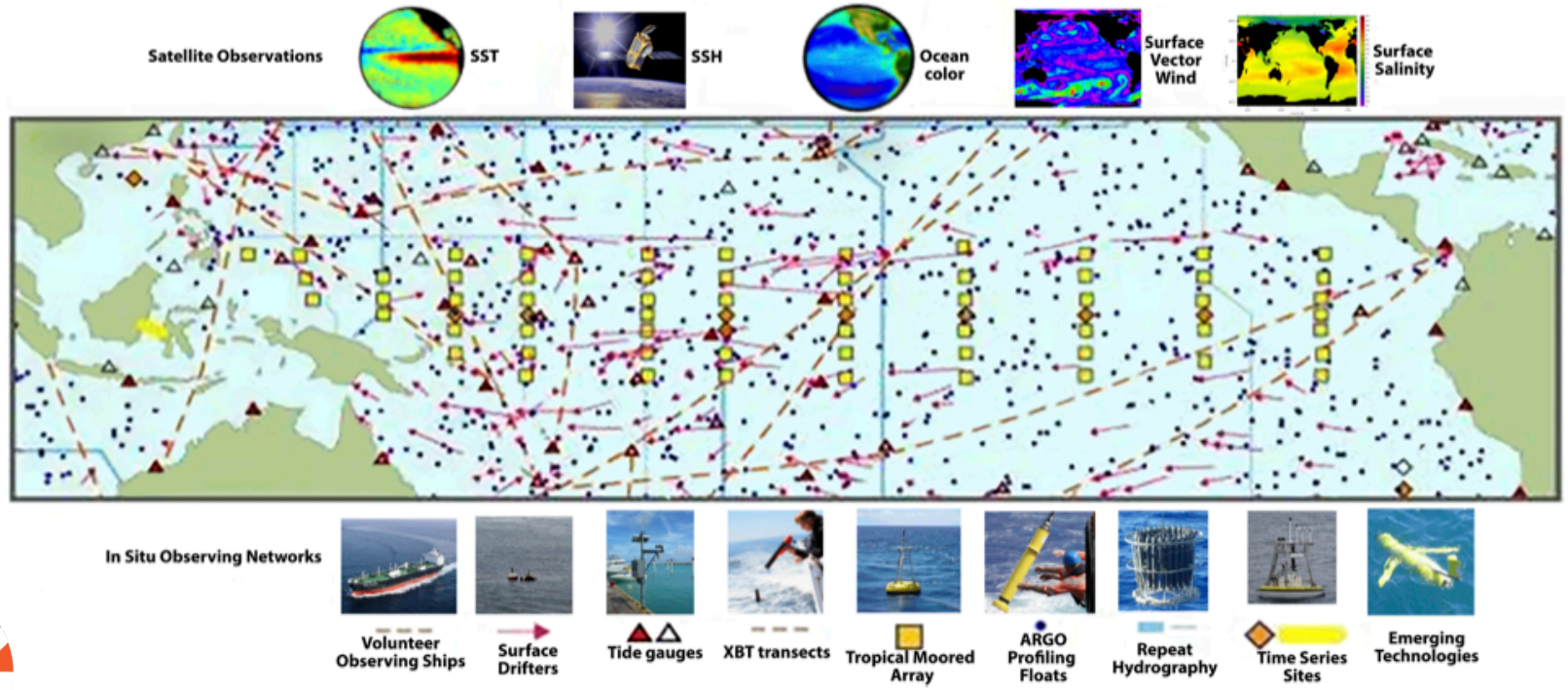
TPOS 2020 Project

Making an opportunity from a crisis

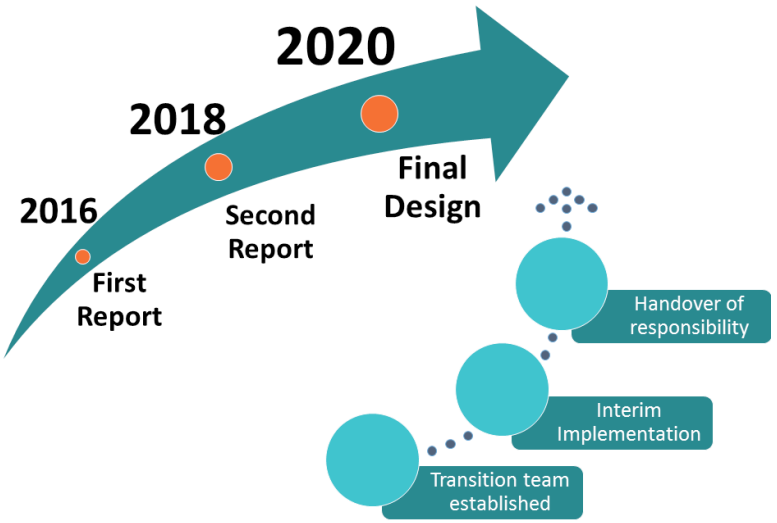
Review and re-design the Tropical Pacific Observing System

- Rethink in response to new needs, purposes, challenges: Define requirements
- Renew the interagency and intergovernmental cooperation that has been the hallmark of the TPOS since the mid-1980's
- Take advantage of new science and technology



TPOS 2020 Goals

- To redesign and refine the T.P.O.S. to observe ENSO and advance understanding of its causes
- To determine the most efficient and effective observational solutions to support prediction systems for ocean, weather and climate services
- To advance understanding of tropical Pacific physical and biogeochemical variability and predictability.



First Report

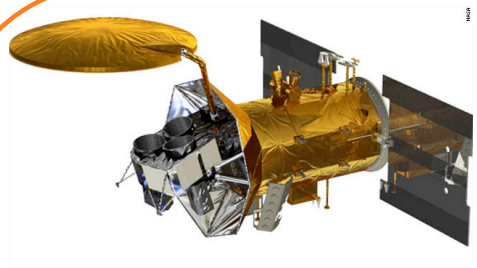
- First Report published (Dec 2016)
- Systematic approach

