

Honolulu, Hawaii  
September 2019

## 1. The ICES Working Group on Hydrography

The International Council for the Exploration of the Sea (ICES) consists of a network of marine scientists that seek to coordinate with the ultimate goal of increasing the scientific knowledge of the marine environment and its living resources and to use this knowledge to provide unbiased, nonpolitical advice to competent authorities. ICES established the Working Group on Ocean Hydrography (WGOH) in 1976 to further the work done by the Hydrography Committee on data management and to coordinate cooperative hydrographic research within the framework of the World Meteorological Organization (WMO).

At that time, 15 years ahead of the creation of the Global Ocean Observing System (GOOS), the ICES WGOH represented a major partnership within the physical oceanography community and a valuable opportunity for international networking.

The WGOH has been active, meeting on a yearly basis, for more than 40 years. Currently, the WGOH is composed of nearly 50 members from 35 institutions and 18 countries around the North Atlantic region.



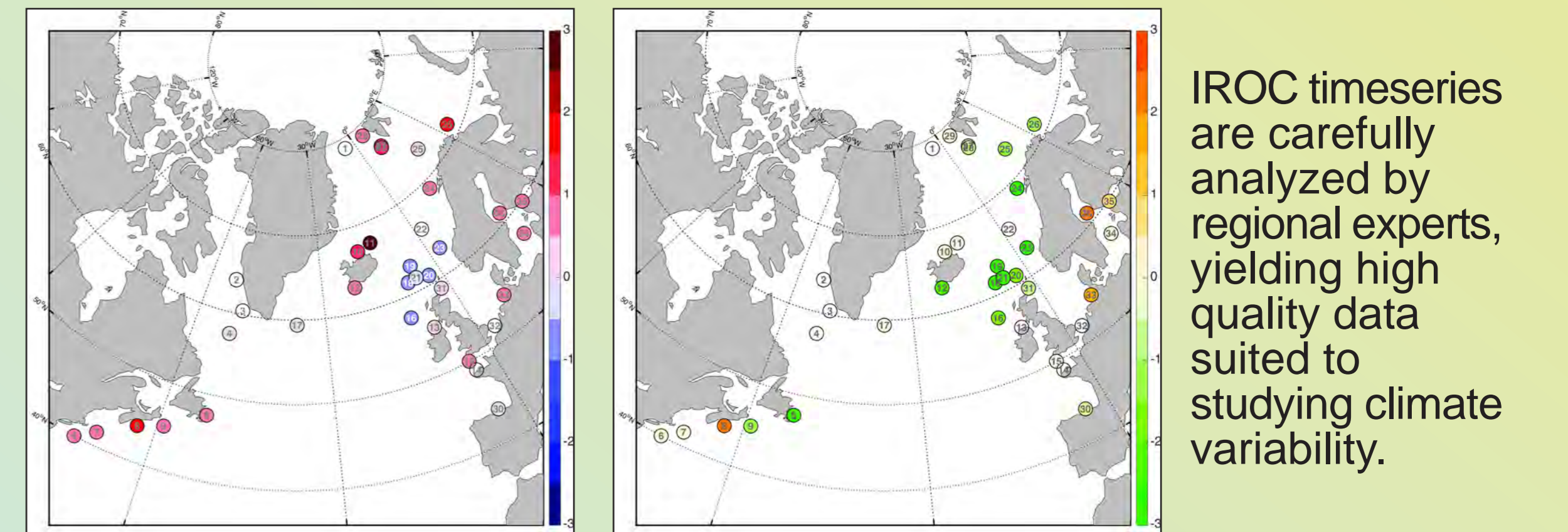
## 2. The ICES Report on Ocean Climate (IROC)

A central component of WGOH annual meetings since its formation has been a session devoted to regional reviews of ocean climate. The joint review of ocean status is valuable to other expert groups working on topics related to marine environment and ecosystems under the ICES umbrella. Since 1999 the WGOH has produced an annual Report on Ocean Climate (IROC) which summarizes trends in the regional hydrography and identifies patterns linking these changes across the North Atlantic.

