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Variability of surface water dynamics during eccentricity minima interglacials of the last 1 Myr in the North Atlantic

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Eccentricity minima occurred only three times during the last 1 Myr in correspondence of Marine Isotope Stages (MIS) 1 (last 11 ka), 11 (425-360 ka) and 19 (791-763 ka). All these stages are characterised by similar orbital configurations and the Pleistocene eccentricity minima interglacials are considered, by several authors, as possible analogues for the Holocene and its future evolution.
Surface water dynamics were reconstructed through quantitative analyses performed on coccolithophore assemblages in two key-sites of the North Atlantic: MD03-2699 core, retrieved off Iberian Margin (IM), and IODP Site U1313, located in the upper western flank of the Mid-Atlantic Ridge. Nowadays, IODP Site U1313 is under the influence of a northern ramification of the Gulf Stream, the North Atlantic Current (NAC). This current forms a transitional zone between the productive cold polar system and the oligotrophic warm subtropical system. In addition, the NAC represents the northern boundary of the Portugal Current (PC) system which influences the modern surface oceanography off the IM at MD03-2699 site.
Coccolithophore data were carried out by sediments of MD03-2699 core for MIS 11 and MIS 1(Amore et al., 2012; Palumbo et al., 2013a,b) and by IODP Site U1313 for MIS 19 (Emanuele, 2013). The mean sampling resolution for MIS 1 is 140 yrs, for MIS 11 about 400 yrs and for MIS 19 about 220 yrs. The high samples resolution allowed reconstructing long term changes at orbital timescale as well as rapid changes at millennial scale. Data from coccolithophore assemblages were compared with available proxy for the studied cores such as alkenones, lithics, oxygen and carbon isotopes. Coccolithophores belong to phytoplankton group and they are widely used as proxy of surface water dynamics thanks to their attitude to record the smallest paleoclimatic changes and because they directly depend on sea surface temperature and salinity, sunlight and availability of nutrients.
Through the use of statistical analyses, a possible role of orbital parameters was hypothesised to drive changes in the main surface ocean currents (NAC and PC) causing changes in paleoproductivity. Abrupt coolings were recognised within coccolithophore assemblages during MIS 11and MIS 1 and related to iceberg-melting waters; similar coolings were also recognised during MIS 19.

References

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