The Marine Climate Data Centre
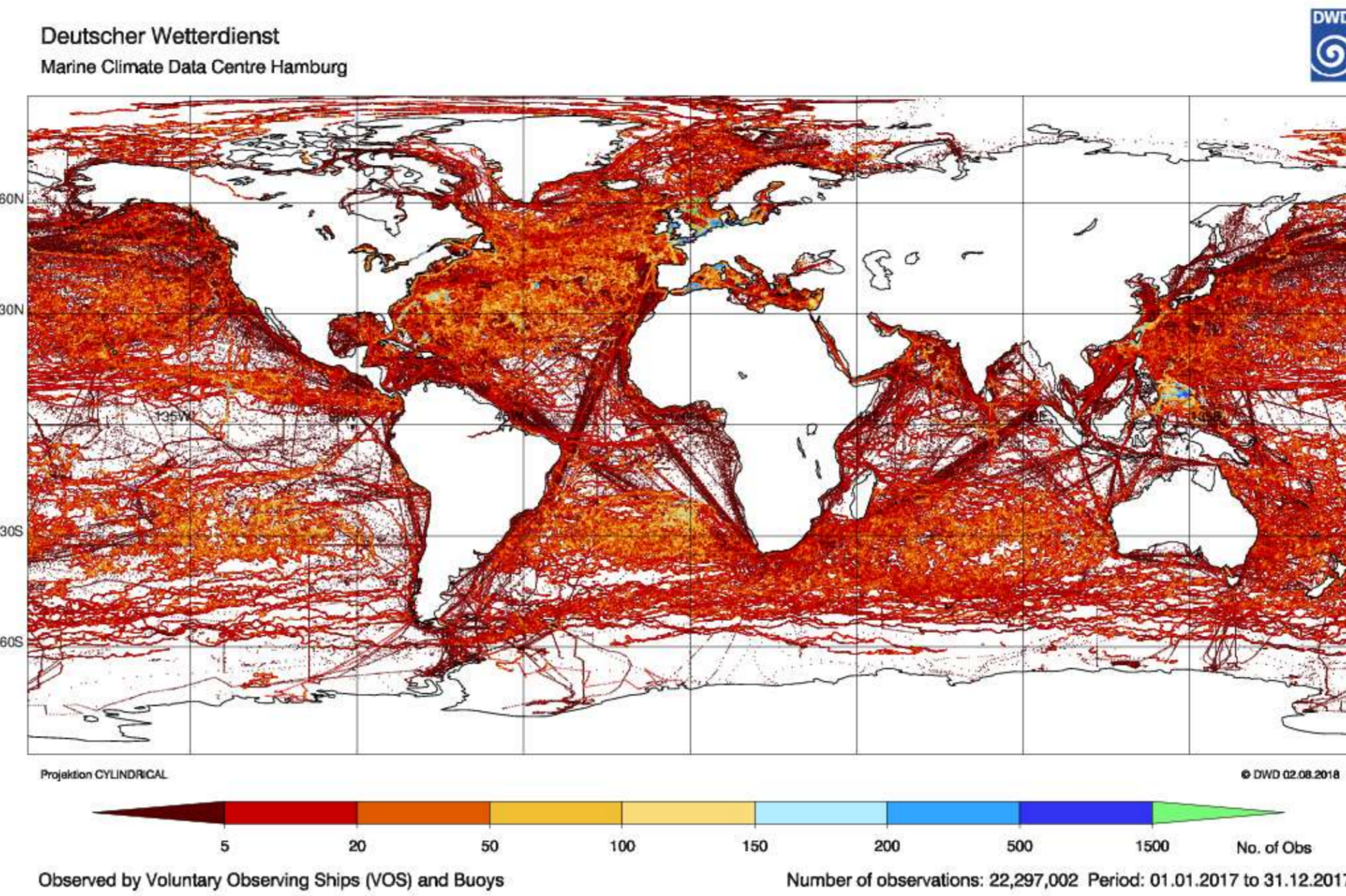