WGOH analyses are based predominantly on existing repeated long-term in-situ hydrographic observations at stations and sections around the North Atlantic, the Nordic Seas and adjacent shelf seas, including the coastal, shelf and deep ocean. These timeseries are considered representative at regional scale, providing notable coverage of the shelf seas and ocean boundaries. Some of these timeseries are the longest running in the world, becoming more valuable with each passing year of continued measurement. The last two decades have yielded outstanding advances in routine automated sampling of the ocean with the Argo array, and the IROC has evolved to include this information in its analysis.

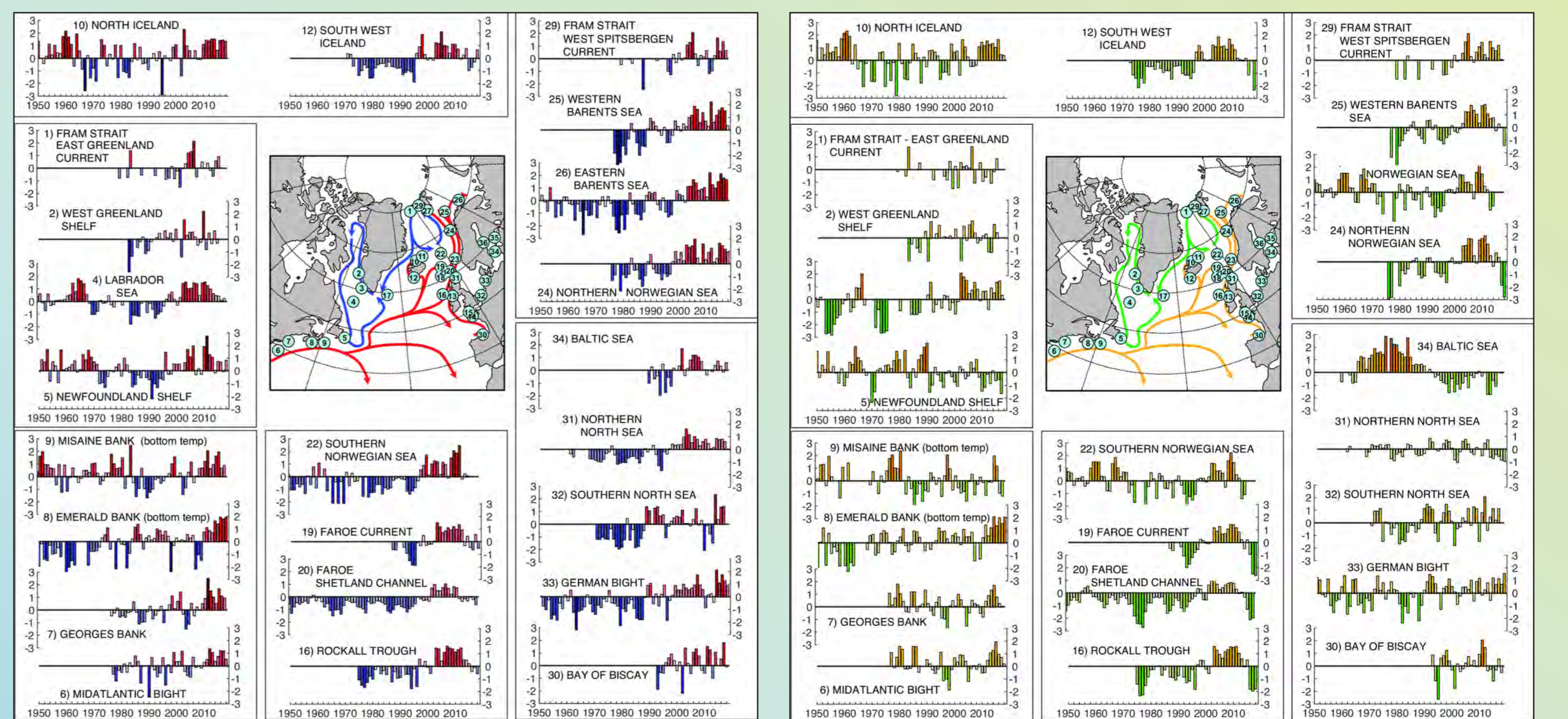
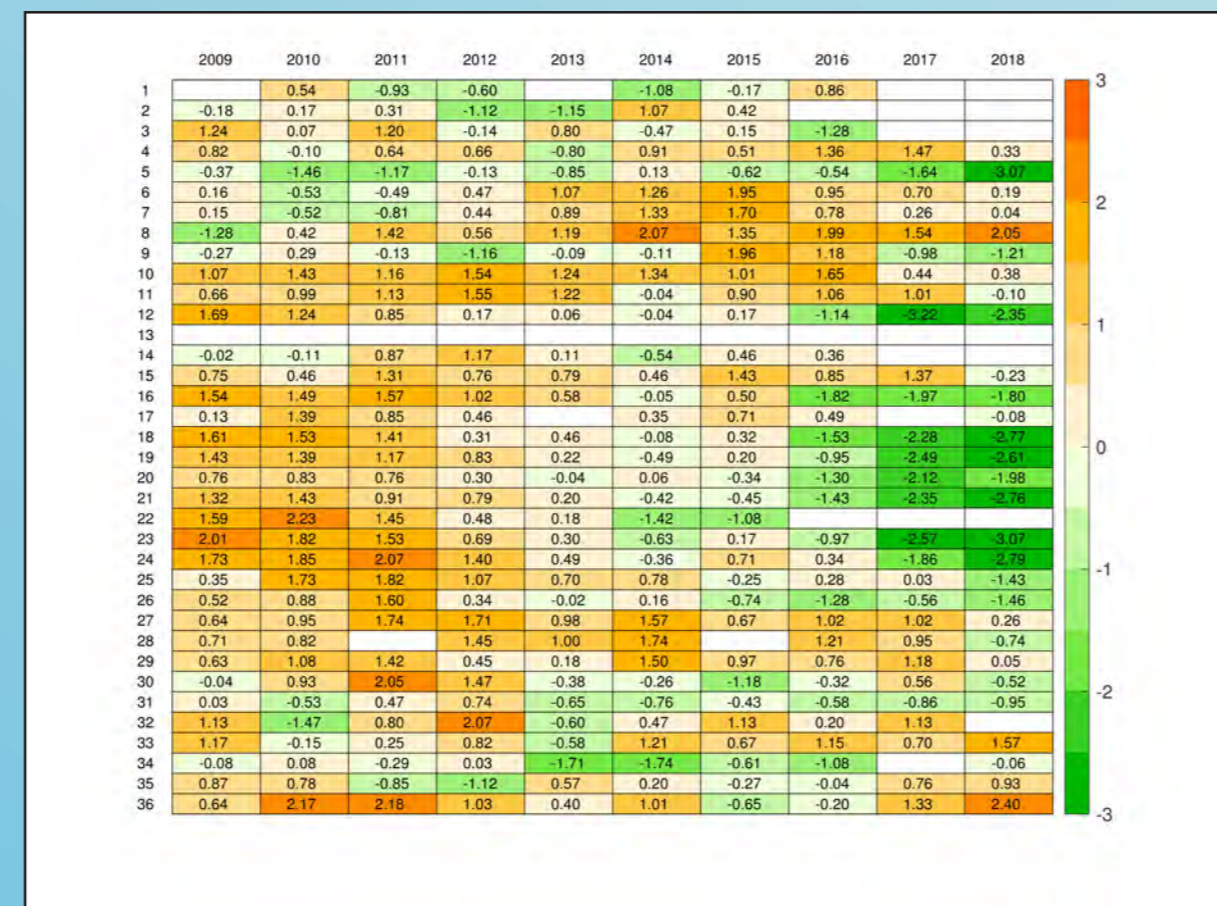
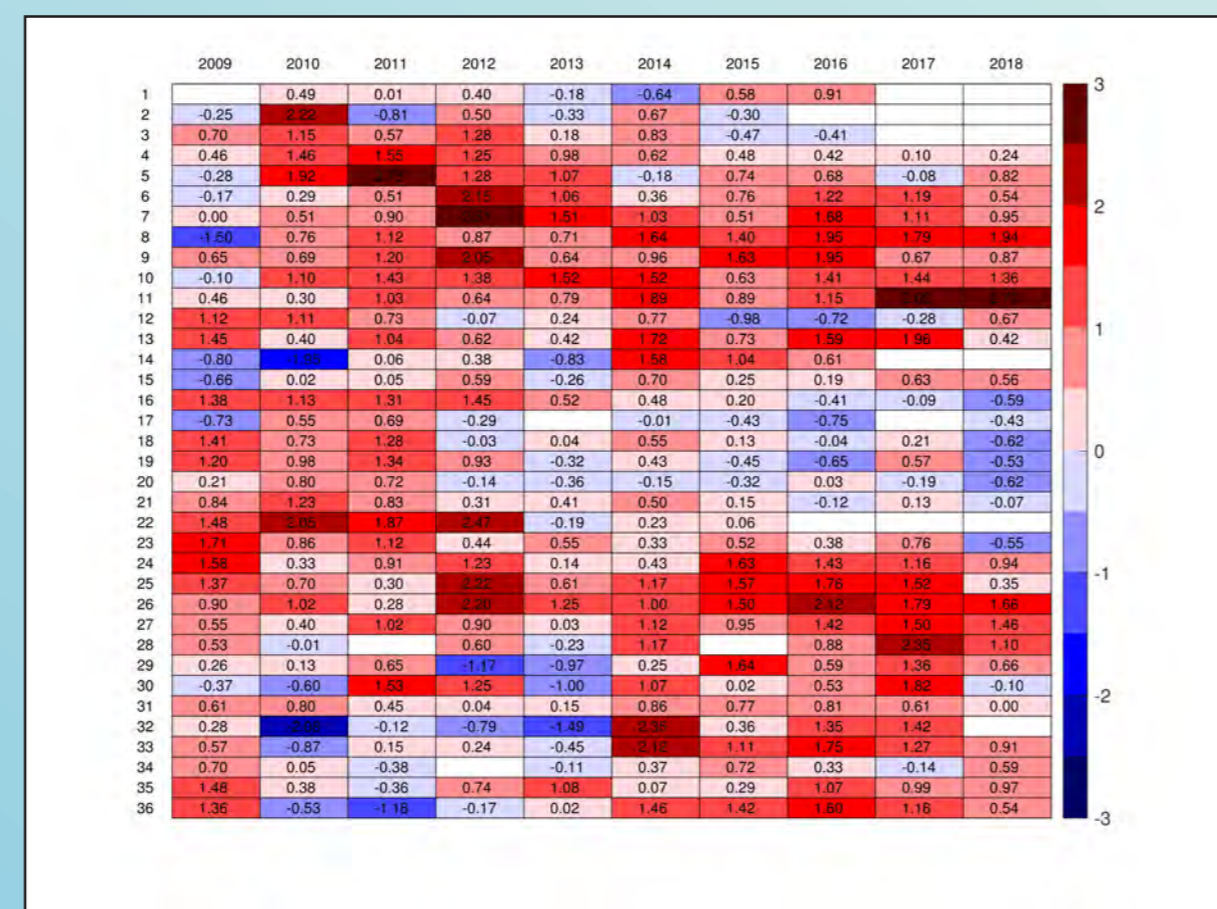
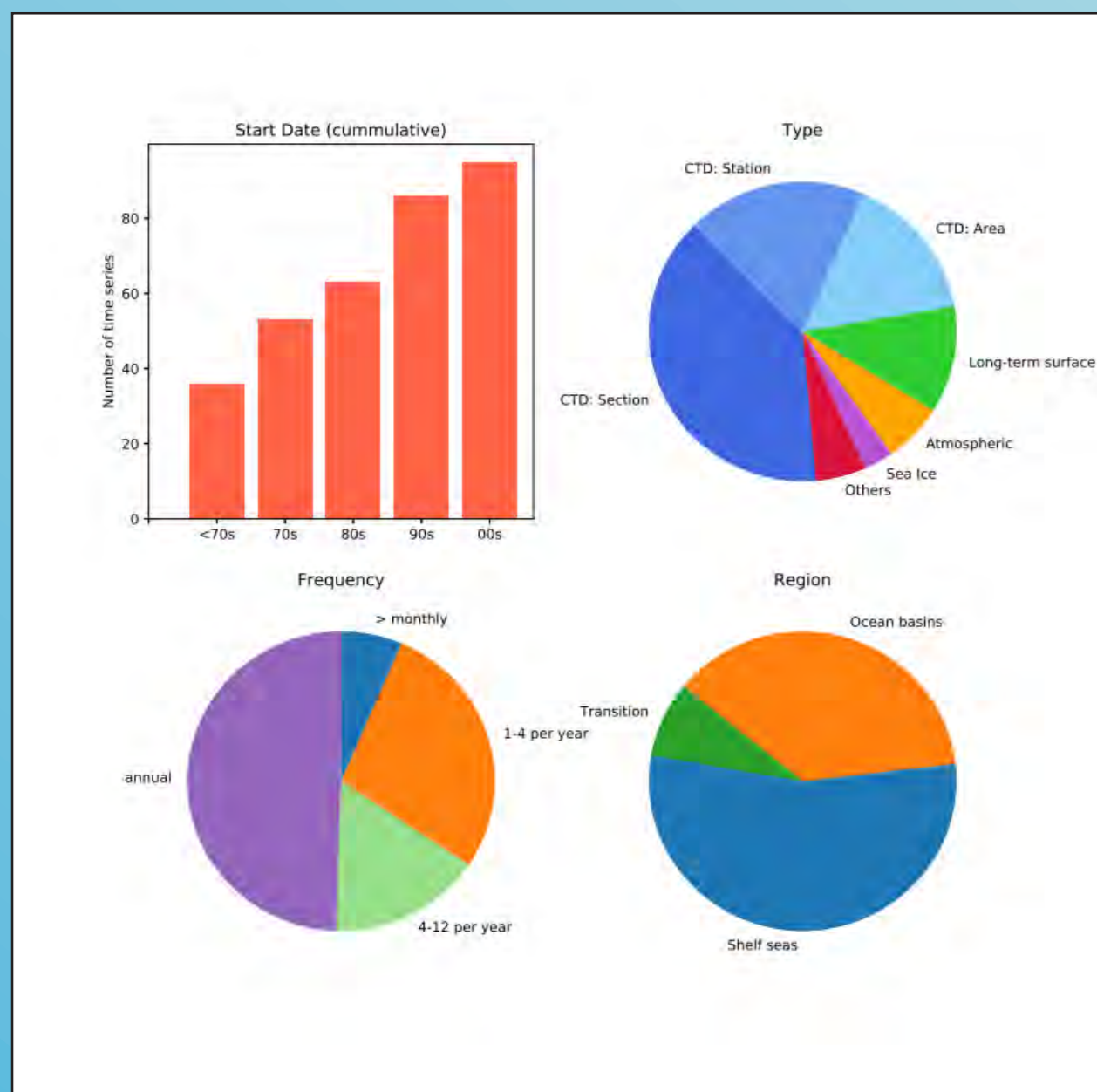


