will then be given, followed by an analysis of the

CO_2 variability in the boundary layer and the free troposphere. Finally, an estimation of the spatial representativeness of these measurements will be proposed.