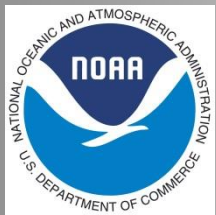


Facilitating and Ensuring Data Stewardship: Data Challenges of NOAA's Climate Observation Division



Prepared by:

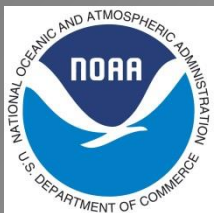
Jennifer Saleem Arrigo, Program Manager

NOAA/OAR/Climate Program Office

Climate Monitoring Program

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Data Liaison for Climate Program Office (primarily Climate Observation Division – Ocean Observing)

NOAA's Climate Program Office (established in October 2005) provides a unique and highly flexible climate research enterprise that focuses on:

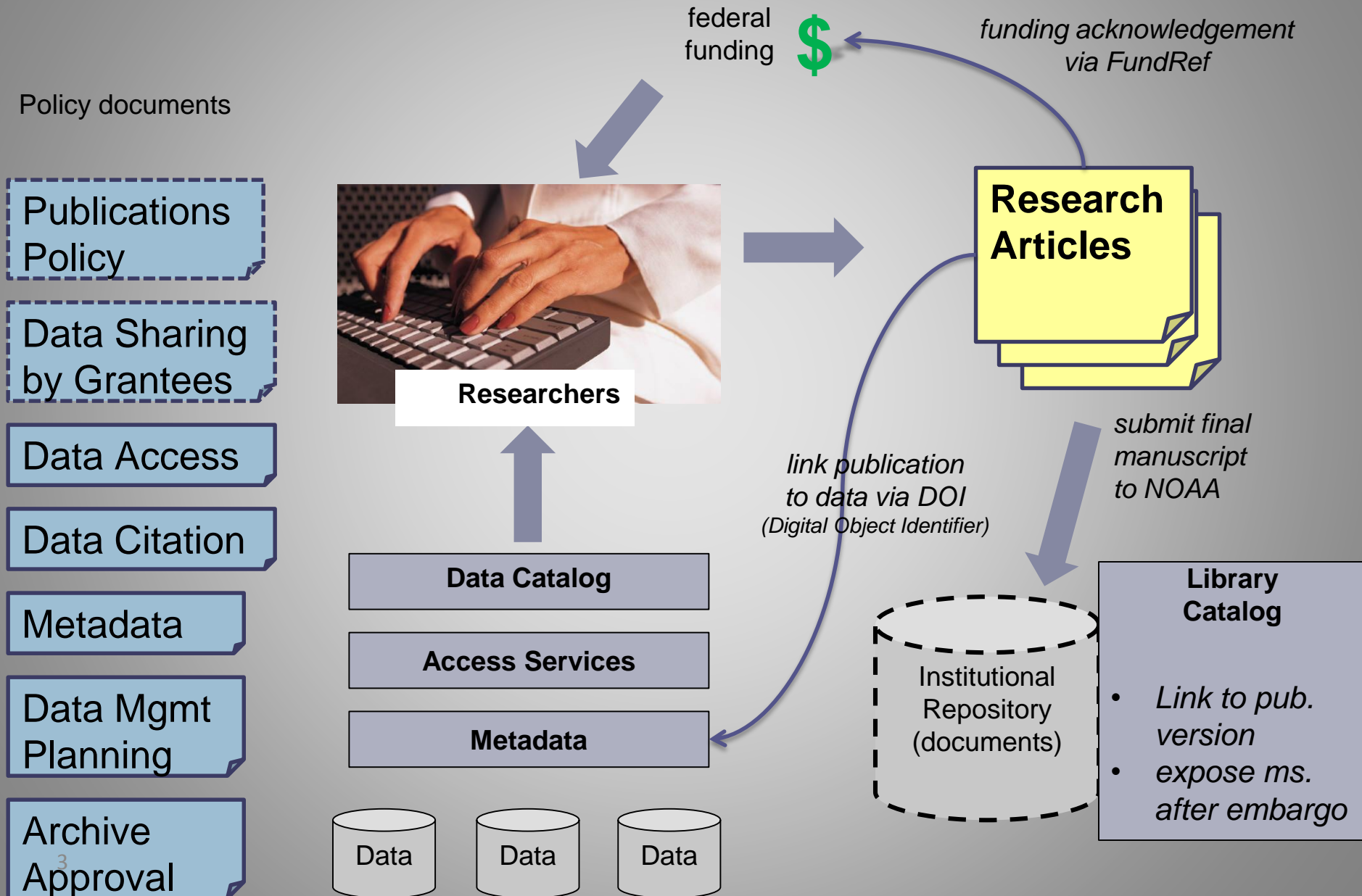
- competitive grant programs that advance and extend our research capabilities;
- partnerships with academia, businesses and other agencies to develop and deliver targeted research and data products; and
- knowledge and information to improve public climate literacy and decision-making needed to maintain resilient economies and environmental services

