The Marine Climate Data System (MCDS)

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GCOS Breakout Group on Global Climate Data Centres

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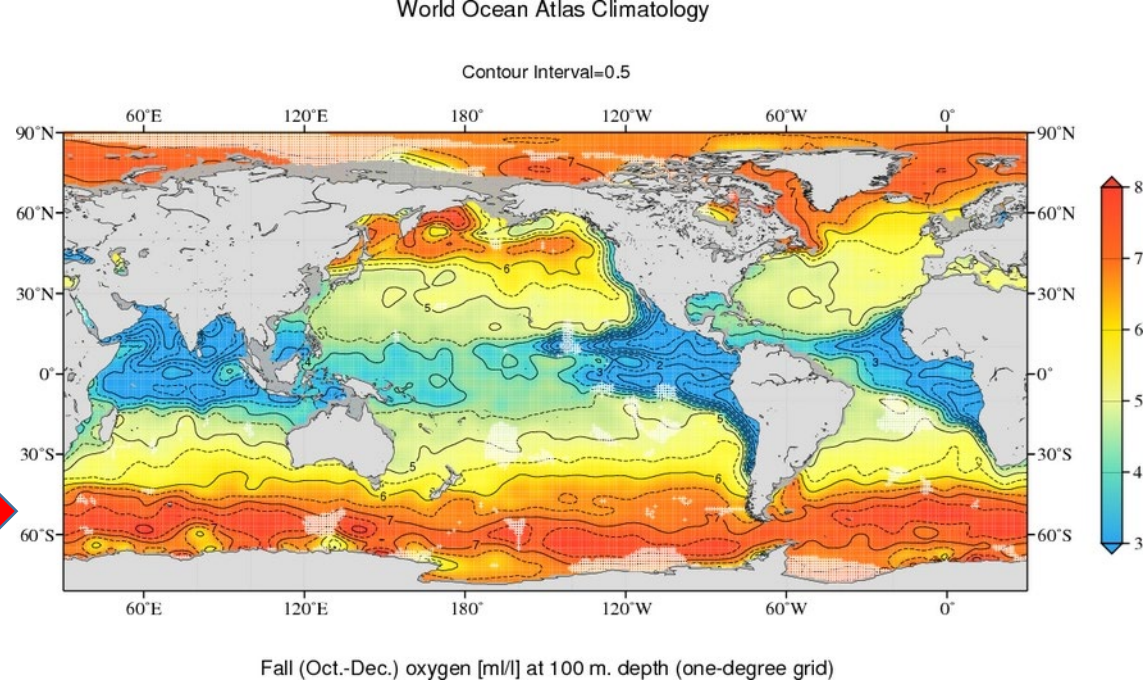
Outline

- PREDECESSOR, DEFINITIONS
- MCDS BASIC STRUCTURE
- MCDS EXAMPLE FLOWS
- MCDS ESTABLISHMENT AND PROCEDURES - WMO PUBLICATIONS
- WORLD OCEAN DATABASE INTRODUCTION: EXAMPLE OF DATA FLOW
- BUILDING THE OCEAN PROFILE MCDS
- CMOC FUNCTION
- WHAT CAN BE DONE IMMEDIATELY WITHIN THE MCDS
- SUMMARY

DEFINITIONS

MARINE CLIMATOLOGY: MEAN CONDITIONS OF A MARINE VARIABLE OVER A SET TIME PERIOD OVER A SET AREA [e.g. daily air temperature over the Banda Sea Oct 22, 2017; seasonal dissolved oxygen over the global ocean 1955-2006]



(near) real-time (RT) data: observations transmitted to users within a short time after measurement (3 hours for marine meteorology, 48 hours for ocean profiles). Necessary for short-term marine climatologies and forecast models.

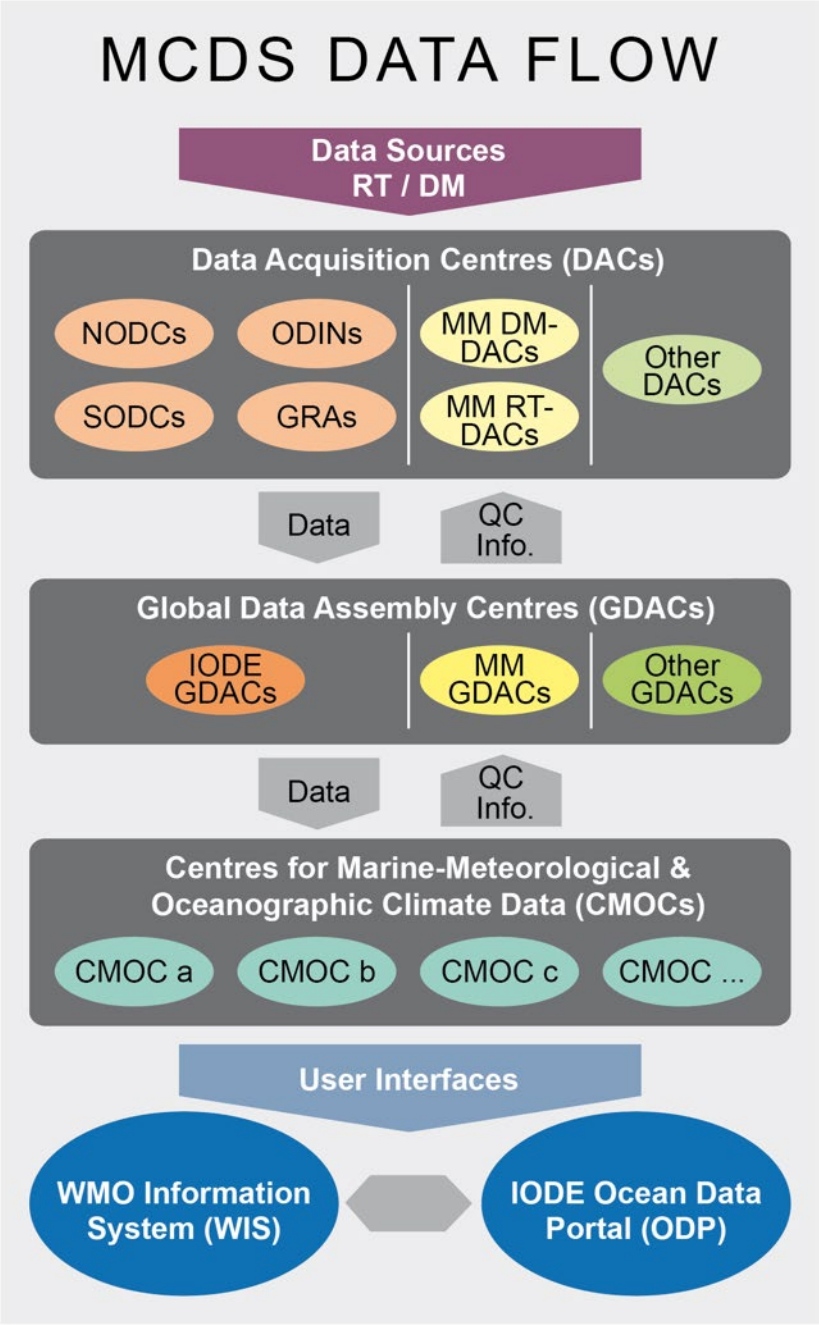
Delayed-mode (DM) data: observations conveyed to users and to data repository for long-term storage, usually after additional calibration and/or quality assurance. Used for research and climate products

OCEAN PROFILE: MEASUREMENT OF ONE OR MORE OCEAN VARIABLES VS. DEPTH (PRESSURE) AT MORE THAN ONE LEVEL BETWEEN THE SURFACE AND THE OCEAN BOTTOM AT THE SAME POSITION/DATE/TIME.
OCEAN CAST: SET OF CONCURRENT OCEAN PROFILE MEASUREMENTS

The Marine Climate Summaries Scheme (MCSS)

- **Established 1963**
- **primary objective the international exchange, quality control and archival of delayed-mode marine climatological data, in support of global climate studies and the provision of a range of marine climatological services**
- **Main functions: (a) Delayed-mode (DM) Voluntary Observing Ship (VOS) Data Management; (b) The production of the MCSS (tabular/graphical) Summaries (MCS).**

Source: DRAFT JCOMM STRATEGY TO REALIZE THE VISION FOR A NEW MARINE CLIMATE DATA SYSTEM (MCDS), Woodruff et al, 2011



MCDS Structure

A well formed MCDS enables establishment of a much needed operational international path for acquisition and for sharing of relevant public access delayed-mode global marine meteorological and oceanographic data leveraging existing tested resources.

