Background

What is TPOS 2020?

The Tropical Pacific Observing System 2020 (TPOS 2020) initiative is a review and redesign of the tropical Pacific Ocean observing system, originally established as part of the Tropical Ocean-Global Atmosphere Experiment (TOGA). Twenty years have elapsed since that original design and a number of scientific and technical advances warrant a fresh examination of the design, taking account of new user requirements and potential observing network options.

TPOS 2020 was established by agencies with a stake in the current observing systems, both as providers of capability as well as users of the system. National weather services are among those stakeholders, for applications ranging from weather prediction to climate prediction and climate change detection (monitoring).

Tropical Pacific Observing System and NWP

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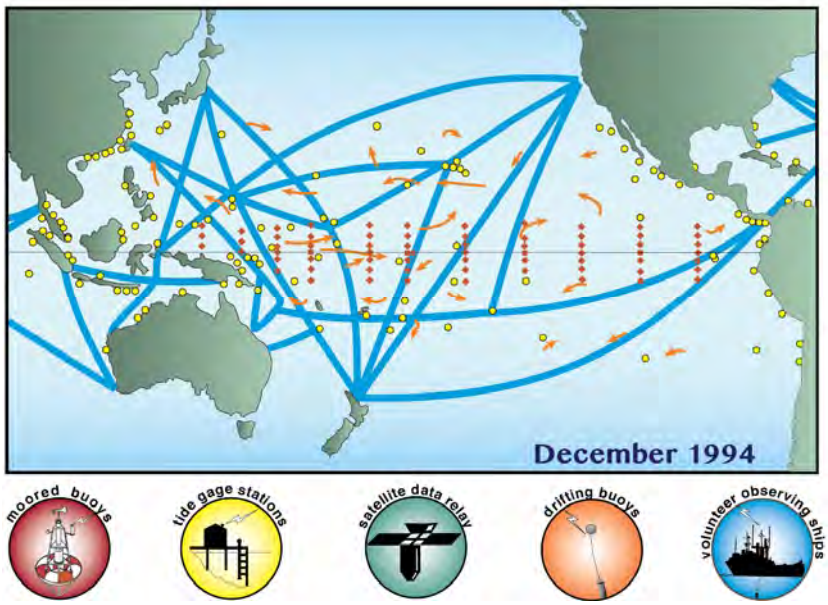
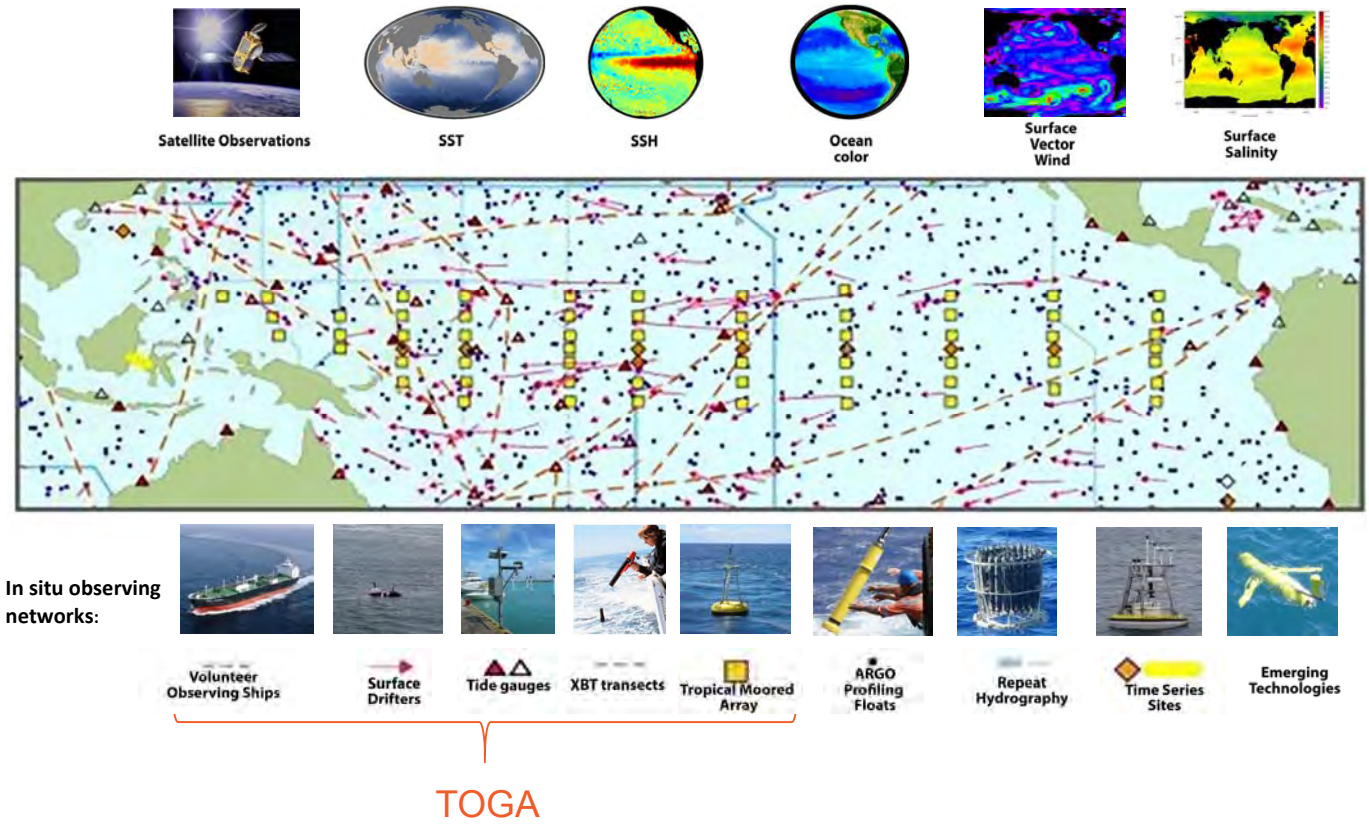
The ENSO Observing System