- **>300 active grants**
- **>700 published papers per year**, contributing to our understanding of climate variability and change
- Worked with more than **70 partners** to implement a sustained **Global Ocean Observing System**
 - >1900 floats**
 - >1400 drifters**
 - >60 moorings**



Conceptual Description of NOAA PARR Plan

doi.org/10.7289/V5F47M2H

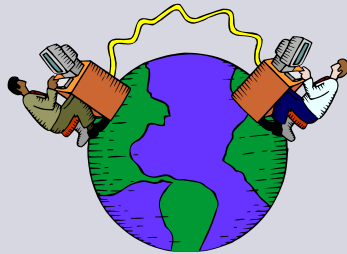


Vision for NOAA Data Management

All NOAA environmental data shall be



Discoverable



Accessible



Usable



Preserved

for all types of users and applications.

As CPO/ COD liaison, responsible for Leading implementation of NOAA's response to PARR and working toward achieving this vision

Largest data responsibility – Ocean Climate Observing Program (Sustained Ocean Observing)

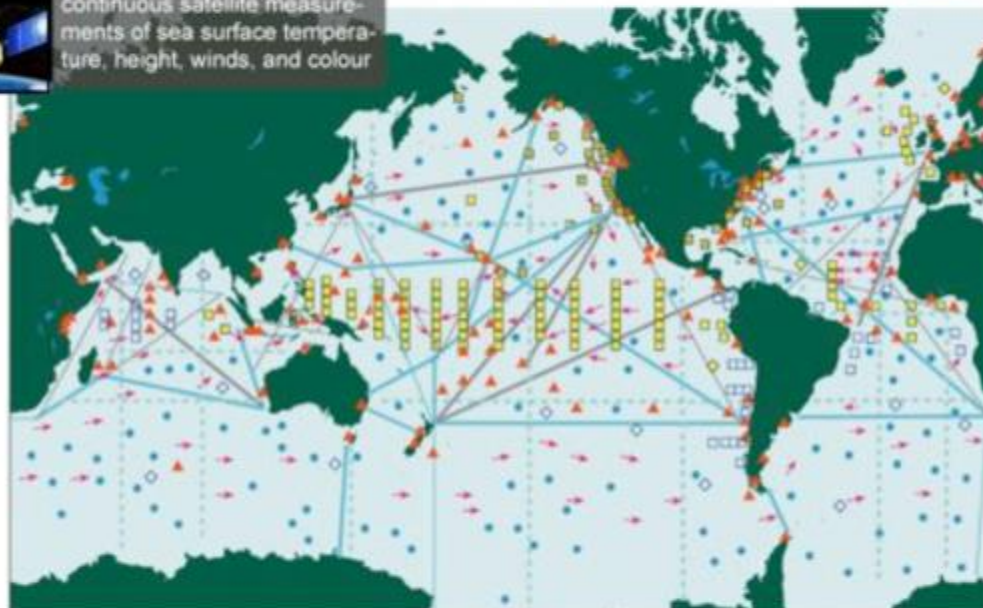
Initial Global Ocean Observing System for Climate

Status against the GCOS Implementation Plan and JCOMM targets

Total *in situ* networks **60%** February 2008



continuous satellite measurements of sea surface temperature, height, winds, and colour



87% Surface measurements from volunteer ships (VOSclim)

200 ships in pilot project



100% Global drifting surface buoy array

5° resolution array: 1250 floats



62% Tide gauge network (GCOS subset of GLOSS core network)

170 real-time reporting gauges



81% XBT sub-surface temperature section network

51 lines occupied



100% Profiling float network (Argo)

3° resolution array: 3000 floats



43% Repeat hydrography and carbon inventory

Full ocean survey in 10 years

Reference time series

24%



58 sites

48%

Global reference mooring network



29 moorings planned



79%

Global tropical moored buoy network



119 moorings planned



Ocean Climate Observation Data Assessment

“Platform Count”

Platform	Active number
Global Drifters	1417
RAMA	30
PIRATA	18
Argo	1921
OceanSITES	12
Rain gauges	218
pCO2 moorings	12
pCO2 ships	14
pCO2 cruises	178
tide gauges	11
tide gauges/GPS	72
gliders	3
xbt crossings	38
TOTAL	3944

Global Observing Systems

In FY15, the Ocean Climate Observations program sustained NOAA’s contributions towards several global ocean observing systems with more than 8,000 platforms—including Argo, the Global Drifter Program, GLOSS, OceanSites, GO-SHIP, RAMA, PIRATA, and SOOP—in support of NOAA’s research and operational requirements.