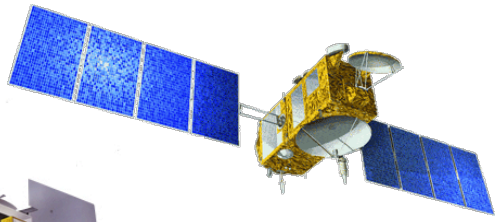
  → Define requirements, deduce OS
- 22 Recommendations, 15 Actions

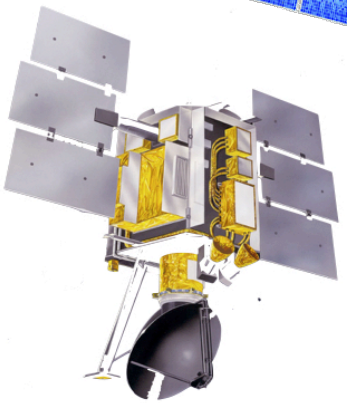
  Louis Uccellini (director US National Weather Service)
  "We need more of this kind of rigorous analysis"
- Working on Second Report:
  New pieces: LLWBCs, BGC, fluxes, ...

Sampling requirements and scales

- Fast sampling near the equator; elsewhere weekly. Short meridional scales near the equator.
- Coupled interaction in tropics requires focus on near-surface and met (flux): diurnal cycle.
- Subsurface T/S: zonal spacing matching mesoscales, especially in conjunction with satellite SSH. Near-surface salinity: ITCZ/SPCZ, warm pool.
- Winds: scatterometers require in situ referencing, especially near the equator, and under heavy rain.
- "Enough" moorings in subtropics to interpret high-frequency signals not otherwise well-sampled.