NODC	=	IODE National Oceanographic Data Centre
SODC	=	IODE Specialized Ocean Data Centre
ODIN	=	Ocean Data and Information Networks
GRA	=	GOOS Regional Alliances
MM	=	Marine Meteorological
DM	=	Delayed-mode data
RT	=	Real-time data
DAC	=	Data Acquisition Centre
GDAC	=	Global Data Assembly Centre
CMOC	=	Centre for Marine Meteorological and Oceanographic Climate Data
QC	=	Quality Control

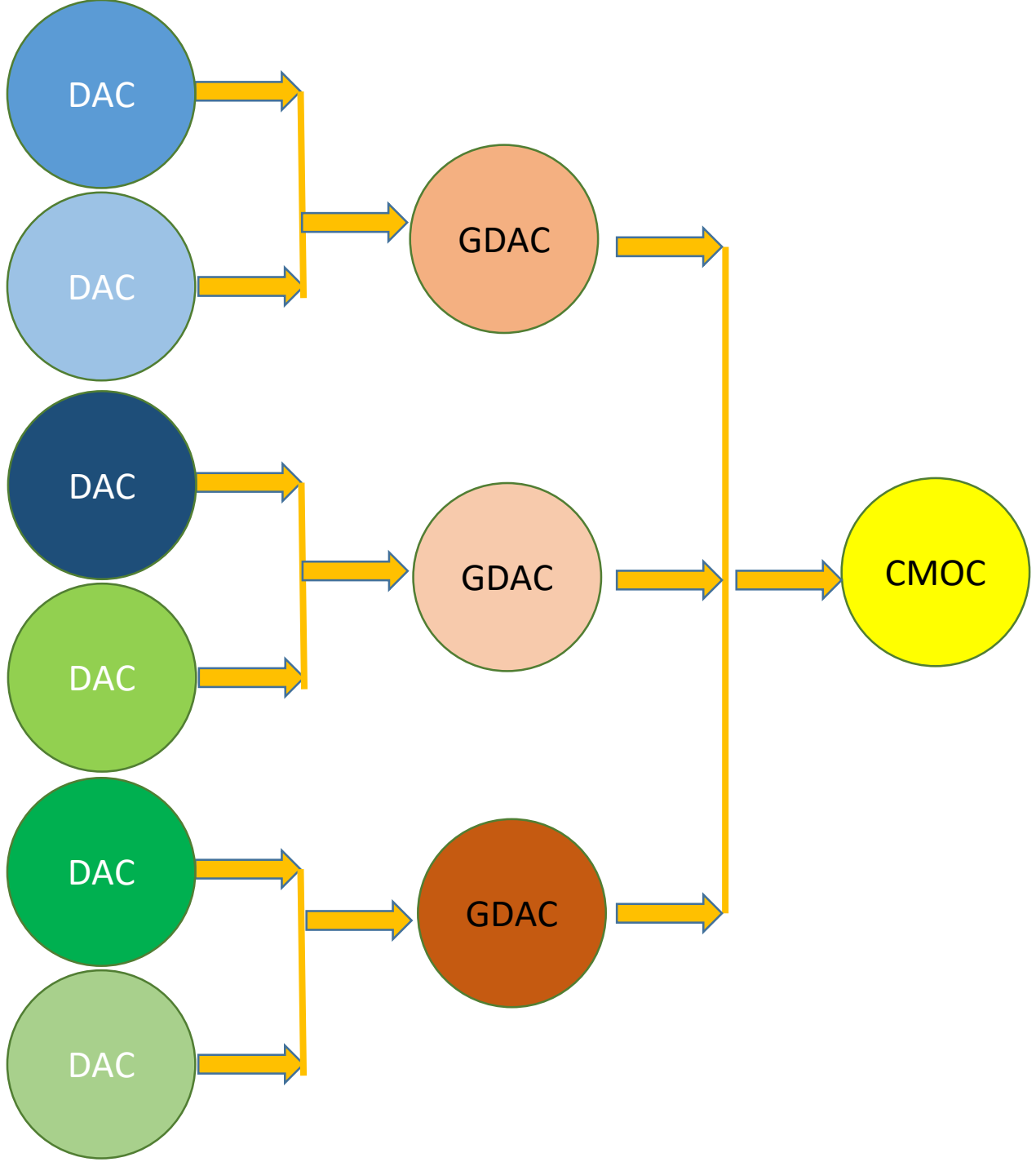
Simplified MCDS Structure

Three main components

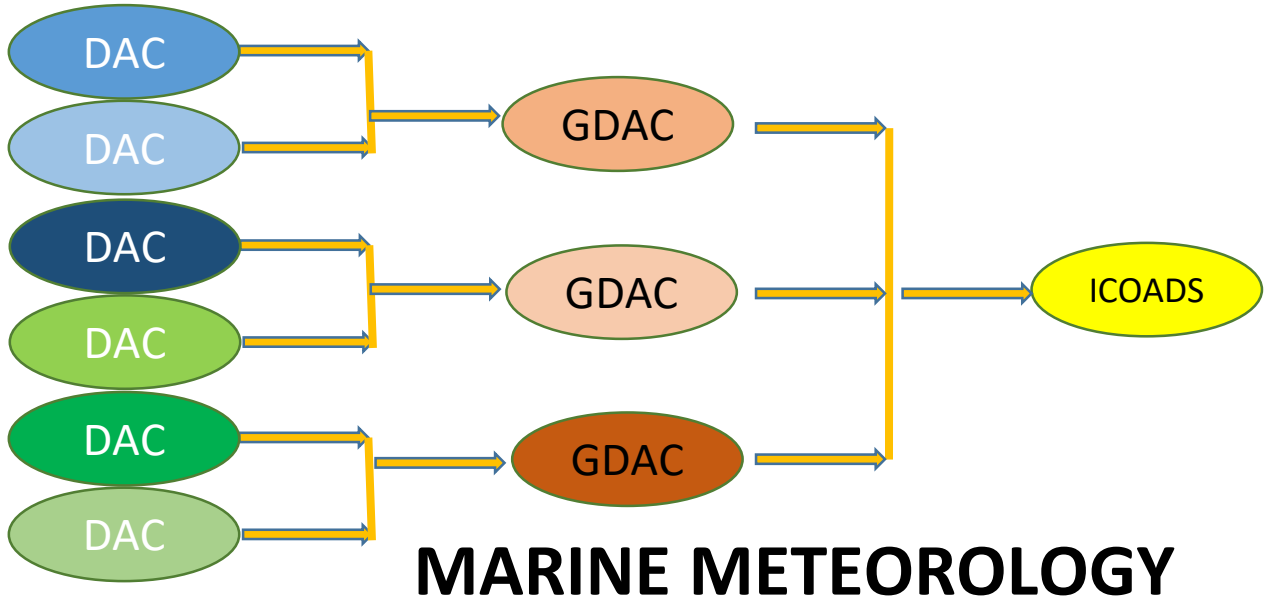
Data Acquisition Center (DAC): first line data receiver – directly from measurement source

Global Data Assembly Center (GDAC): world-wide aggregation for specific observation system

Center for Marine Meteorology and Oceanographic Climate Data (CMOC): Aggregates all relevant data types for a specific set of environmental variables