▲ The deployment of an Argo float into the ocean. Credit: CSIRO.

We support Observations, Analyses, and Products

Sea Surface Temperature and Surface Currents

Ocean Heat Content and Transport

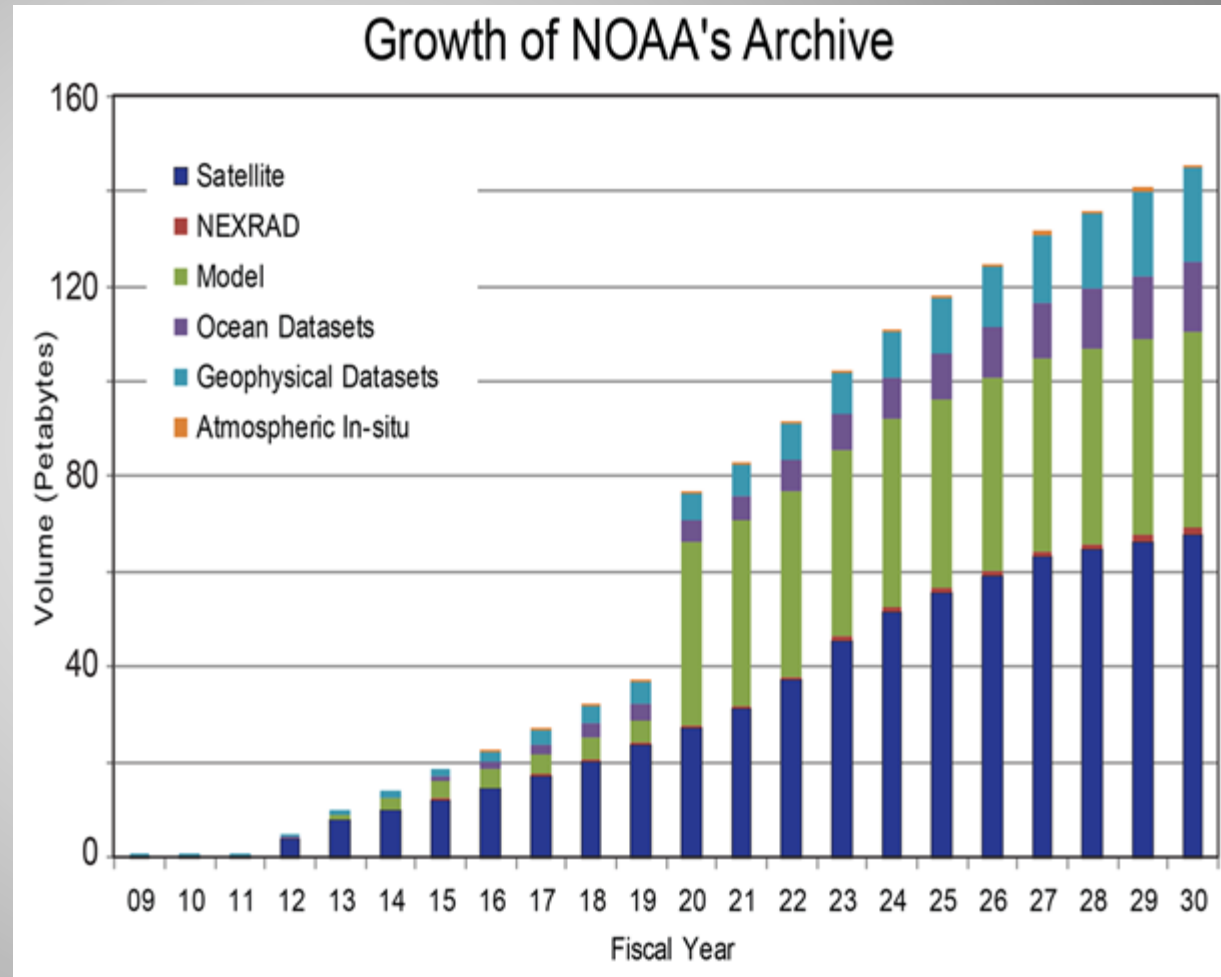
Air-Sea Exchanges of Heat, Momentum, and Fresh Water