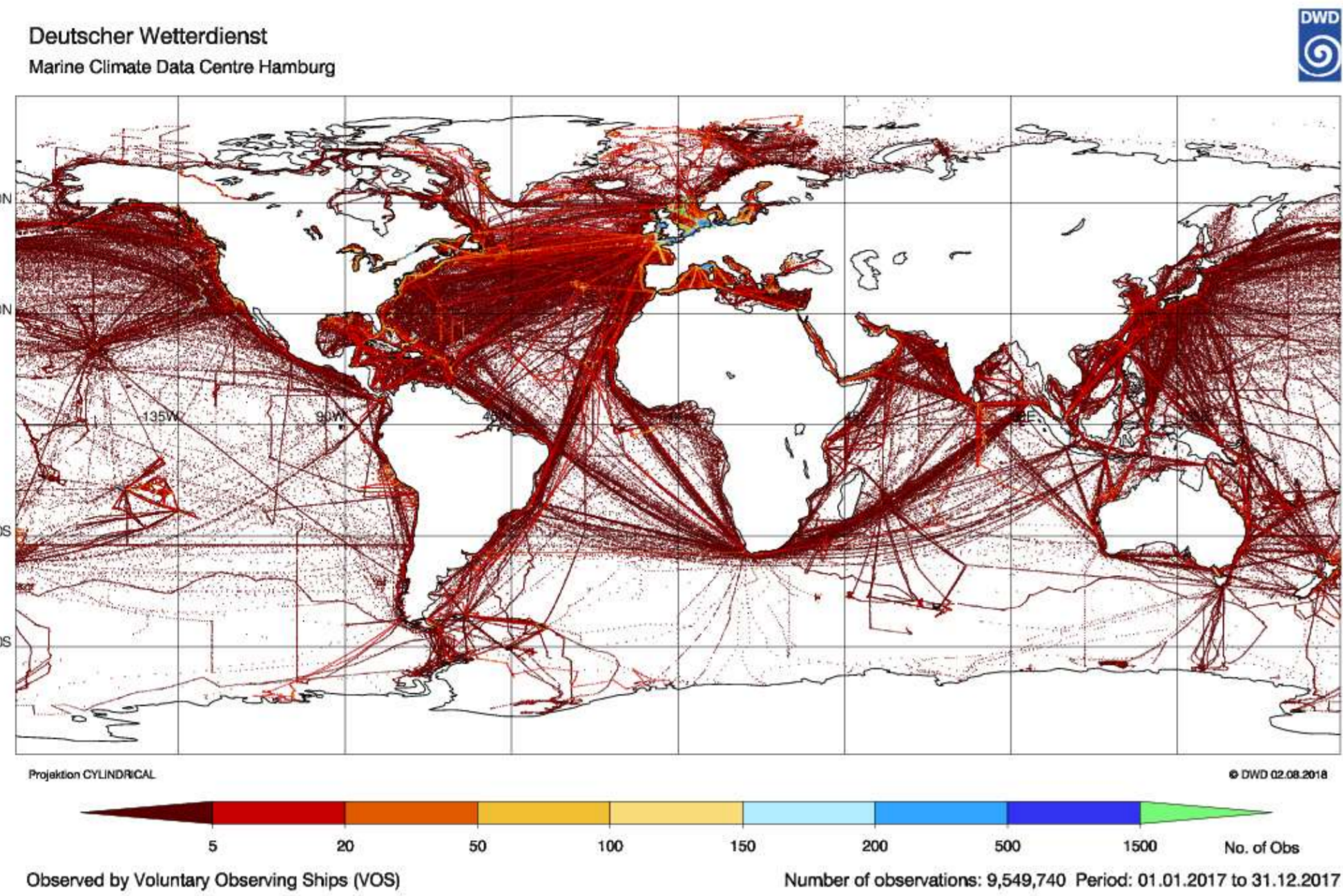# of Deutscher Wetterdienst in Hamburg