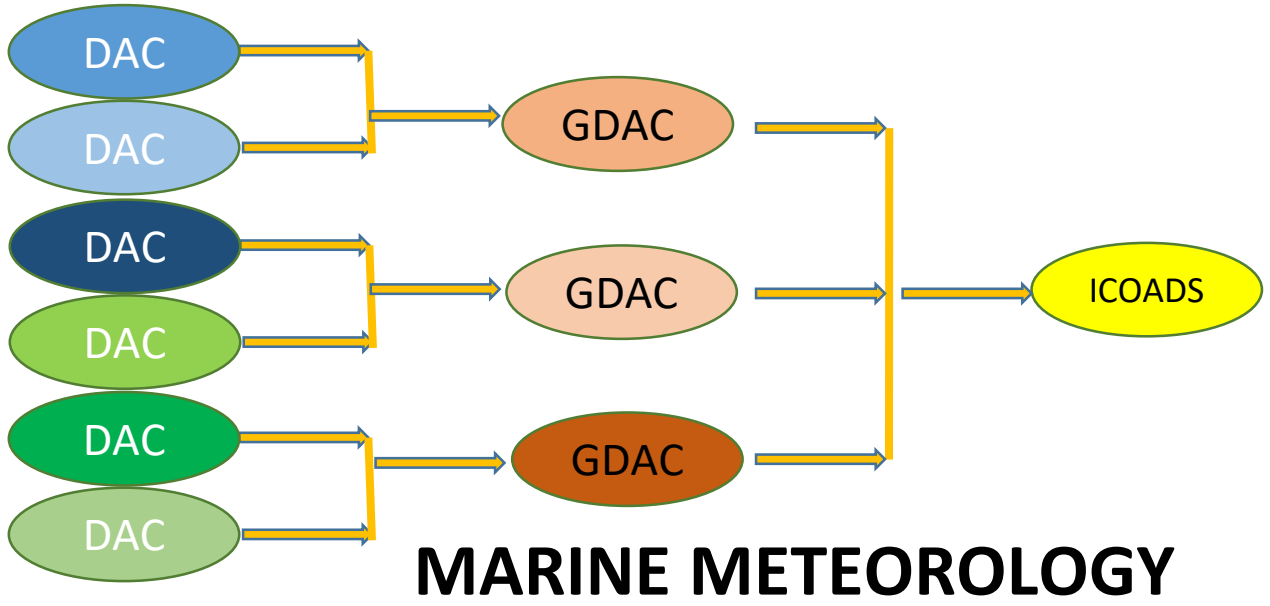


SIX TO TEN MCDS AREAS ENVISIONED
1. MARINE METEOROLOGY – SUCCESSOR TO THE MCSS WITH ICOADS AS CMOC

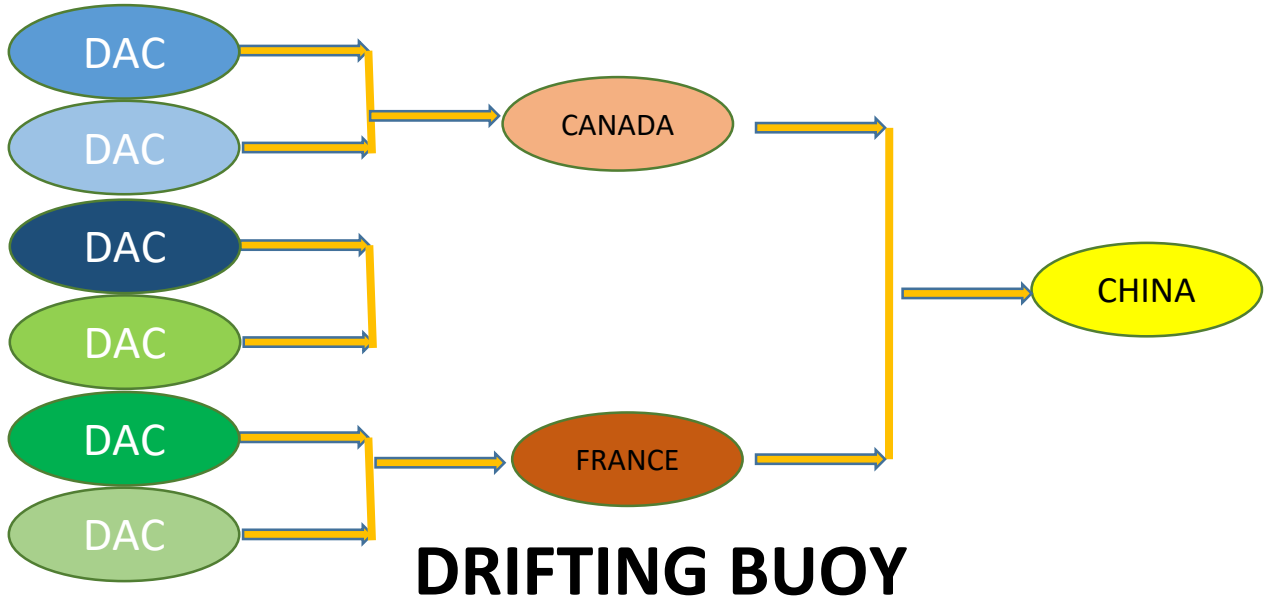


SIX TO TEN MCDS AREAS ENVISIONED

1. **MARINE METEOROLOGY – SUCCESSOR TO THE MCSS WITH ICOADS AS CMOC**
2. **DRIFTING SURFACE DROGUE BUOYS – CMOC CHINA, GDAC CANADA, FRANCE**



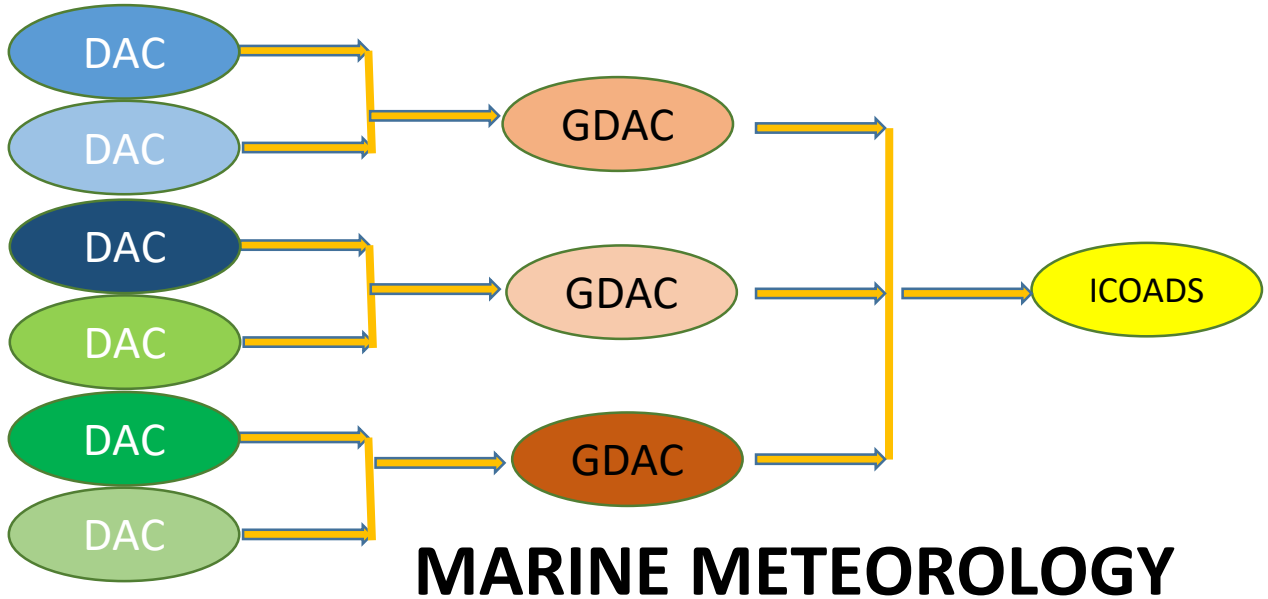
MARINE METEOROLOGY



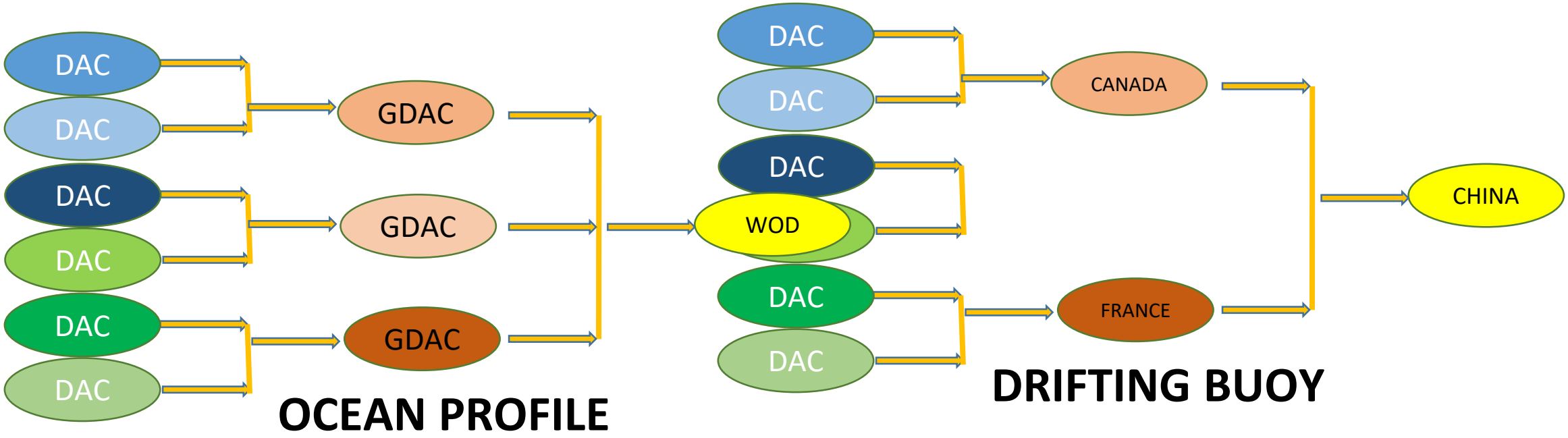
DRIFTING BUOY

SIX TO TEN MCDS AREAS ENVISIONED

1. **MARINE METEOROLOGY – SUCCESSOR TO THE MCSS WITH ICOADS AS CMOC**
2. **DRIFTING SURFACE DROGUE BUOYS – CMOC CHINA, GDAC CANADA, FRANCE**
3. **OCEAN PROFILE – SUBSURFACE PHYSICAL, CHEMICAL VARIABLES**



