Extreme temperature events in the semi-enclosed inner sea of Northern Chilean Patagonia

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I - Context

MHWs (MCSs) are anomalously warm (cold) sea temperature events lasting for days, weeks or months

They require **long-term datasets** (>30 years of data) to build a **climatology** that best **reflects the region**

They have **impacts on ecosystems**, causing mass mortality, forced migration, modification of ecosystem structure (e.g. phytoplanktonic assemblage)

Study area: **Northern Chilean Patagonia**

Coastal environments challenging due to the **lack of adequate data**

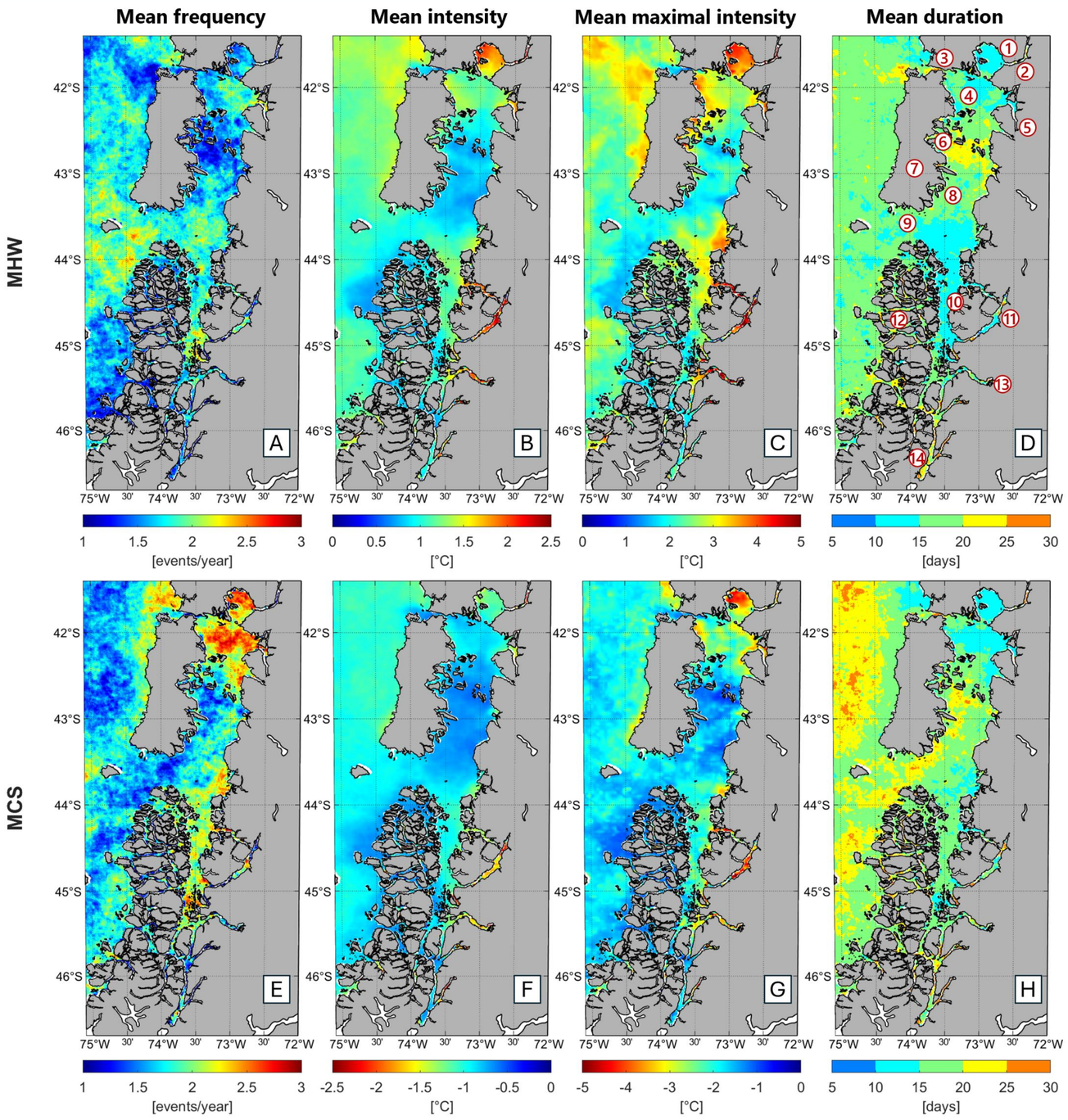
II - Method

Definition of MHWs and MCSs from Hobday et al. 2016: long-term climatology (>30 years of data), threshold : 90th (MHW) and 10th (MCS) percentile of the temperature dataset