Lydia Gates, Axel Andersson, Hildrun Otten-Balaccanu, Martina Schulz

### Elements observed by Voluntary Observing Ships (VOS)

Many important parameters for climate monitoring are observed by VOS:
- atmospheric pressure & tendency
- sea surface temperature
- wind speed and direction
- air temperature
- humidity (dew point)
- cloud amount, types and height of base
- sea ice and/or icing
- direction, period and height of waves
- visibility
- present and past weather, special phenomena
- Navigational information (position, course and speed)

The DWD Marine Climate Data Centre provides quality controlled datasets of these parameters.

The Marine Climate Data Centre of Deutscher Wetterdienst maintains an extensive climatological archive of quality controlled marine surface and atmospheric observations. Apart from recent data, the archive consists of a large amount of historic data ranging back to the mid-19th century. Data from the archive is freely available and is used in a variety of applications, such as operational climate monitoring and international data exchange in the context of the JCOMM Marine Climate Data System (MCDS).

Data Flow
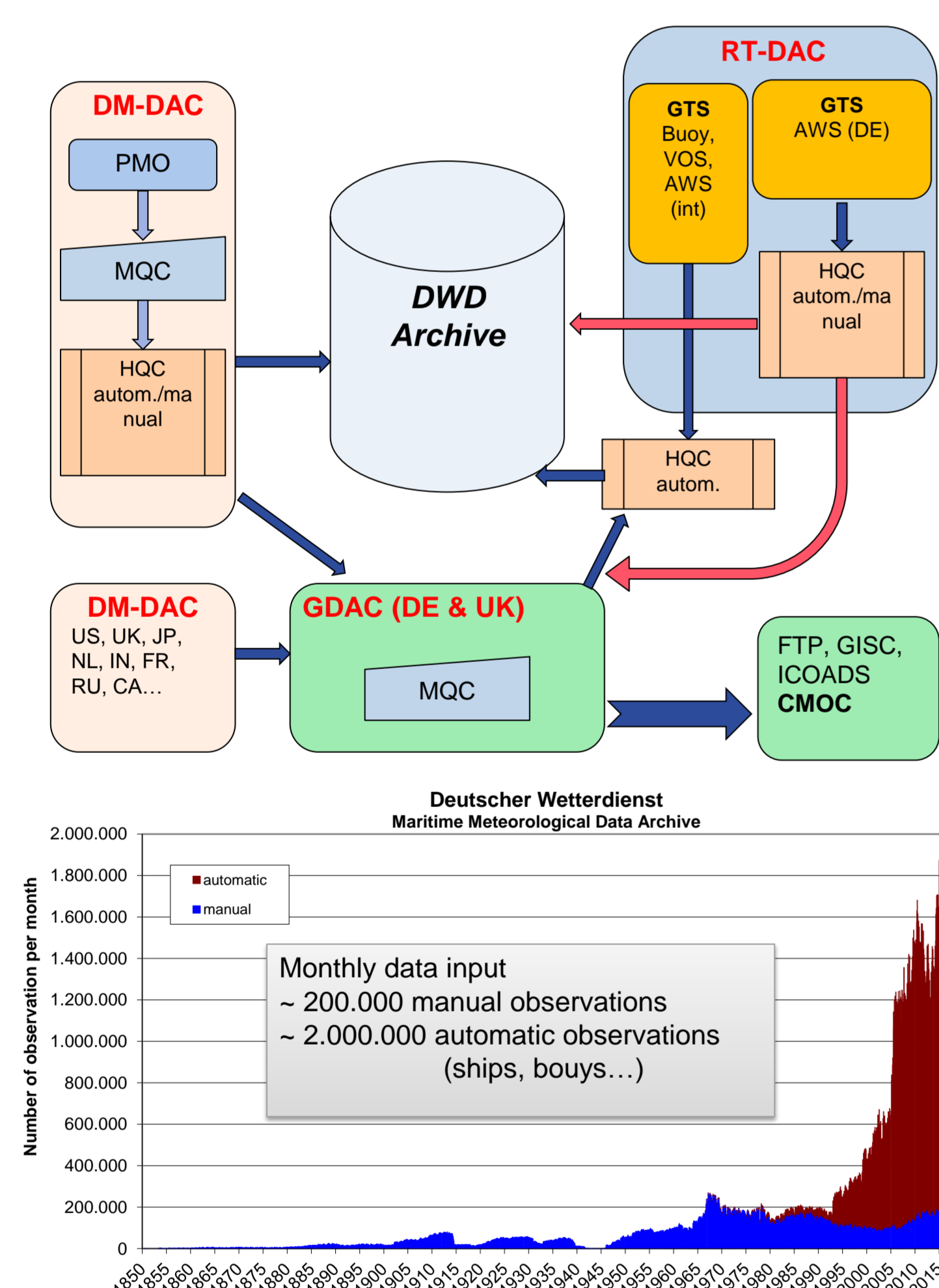
Several data streams are combined into a consolidated archive with regular additions of data. Real-time data from ships, buoys and other marine measurement platforms are automatically retrieved in near real-time from the Global Telecommunications System (GTS). Another important data contribution are delayed-mode observations from Voluntary Observing Ships (VOS). Historic ship observations and data from stationary measurements, such as from the research platforms in the North and Baltic Sea (FINO 1,2,3) complement the available data.
The total archive contents are more than 400 Million individual observations from ~1850 to present.