MARINE METEOROLOGY

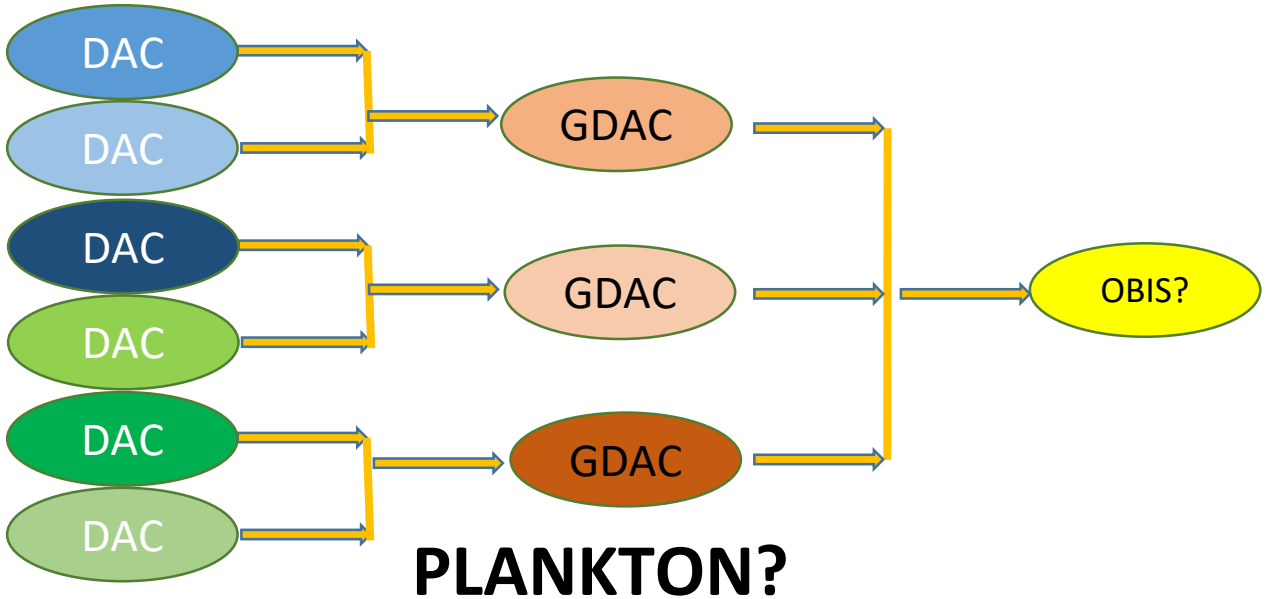


OCEAN PROFILE

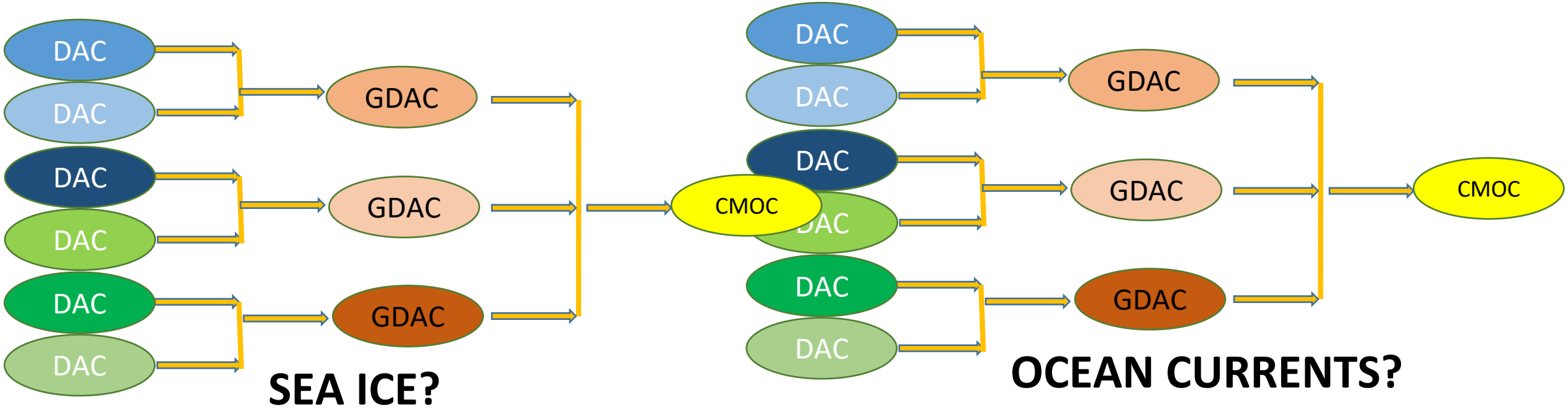
DRIFTING BUOY

WHAT OTHER ENVIRONMENTAL AREAS WOULD BENEFIT FROM MCDS?

- **ROBUST BUT POSSIBLY DISPERSED MEASUREMENT PROGRAMS**
- **VITAL TO UNDERSTANDING CLIMATE CHANGE AND/OR CRITICAL TO FACILITATING HUMAN ENDEAVOUR/HEALTH**



PLANKTON?

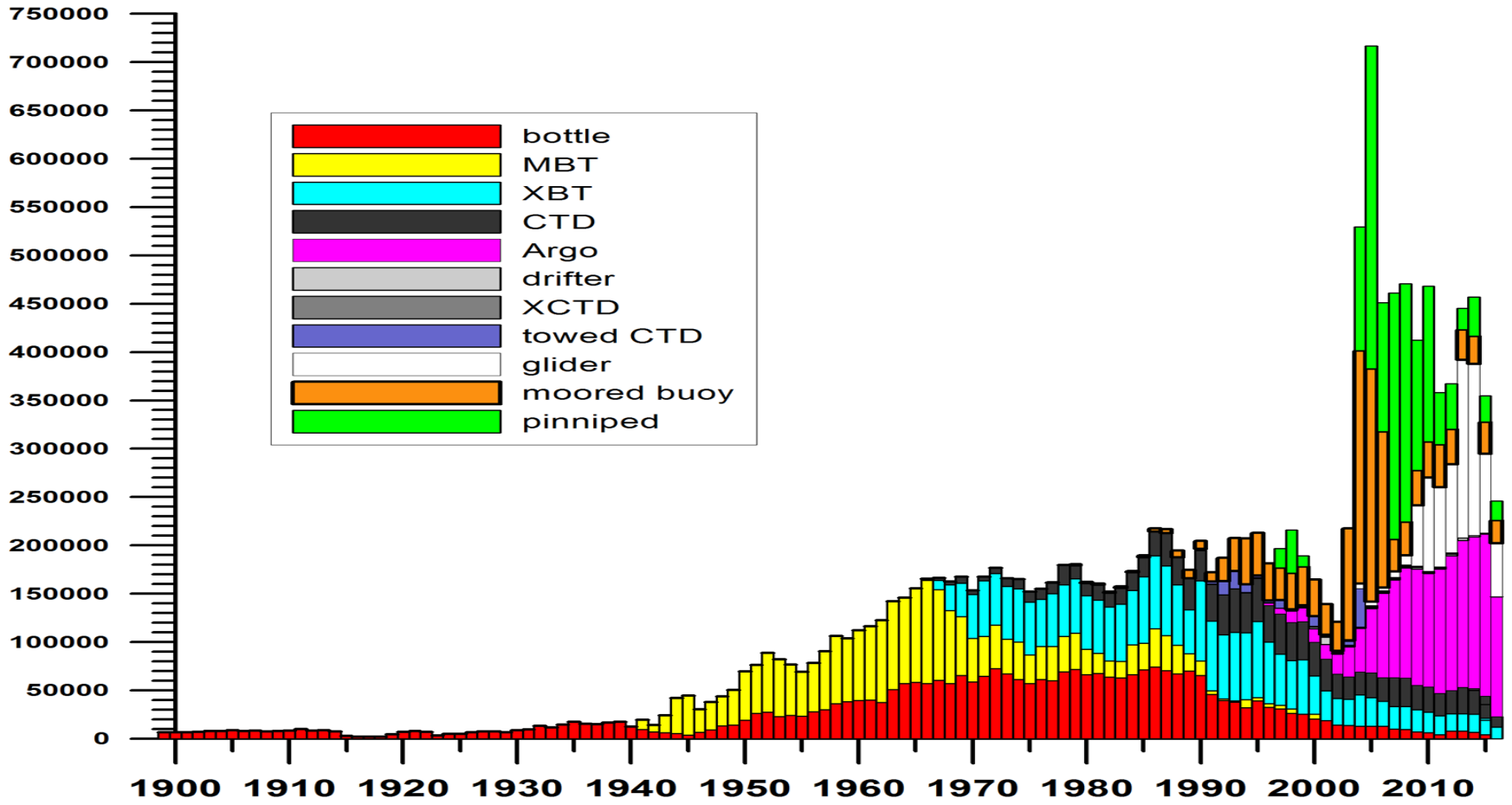


SEA ICE?

OCEAN CURRENTS?

MCDS DOCUMENTATION AND PROCEDURES

- WMO NO. 471 - GUIDE TO MARINE METEOROLOGICAL SERVICES
  - Chapter 9 - Services for Marine Climatology
  - DAC and GDAC requirements and establishment procedures
  - Expectation was for many DACs/GDACs to be established in the MCDS
    - needed more informal pathway to be able to fast-track documentation updates and newly established procedures
- WMO NO. 558 - MANUAL ON MARINE METEOROLOGICAL SERVICES
  - Part VII - Services for Marine Climatology
  - CMOC requirements and establishment procedures
    - Limited number of CMOCs, 6-10 overall, originally envisioned
    - Less changes required to documentation and procedures for smaller number of CMOCs