Surface detection: build from **in situ and satellite data,** spatial resolution **900m** (Pujol et al., in prep.) → Resolves all fjords and channels of the study area

Subsurface detection: CMEMS **model**, spatial resolution 8km → Resolves only the main inner sea

III - General MHWs and MCSs characteristics in Chilean Patagonia



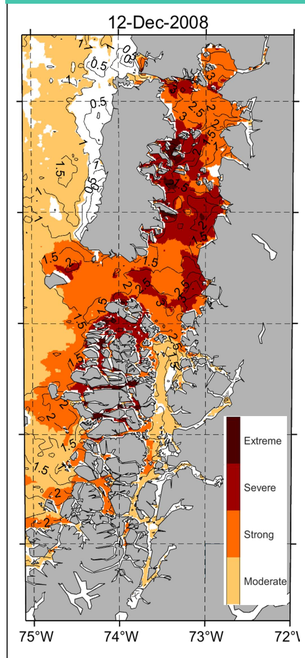
MHWs (up) and **MCSs** (bottom) show **heterogeneous dynamics** across Chilean Patagonia

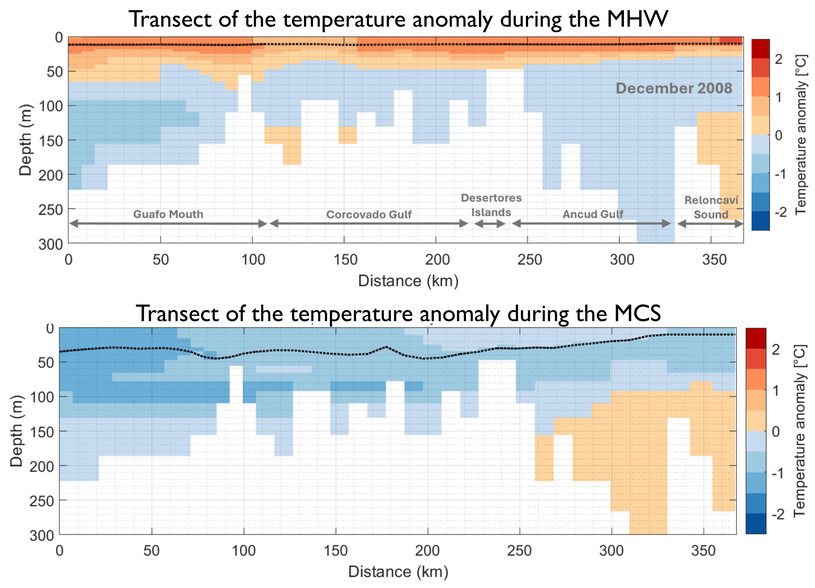
Enclosed basins (Fjords, Reloncaví Sound) show **higher intensities**, linked to **local processes** such as higher stratification

Puyuhuapi Fjord is the **most impacted** with average maximal intensity of 5°C during MHWs

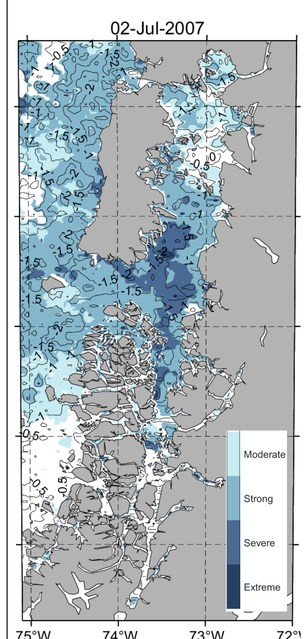
Trends in Chilean Patagonia show **increasing frequency and intensity of MHWs** and **decreasing frequency and intensity of MCSs**

IV - Typical MHW and MCS development





Heterogeneous development across Northern Patagonia



Corcovado Gulf/Chonos Archipelago: highest MHW/MCS category but relatively low SST anomaly → **regions of low thermal amplitude strongly affected weak temperature changes**