An integrated vision

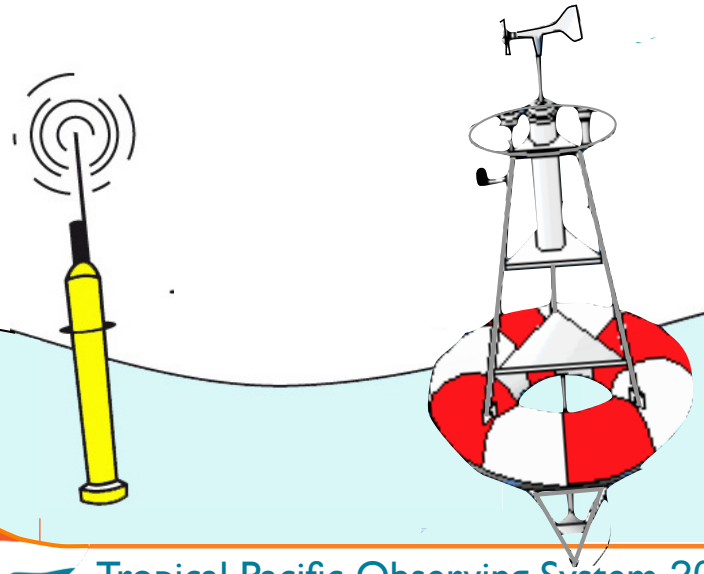
Complementary "backbone" technologies:

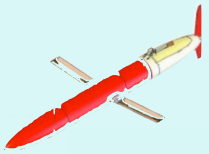
- Satellites give global coverage, horizontal detail
- Moorings sample across timescales, allow co-located ocean-atmosphere observations, velocity sampling
- Argo resolves fine vertical structure, adds salinity, maps subsurface T and S, connects to subtropics

Assimilating models integrate diverse observations

Users will increasingly rely on gridded products

Requires model improvement!