WORLD OCEAN DATABASE (WOD)
CASTS PER YEAR/INSTRUMENT

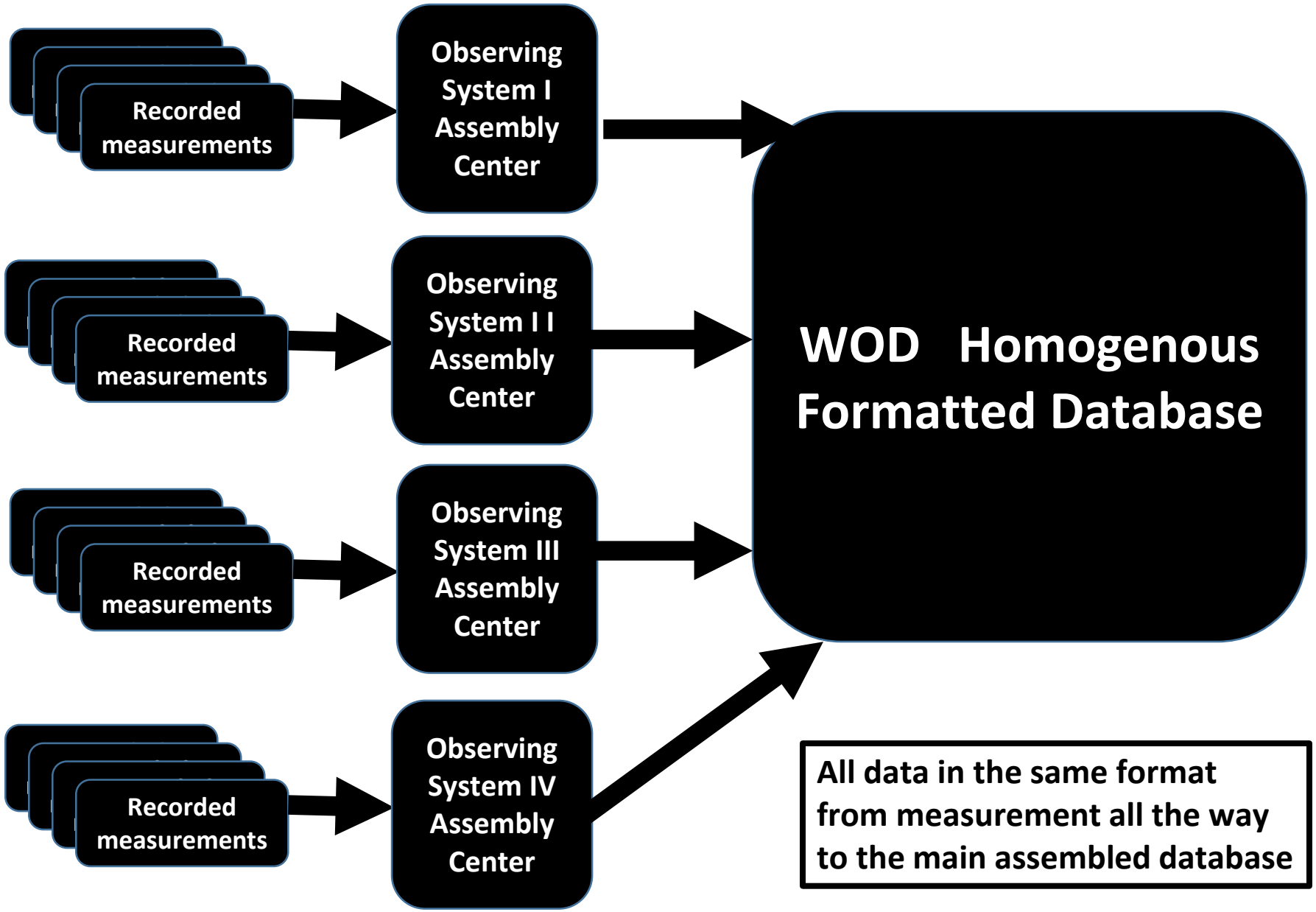
World Ocean Database: World's largest publicly available oceanographic profile database

(1a) Bottle (1b) MBT (1c) XBT (1d) CTD

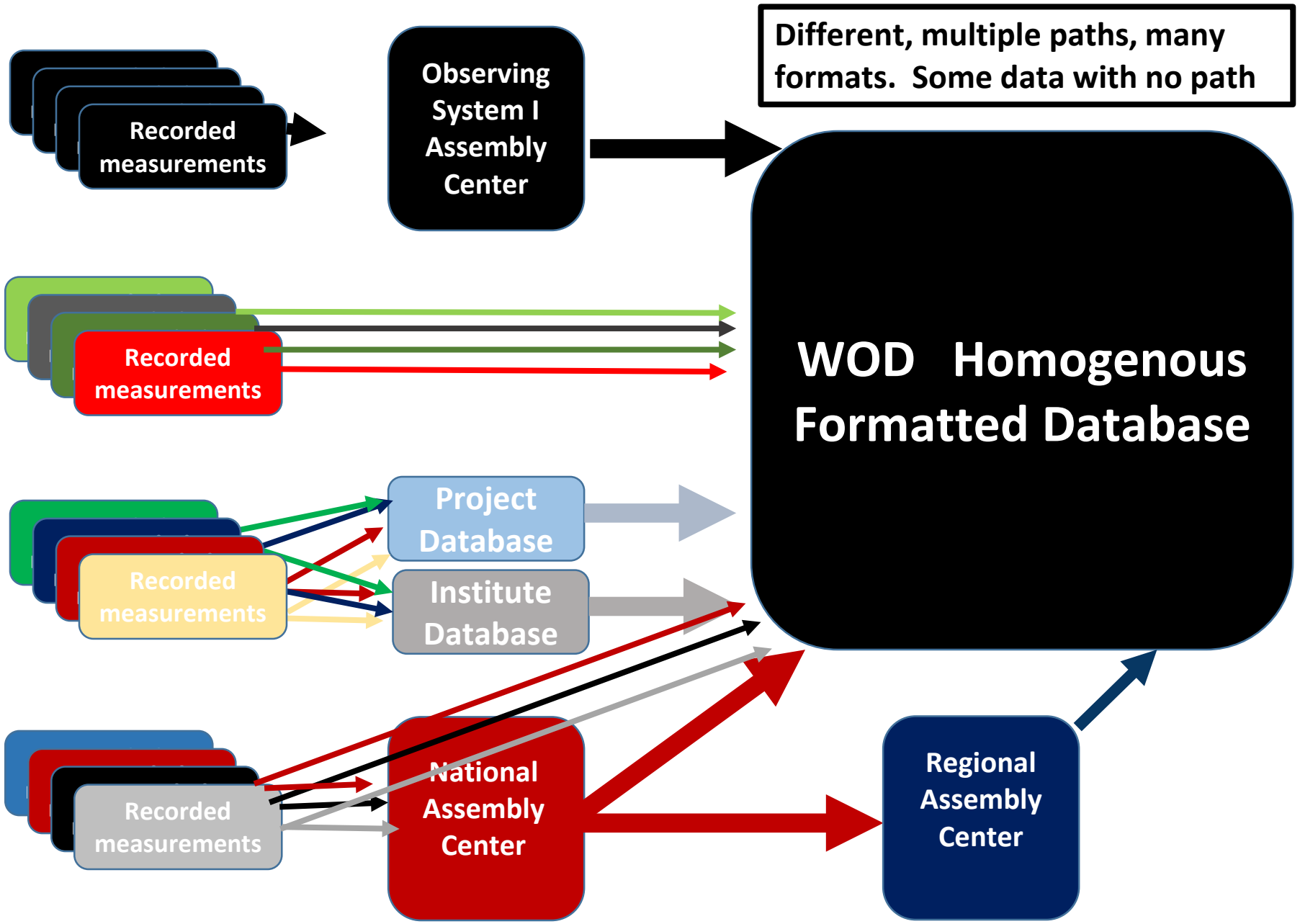
(1e) Towed CTD (1f) Profiling floats (Argo) (1g) Moored Buoys (1h) Drifters (mainly ice)

