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Deep ventilation process in Patagonian fjord, Chile

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The Puyuhuapi Fjord (44.6° S) has previously been reported as one of the hypoxic fjords in Chilean Patagonia (dissolved oxygen -DO below 2 mL L-1). Hydrographic sampling between 1995-2016 confirmed hypoxia below 100 m depth, down to the bottom (250 m). A line of sensors at an oceanographic mooring in Puyuhuapi were deployed to continuously record the temporal-vertical behaviour of water column temperature and salinity from the surface down to 120 m, from February to July 2015. A multi-Parameter water quality sonde was deployed at the bottom of the line, with a DO optical sensor. From February to mid-May, hypoxia was sustained (1.4-1.6 mL L-1). However, from May until the end of June, DO values increased (2.8 mL L-1), exceeding the hypoxia threshold. This was the first event of deep ventilation reported in a Chilean Patagonian Fjord. During this time period, deep water temperatures increased by 1.3 °C, coinciding with the decreased in salinity from 33.6 to 32.8. The main cause of this event was attributed to the arrival of a new volume of mixed oceanic water into the fjord, transported by Modified Subantartic Water, with warm temperatures, lower salinities and slightly higher DO values, given its origin in the surface layer of the outer oceanic region.
A new experiment was carried out during January-November, 2016 in order to corroborate the ventilation process and its connection with the adjacent ocean. Temperature, salinity and DO sensors were deployed in the outside fjords region close to the ocean (Melinka Channel) and in Puyuhuapi Fjord, to record the data at very high temporal resolution. The distance between both stations was 150 km. In the oceanic mooring the DO time series collected at 150 m depth showed hypoxia in summer related to the position of the Equatorial Sub-surface water, but from fall DO started to increase registering high values in August and September (4-5 mL/L) when the Subantartic Water arrive. The DO records in Puyuhuapi at 120 m showed a similar behaviour but with lower magnitude, confirmed the 2015 results. Winds and internal wave, registered with acoustic current profilers, contributed to this connection. The deep ventilation recorded in Patagonian Fjords would be helping to maintain their environmental health avoiding dead zones due to the increasing input of organic matter from salmon aquaculture.