Figure 1: a) Data flow in the Marine Climate Data Centre from data input to dissemination (top)
b) Monthly data input of the data centre (bottom)

Monthly data input
~ 200.000 manual observations
~ 2.000.000 automatic observations
(ships, buoys…)

Quality Control

All incoming observations are routinely checked with a two step quality control procedure that performs several formal and meteorological checks on the data. The first check is a minimum quality control (MQC) check, the second step is a thorough inspection of the data with a high quality control procedure (HQC). The data is only flagged, no adjustments or changes are made.
German VOS data are additionally quality checked with a manual route check, automatic HQC and manual re-examination of the flagged values.

WMO Minimum Quality Control Standard, MQCS-7:
- Tests on individual reports
- Static (climatological) limits
- Simple tests for inner consistency

DWD High Quality Control (HQC):
- Time sequence test of observations from one specific ship/platform
- Check for correct position, land/sea test, displacement, route check
- Internal consistency of message
- Climatological validity
- Checks for jumps, spikes, repetition
- Neighborhood test
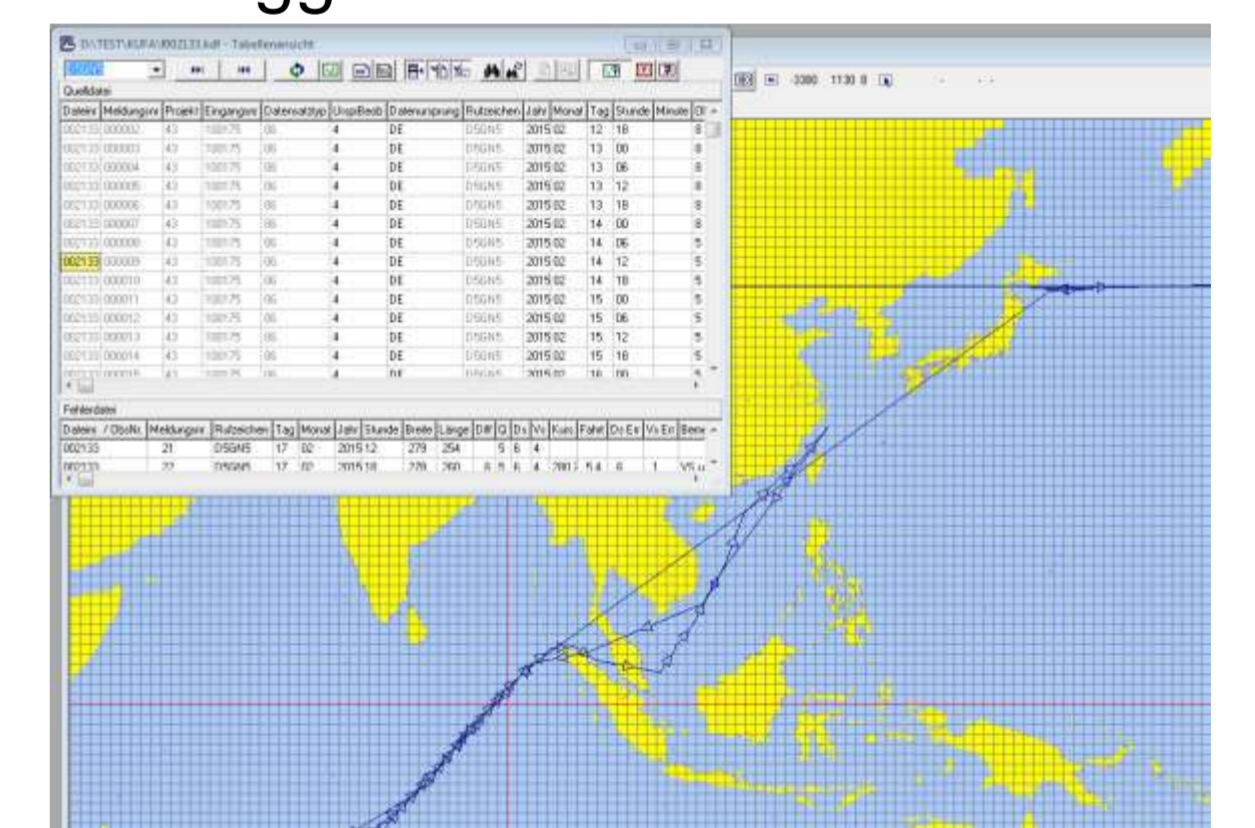- Possibility for manual re-inspection of the flagged values

