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Underwater glider observations and modeling of an abrupt mixing event in the upper ocean

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An abrupt mixing event in the upper ocean is investigated in the Northwestern Mediterranean Sea using gliders, a new ocean monitoring technology, combined with regional atmospheric model outputs and mooring data. Intense winds (up to 20 m s-1) and buoyancy forcing during December 2009 induced strong vertical mixing of the upper ocean layer in the Balearic Sea. High-resolution data from a coastal glider reveal a surface cooling of near 2 ˚C and the deepening of the Mixed Layer Depth (MLD) by more than 40 meters in the center of the basin. Comparisons between glider and ship-emulated sections of hydrographic profiles show that the glider data make visible the small-scale spatial variability of the MLD. The heat content released to the atmosphere by the upper ocean during this mixing event exceeds 1000 W m-2. A simulation from the Weather Research and Forecasting model reports values consistent with these observations. Additionally the atmospheric numerical simulation shows the development and evolution of a cyclone located south of the Balearic Islands. This cyclone is likely to be responsible for the wind intensification and the consequent air-sea energy exchanges that occurred in the study area during this period.