The IROC begins with a general summary of hydrographic conditions in the North Atlantic, including a list of highlights for the current year that have been compiled by the working group at the annual meeting. The remainder of the report consists of more detailed descriptions of conditions within specific regions for the upper and deep waters.



IROC timeseries are carefully analyzed by regional experts, yielding high quality data suited to studying climate variability.

The report currently includes 95 individual timeseries from 76 locations, provided by 32 organizations across 15 countries.



In recent years, conditions in the North Atlantic have been dominated by expanding accelerated freshening in the upper ocean, contrasting with the strong salinification that was observed one decade earlier.

## 3. WGOH, IROC and the Global Ocean Observing System

The IROC is compiled from the collective input of regional experts. These experts apply their specialized knowledge to construct observational timeseries that are considered the most representative of hydrographic change in a given region. This is what makes the IROC unique relative to other comprehensive Ocean/Climate Status Reports, e.g. Copernicus (von Schuckmann et. al., 2018) or BAMS (Hartfield et. al. 2018). Hence, the IROC is not simply a data repository but a heterogeneous collection of specialized timeseries. IROC users tend to be marine ecologists and/or fisheries scientists who seek oceanographic context to frame a regional fisheries-related question, while keeping in mind the broader basin-scale condition.

IROC timeseries offer significant added value to GOOS programs. In particular, (i) IROC observations sample the deep ocean in a variety of locations across the North Atlantic, filling a major gap in present day GOOS where deep observations (> 2000 m) are limited to GO-SHIP sections (Deep Argo floats and deep gliders still have a long way to fully cover the gap) and (ii) IROC observations bridge a gap between the blue ocean and regional seas, shelves and oceanic boundaries, where most classical monitoring programs take place but the Argo network cannot access. Further, in-situ hydrography remains essential for the groundtruthing of data from autonomous vehicles and profiling floats. We argue that traditional ship-based hydrographical observations will be required well into the future.

WGOH continues a long tradition of international collaboration, bringing together physical oceanographers with regional expertise and a rich collection of ocean data to contribute to this annual assessment. While global ocean observation has evolved in the past decade, greatly increasing in volume and complexity, the WGOH-IROC continues to be a key link between regional ocean monitoring and research, and actual policy advice. Looking toward the future, ICES-WGOH has much to offer the burgeoning GOOS community, including a history of observations in key areas of the ocean and experience in meeting the needs of fisheries scientists. However, further engagement with GOOS is essential. WGOH will continue to track key observational timeseries, stressing continuity and quality while working to incorporate these data into the GOOS system.

References:

- \* González-Pola, C., Larsen, KMH, Fratantoni, P. and Beszczynska-Möller, A (Eds.) (2019). ICES Report on Ocean Climate 2018. ICES Cooperative Research Report No. 349. 122 pp. doi: 10.17895/ices.pub.5461
- \* Hartfield, G., Blunden, J., and Amdt, D. S. (2018). State of the climate in 2017. Bull. Am. Meteorol. Soc. 99, S1-S310. doi: 10.1175/2018bamsstateofthecclimate.1
- \* von Schuckmann, K., Traon, P.-Y.L., Smith, N., Pascual, A., Brasseur, P., Fennel, K. et al. (2018). Copernicus Marine Service Ocean State Report. Journal of Operational Oceanography, 11(sup1):S1-S142. doi: 10.1080/1755876x.2018.1489208

An interactive web version of the report, maintained in collaboration with the ICES Data Center, allows users to browse and download the data that inform the IROC. Summary highlights for current year conditions are posted immediately following the WG annual meeting. The summary colour-coded table and reports from previous years are also provided in the web page.

<https://ocean.ices.dk/iroc/>