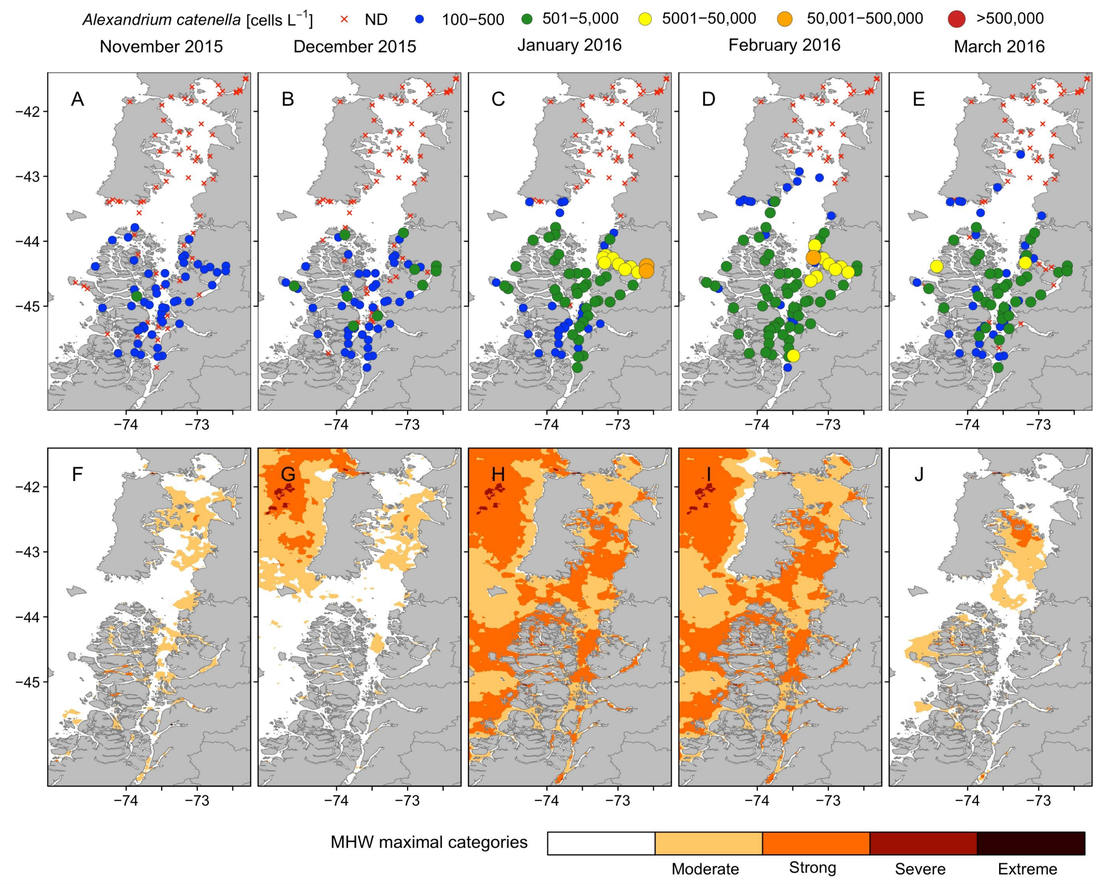
Reloncaví Gulf: SST anomalies > 3°C but "only" category 2 MHW → **region of higher temperature variability less affected by strong SST anomalies**

Vertically, MHW mainly present in the **upper layers**, linked with water masses distribution in Northern Patagonia

MHWs and MCSs vertical propagation influenced by topography (e.g. Desertores Islands)

MHWs (MCSs) in Northern Patagonia typically **influenced by atmospheric factors**: higher (lower) solar radiation, weaker (stronger) winds, atmospheric heatwave (cold spell), lower (higher) heat transfer from the ocean to the atmosphere, all drivers influenced by ENSO and SAM

V - Consequences of MHWs



***Alexandrium catenella* bloom** development **following the MHW**

Temperature rose above 12°C during the MHW → **optimum temperature development for *A. catenella***

Environmental factors also important: lower freshwater inputs and higher salinity, weaker vertical stratification

MHWs act as catalyst of *A. catenella* blooms in addition to other environmental factors

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