Figure 3: Route check of VOS observations

JCOMM Marine Climate Data System

International Exchange of Marine Climate Data

The JCOMM Marine Climate Data System (MCDS) is currently in its implementation phase and will be fully operational by 2020. The aim of the MCDS is to formalize and coordinate the activities of existing international marine meteorological and oceanographic data systems in order to produce a dedicated WMO-IOC operational data system with data sets of known quality, extending beyond the Essential Climate Variables. Data and metadata are collected from multiple real-time and delayed mode sources to be served on a free and unrestricted basis to the end users. DWD's Marine Climate Data Centre operates one of two VOS GDACs within the MCDS.
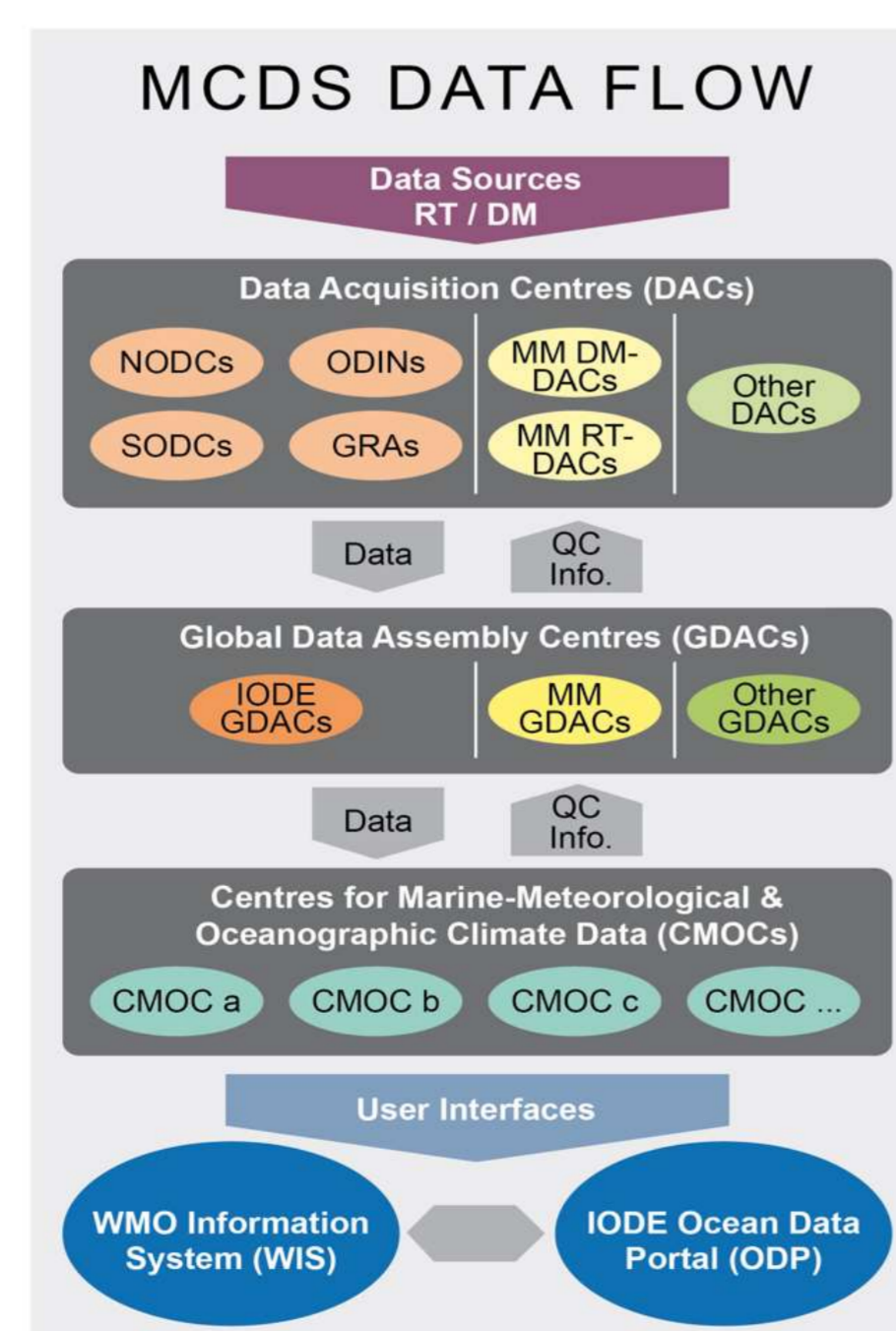

Figure 2: Schematic view of data flow in the MCDS
DAC = Data Acquisition Centre
GDAC = Global Data Assembly Centre
CMOC = Centre for Marine Meteorological and Oceanographic Climate Data

Application Examples

KLIWAS North Sea Climatology
- Developed in the frame of the research program "KLIWAS" (Klimawandel und Wasserstraßen) of the BMVBS, cooperation of CliSAP (UHH), BSH, and DWD
- Hydrographic and meteorological climatologies of the North Sea and surrounding regions
- Based on quality controlled in-situ data only
- Data: gridded yearly and monthly mean (met. 1950-2010, ocean 1873-2013)
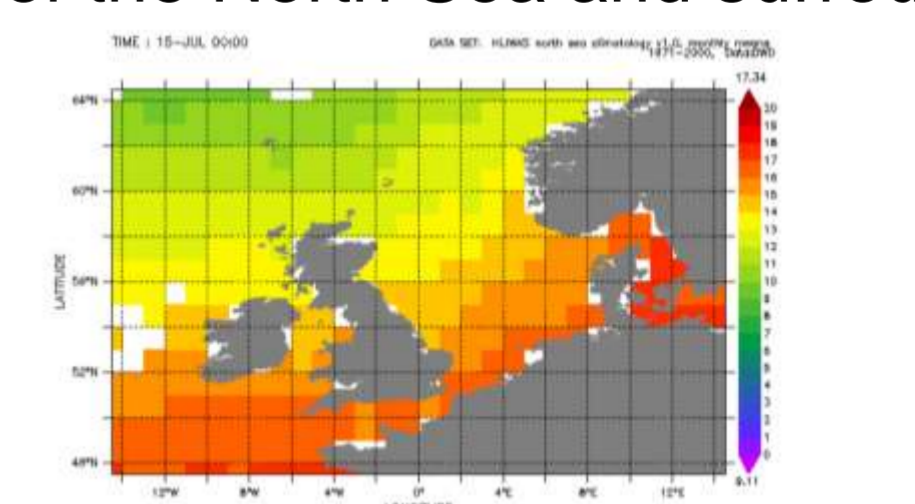- Available from Integrated Climate Data Center (http://icdc.cen.uni-hamburg.de/knsc.html)