(1i) Instrumented pinniped (1j) Gliders (1k) surface-only (1l) Plankton tows

Idealized Flow of data from originator to database

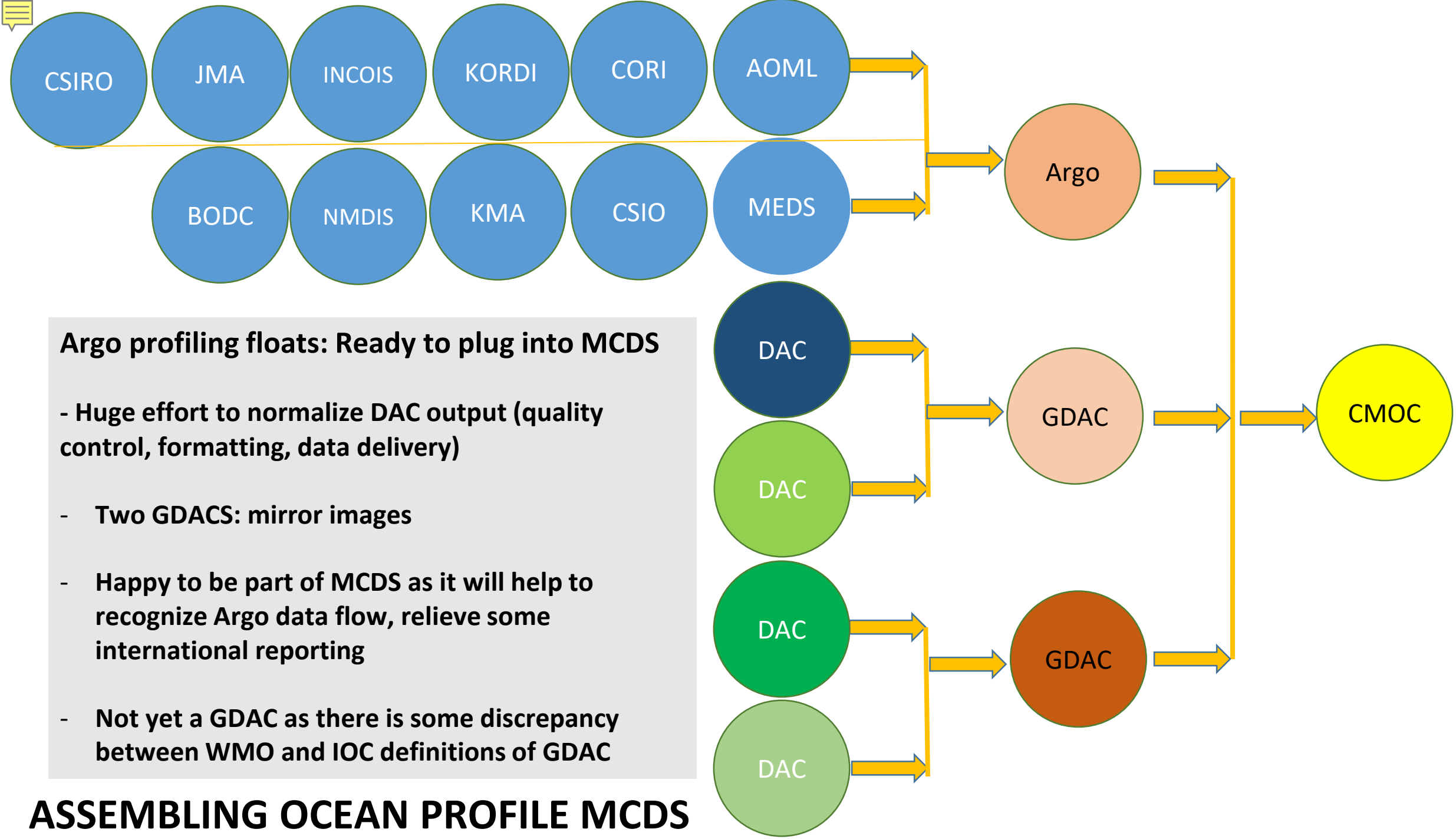


Real flow of data from originator to database



WHY DO WE NEED THE MCDS?

- Bring some clarity to the submission points for data
- Bring clarity on how/where submitted data will be disseminated
- Work toward standardization of forms, metadata, quality control processes
- Encourages dissemination and sharing of marine data
- Bring clarity to a user looking for specific (or general) data
- Recognition of contribution to global data system



Argo profiling floats: Ready to plug into MCDS

- Huge effort to normalize DAC output (quality control, formatting, data delivery)

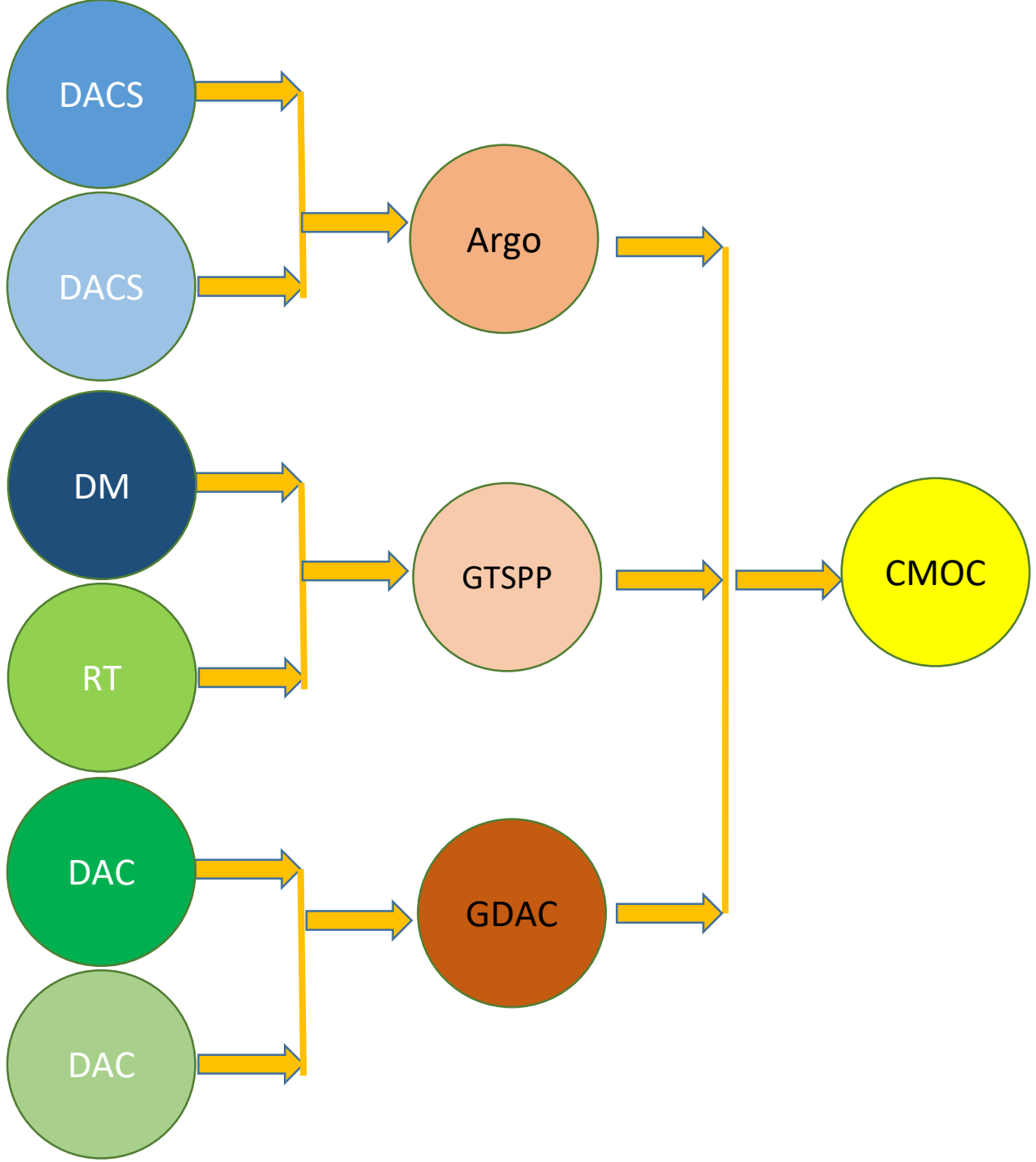
- **Two GDACS: mirror images**
- **Happy to be part of MCDS as it will help to recognize Argo data flow, relieve some international reporting**
- **Not yet a GDAC as there is some discrepancy between WMO and IOC definitions of GDAC**

ASSEMBLING OCEAN PROFILE MCDS

GLOBAL TEMPERATURE AND SALINITY PROFILE PROGRAM: GTSPP

- **ESTABLISHED 1990 TO PRESERVE AND QUALITY CONTROL OCEAN PROFILE DATA FROM THE GTS (REAL-TIME, RT).**
- **MEDS-CANADA IS RT DAC**
- **ALSO REPLACE RT WITH FULL QUALITY DELAYED-MODE (DM) DATA.**
- **CANADA, AUSTRALIA, FRANCE, UNITED STATES (AOML+SCRIPPS), JAPAN HAVE DM DACS**
- **MAIN DM STREAM IS XBT DATA**
- **SOME RT PROFILING FLOATS WHICH ARE NOT PART OF Argo**

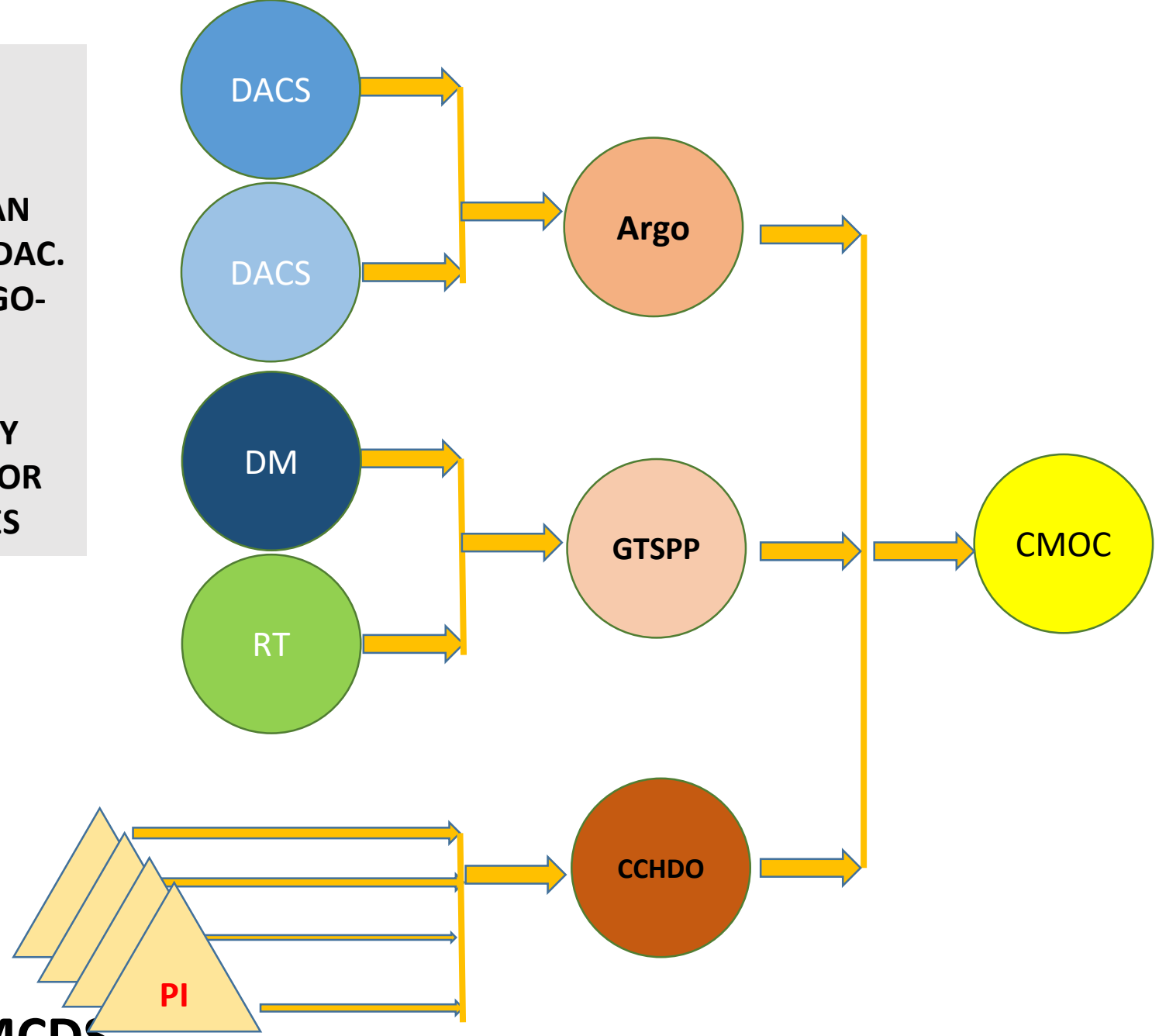
Assembling Ocean Profile MCDS



CLIVAR AND CARBON HYDROGRAPHIC OFFICE (CCHDO):