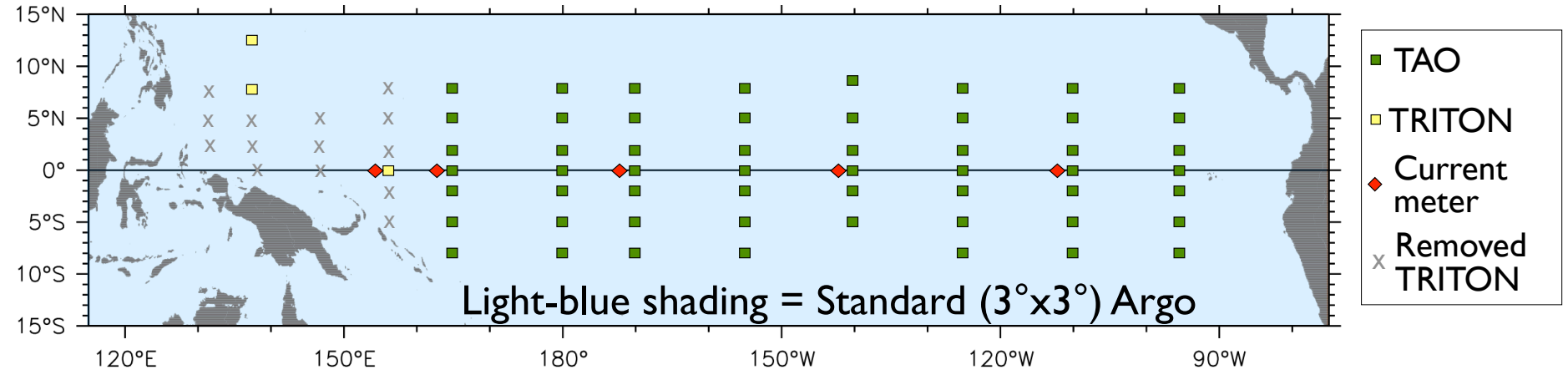




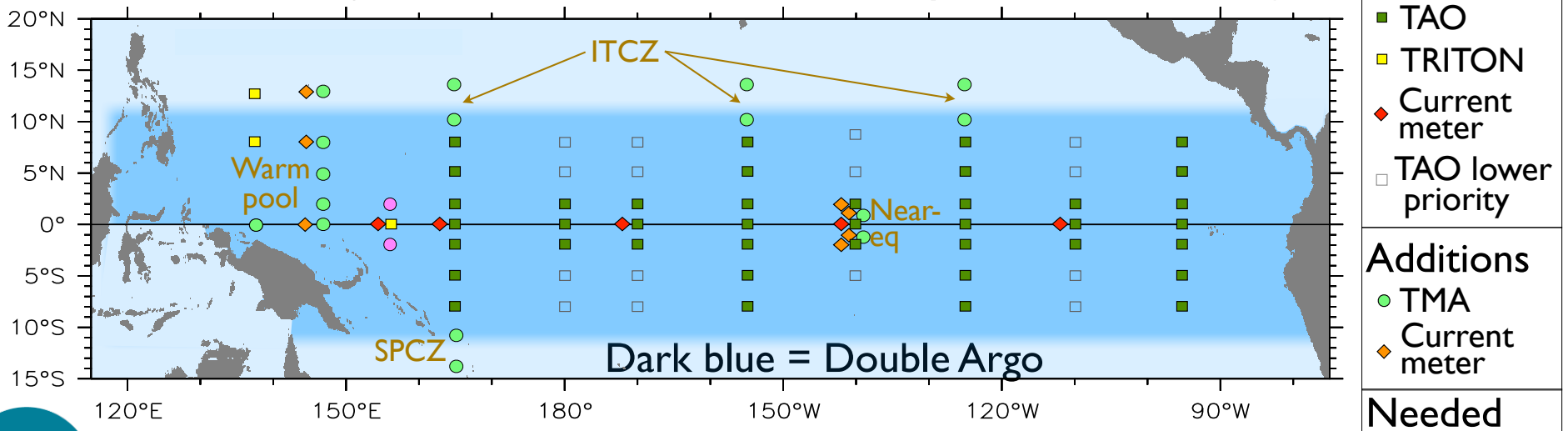
Rethinking Argo and the moored arrays

Reduced need for grid of moorings. Regime focus, highly-instrumented sites.

Present/historical TAO-TRITON array ... and 3°x3° core Argo



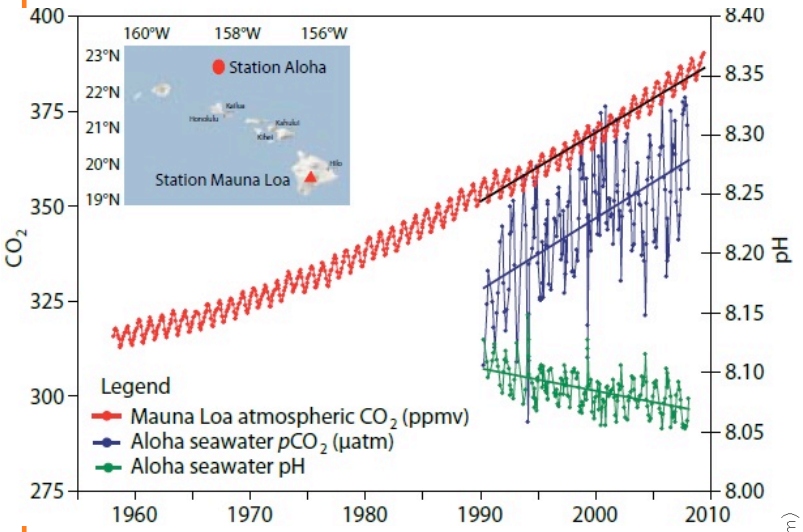
Future TAO + JAMSTEC + SOA moored arrays ... and 2°x2° Argo