Figure 4: Example from the KLIWAS North Sea Climatology

Satellite Data Validation / Error Characterization

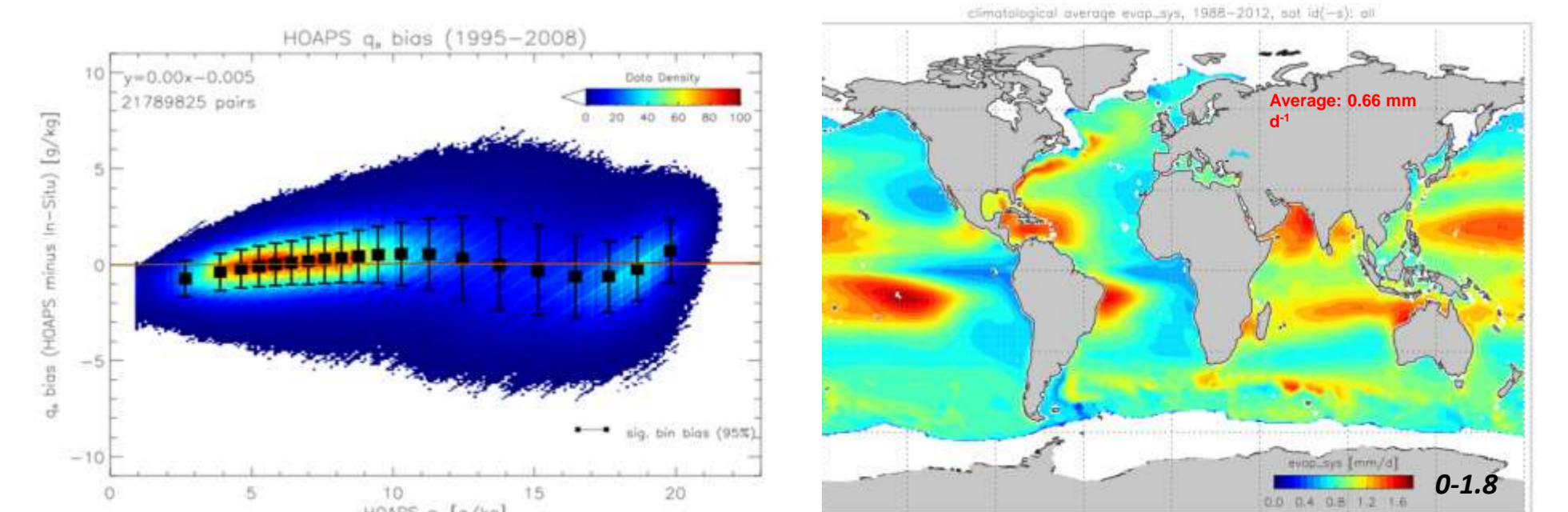Uncertainty estimates for HOAPS turbulent fluxes are derived from multiple triple collocation with data from the DWD Marine Climate Data Centre.

Figure 5: Error analyses of HOAPS Qa and evaporation

Contact for data access: lydia.gates@dwd.de / axel.andersson@dwd.de