- **ORIGINALLY SET UP AS WORLD OCEAN CIRCULATION EXPERIMENT (WOCE) DAC. NOW FOR REPEAT HYDROGRAPHY (GO-SHIP)**

- **NO TRUE DAC. DATA COME DIRECTLY FROM CRUISE PRIMARY INVESTIGATOR (PI) OR MARINE TECH IN MANY CASES**



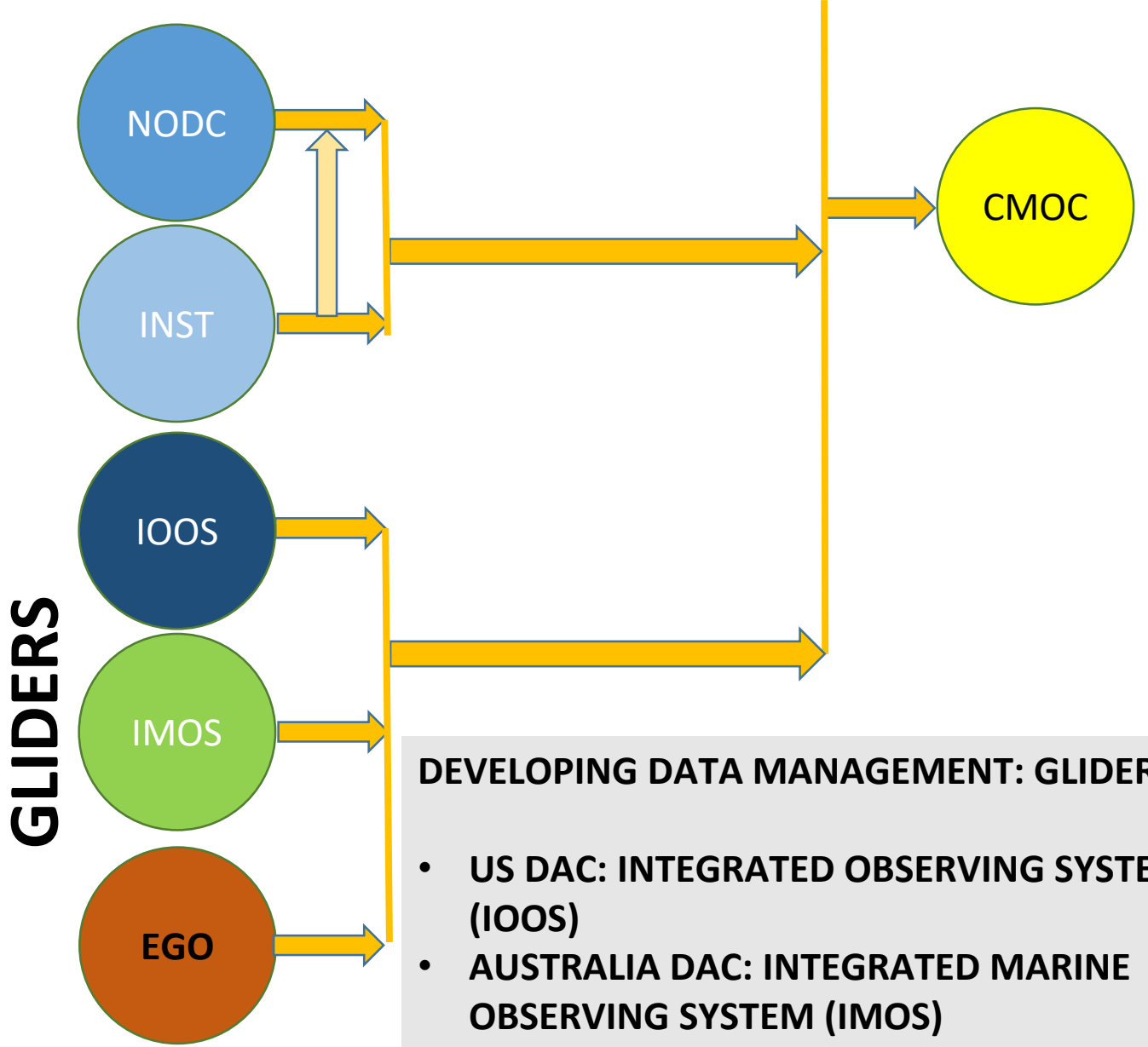
Assembling Ocean Profile MCDS

NATIONAL OCEANOGRAPHIC DATA CENTERS (NODC): BACKBONE OF IOC INTERNATIONAL DATA EXCHANGE (IODE)

- **NOT ALL RELEASE THEIR DATA PUBLICLY**
- **NOT INSTRUMENT SPECIFIC**
- **NO GDAC**

INSTITUTES (INST): RESEARCH INST, FISHERIES, UNIVERSITIES, NAVIES

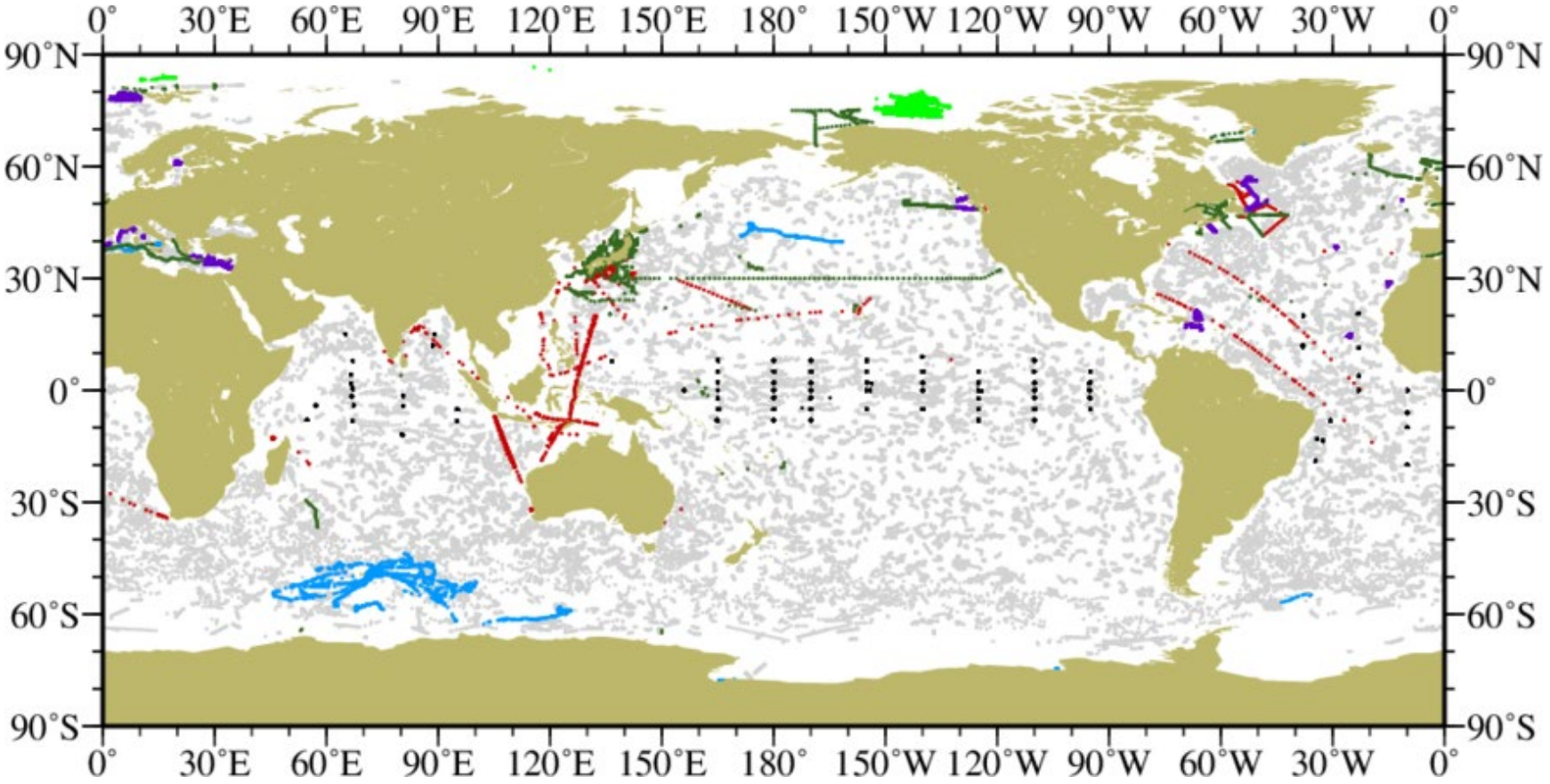
- SOME PASS DATA TO NODC, SOME DO NOT



DEVELOPING DATA MANAGEMENT: GLIDERS

- **US DAC: INTEGRATED OBSERVING SYSTEM (IOOS)**
- **AUSTRALIA DAC: INTEGRATED MARINE OBSERVING SYSTEM (IMOS)**
- **EUROPE DAC: EVERYONES GLIDER OBSERVATORIES (EGO)**
- **NO GDAC**