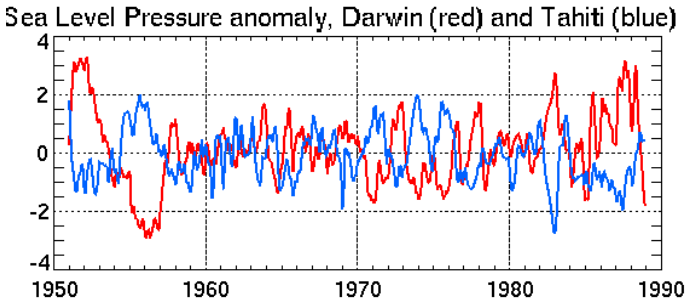


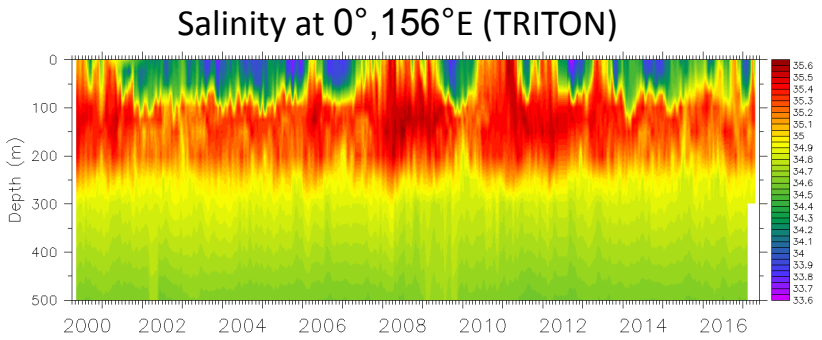
The climate record in an evolving observing system

A "climate data record" is a time series at a point (examples).

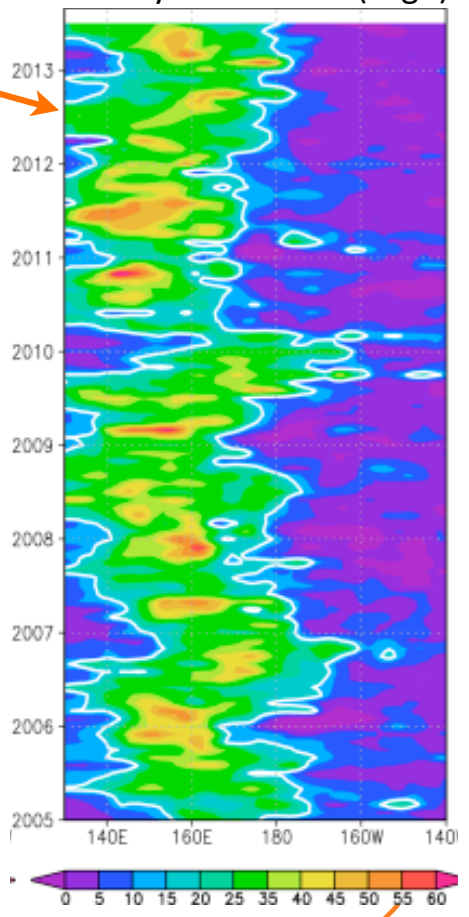
A "climate record" is a set of measurements that enable detection and accurate description of an element of climate variability in its longterm context.







Barrier layer thickness (Argo)



Results so far

- Resource Forum meeting (May 2017):
  Endorsement of the Report. Strong basis for partnerships

  BMKG, BOM, CSIRO, IRD, IOC, JAMSTEC, NOAA, NASA, QNLM, SOA
  WMO endorsement allows Met Services to engage

- Actions by partners:
  - SOA committing to new moored array in the west
  - JAMSTEC committing to upgrade remaining TRITON, add cruises
  - NOAA (NWS) committing to upgrade TAO. New pilot projects
  - KIOST deployed new moored array across the Mindanao Current
  - SOA and IFREMER (+ ...) committing to Argo additions

Extra slides below

Our first customers are the operational centers

Although TPOS 2020 is mostly about observations,
we consider the role of observations in the entire system:

Observations • Analyses • Forecasts

Current-generation assimilation/forecast systems do not make effective-enough use of observations.

Thus we aim to:

- Target sampling where the models and data assimilation systems need guidance for improvements (near-surface and near-equator)
- Improve model representation of unresolved processes
- Evolve the T.P.O.S. in concert with advances in the forecast and data assimilation systems
- The operational "backbone" array must provide infrastructure for research to improve the models, and refine the design

We design our arrays to serve both operations and research

TPOS 2020 vs other developing observing systems

- The tropical Pacific has a dominant signal: ENSO
  → We are strongly driven by phenomena
- In large part due to ENSO,
  the history of successful seasonal forecasts means we have important operational stakeholders.
- The fundamental coupled nature of the tropical climate
  means the planetary boundary layer is a core part of our sampling (dictates platform requirements)