Sea-Level

Ocean Carbon Uptake and Content

Ocean Climate Observation

- Sustained ocean observing
- Internal and external partnerships
- Contributions to international efforts
- Contributions to maintaining 6 NOAA Systems of Record



Data Management Assessment

- **Starting with the Six NOAA Systems of Record that contribute to GOOS**

- Expendable Bathythermograph (XBT)Network, contributions to Global Sea Level Observing System, Ocean Reference Sites – part of Global OceanSITES, Argo program, Global Carbon Networks, Global Drifter Program

- Template to Assess

- Data Lineage and Quality*

- Workflow and quality control

- Documentation*

- The EDMC Data Documentation Procedural Directive requires that NOAA data be well documented, specifies the use of ISO 19115 and related standards for documentation of new data, and provides links to resources and tools for metadata creation and validation.*

- Access*

- The EDMC Data Access Procedural Directive contains specific guidance, recommends the use of open-standard, interoperable, non-proprietary web services, provides information about resources and tools to enable data access*

- Data Preservation and Protection*

Results - *Varied*

Name of System	Global Ocean Carbon Network
Metadata Compliance ?	TBD - follows CDIAC metadata procedures
Data Access	http://cdiac.ornl.gov/oceans/datmet.html
Data Format	CDIAC: Data will be made available to users through the WWW-based LAS server, ODV format, and as a simple ASCII formatted files through CDIAC's public FTP area.
Long term Data Archive	(CDIAC): The Carbon Dioxide Information Analysis Center (CDIAC) is the primary climate-change data and information analysis center of the U.S. Department of Energy (DOE). http://cdiac.ornl.gov/oceans/search.html

Metadata questions, Archive questions

Results - *Varied*

Name of System	Global Argo Profiling Floats
Metadata Compliance ?	Yes, full documented procedures: Argo user's manual, http://dx.doi.org/10.13155/29825
Data Access	http://www.usgodae.org/argo/argo.html
Data Format	via the GTS for operational centers (data are in TESAC or BUFR format), via DOIs on the GDACs, via the two Global Data Assembly Centers (GDACs) in NetCDF format, via Data selection tools on the GDACs, via gridded fields and velocity products based on Argo NetCDF files from the GDACs, via data viewers that incorporate Argo data, via individual float data and plots at Coriolis GDAC, via the Global Argo Data Repository (GADR) for archived and offline data
Long term Data Archive	NODC: http://www.nodc.noaa.gov/argo/accessData.htm

Full international data management team, full documentation

Overall Results – still some work on formats, metadata, archives

Name of System	Metdata Compliance?	Data formats	Long term Data Archive
Global Ocean Carbon Network	TBD - Follows CDIAC	CDIAC: Data will be made available to users through the WWW-based LAS server, ODV format, and as a simple ASCII formatted files through CDIAC's public FTP area.	(CDIAC): The Carbon Dioxide Information Analysis Center (CDIAC) is the primary climate-change data and information analysis center of the U.S. Department of Energy (DOE). http://cdiac.ornl.gov/oceans/search.html
Global Ships of Opportunity for the XBT Network	YES for archived- NCEI generated	THREDDS, HTTP, FTP, OPenDAP	NOAA NODC for archival and replacement into the “Best Quality” GTSP data set
Global Argo Profiling Floats	Yes, Argo User Manuel	Several	NODC
Global Ocean Reference Stations	YES for arhcived, NCEI generated	7.2.3. FTP: f	NCEI NODC
Global Sea Level Observing System	Yes. ISO-19139 Metadata	THREDDS, HTTP, FTP	NCEI NODC
Global Drifter Program	Unclear, provided by NOAA's AOML	FTP, GTS	NODC and Oceanography and Scientific Data (OSD) of Fisheries and Oceans Canada (DFO)

Immediate Issues that Arise

- Global Partnerships and Efforts (~3900 platforms contributing to 8000+ platform effort)
- Different levels of maturity and configurations of networks
- New Data Directives, still coalescing around standards – NOAA v. partners
- Provenance and Control of raw observations to derived products- several versions
- Long term archiving sustainability – ensuring

Where we are and what's next

- Initial Data Management Plans for six systems on file (soon public)
 - Projects are spending between **2% and 21%** of resources on data management
 - Meeting metadata requirements; Getting data registered in noaa.data.gov
 - Harnessing the results (better dissemination)
 - Grants-generated data
 - Online access formats need more standardization
 - build on good examples
 - UAF- Unified Access Framework (TDS/CF/NetCDF)
 - <https://geo-ide.noaa.gov/>