Assembling Ocean Profile MCDS

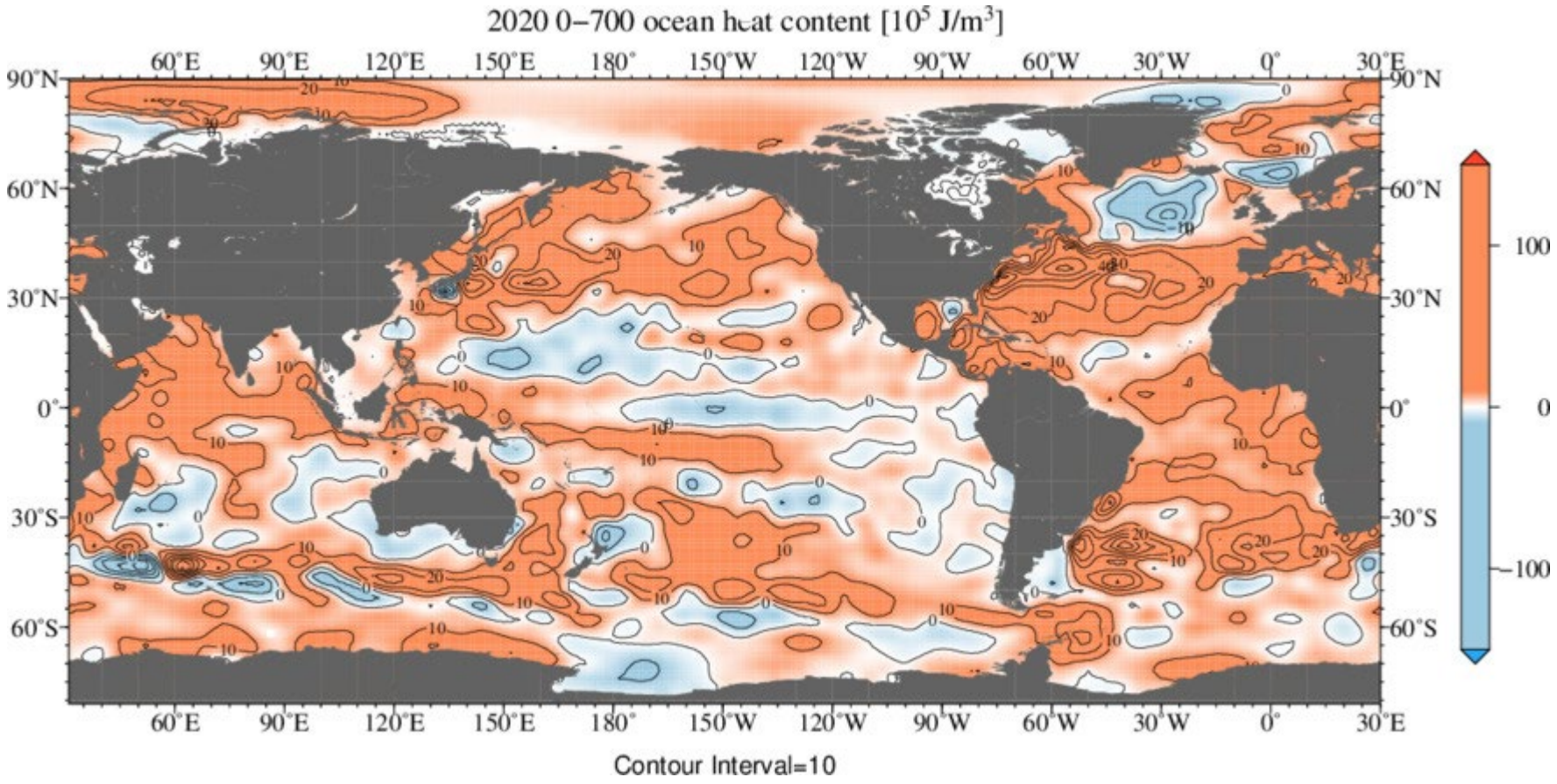


Grey - Argo cycles
Dark Green - CTD casts
Purple - Glider dives
Black - moored buoy series
Red - XBT drops
Blue - pinniped dives
Light Green - Ice Tethered profilers

Jan. - March 2021 subsurface data input to WOD

CMOC pulls all relevant data streams together: WOD is an ocean profile CMOC

CMOC ALSO PROVIDES CLIMATE PRODUCTS: WOD OCEAN HEAT CONTENT



Quarterly Heat Content (+ temperature/salinity anomalies/steric sea level) out to users. Above 2020 Heat Content anomaly

Blue=below long term average (1955-2020)

Red = above long term average (1955-2020), Units= 10^5 joules/m^3

Seventeenth World Meteorological Congress
Geneva, 25 May–12 June 2015

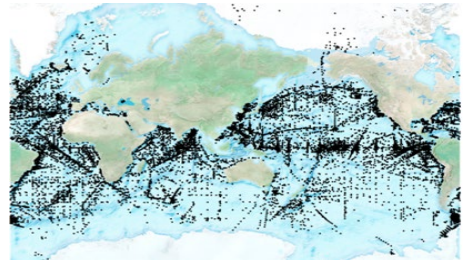
Twenty-eighth Session of the Assembly
Paris, 18–25 June 2015

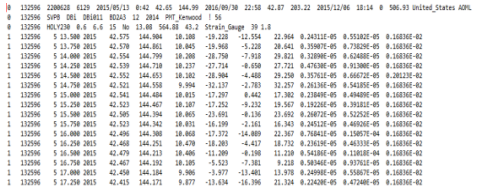
Computer automated QC

Man-machine interactive

Expert review

Integrate marine-meteorological and oceanographic climate data, metadata





Project Database

Institute Database

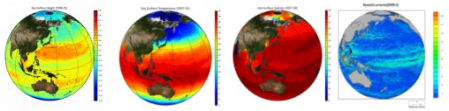
National Assembly Center

Operational Oceanographic Data

Historical Data

CMOC China

Research and development of oceanographic and marine-meteorological products, and their related services



Provide capacity building support to the countries in the region.

WHAT CAN BE DONE IMMEDIATELY

ASSEMBLE ALREADY EXISTING ENTITIES INTO THE MCDS STRUCTURE

MAKE SURE MCDS STRUCTURE IS ADAPTABLE TO THE EXISTING ENTITITES

IDENTIFY AND FACILITATE FILLING GAPS IN THE MCDS (e.g. GLIDER GDAC)

JUST AS OCEAN-OPS MONITORS AND PROVIDES INFORMATION ON OBSERVING SYSTEMS, HAVE DEDICATED RESOURCE FOR MONITORING THE DATA STRUCTURE AND FLOW WITHIN THE MCDS AND OTHER DOMAINS

PROMOTE THE MCDS TO DATA PROVIDERS, POTENTIAL ENTITIES WITHIN THE MCDS, AND MARINE/OTHER GLOBAL DATA USERS

CONTINUE TO ENGAGE IODE IN DEVELOPMENT OF THE MCDS

SUMMARY

THE MARINE CLIMATE DATA SYSTEM (MCDS) CAN BE A VITAL STRUCTURE FOR PROVIDING FLOW OF MARINE DATA FROM PROVIDER TO USER, FACILITATING A FURTHER UNDERSTANDING OF THE HUMAN AND NATURAL ENVIRONMENT.

THE COMPLEXITY OF MODERN DATA FLOW AND THE NEED FOR A GLOBAL PERSPECTIVE NECESSITATES SUCH A GUIDING STRUCTURE OVERSEEN BY AN INTERNATIONAL BODY.

THE MCDS WILL ASSIST THE DATA PROVIDER WITH EASY ACCESS TO DATA SUBMISSION AND AN UNDERSTANDING OF WHERE THE DATA WILL GO.

THE MCDS WILL ASSIST THE DATA USER WITH EASY ACCESS TO THE OPTIMAL DATA NODE FOR THEIR NEEDS

THERE WOULD BE GREAT BENEFIT IN PROVIDING DEDICATED RESOURCES TO CLARIFY AND ASSEMBLE THE STRUCTURE OF THE MCDS AND CONTINUOUSLY MONITOR, REVISE, UPDATE, FILL GAPS AS THE FUTURE OBSERVING SYSTEM DICTATES.

DETERMINE HOW THE MCDS FITS INTO NEW WMO STRUCTURE AND CONTINUE TO ENGAGE IODE DURING THE TRANSITION