The original observing system was designed to detect equatorial waves, a key issue for ENSO diagnosis and prediction. The TOGA Atmosphere-Ocean Array (TAO) was the centre piece of the design. There were no Argo floats, no altimetry, no SCAT.

The Observing System Today

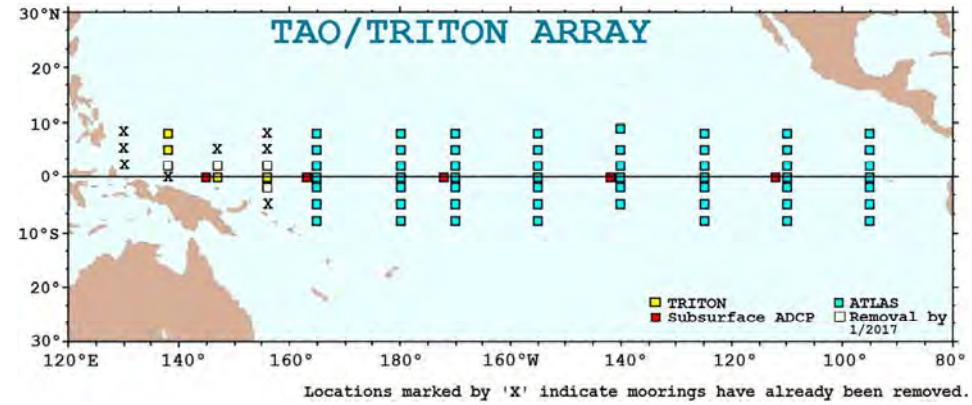


TPOS 2020 will move the system from a collection of pieces to an integrated, coordinated, purpose-driven, and sustainable observing system.

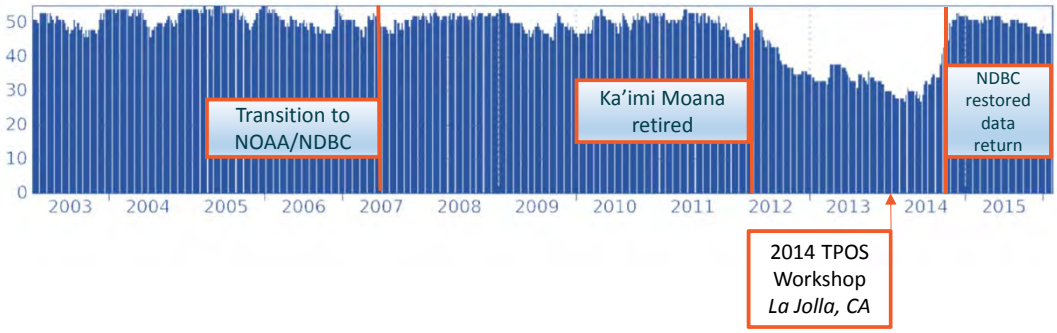
The TPOS Project

Major disruption to TAO/TRITON

A major disruption occurred in 2012-14. Servicing was severely reduced and support for the western part began to decay. Data returns dropped dramatically.



Number of TAO moorings reporting data

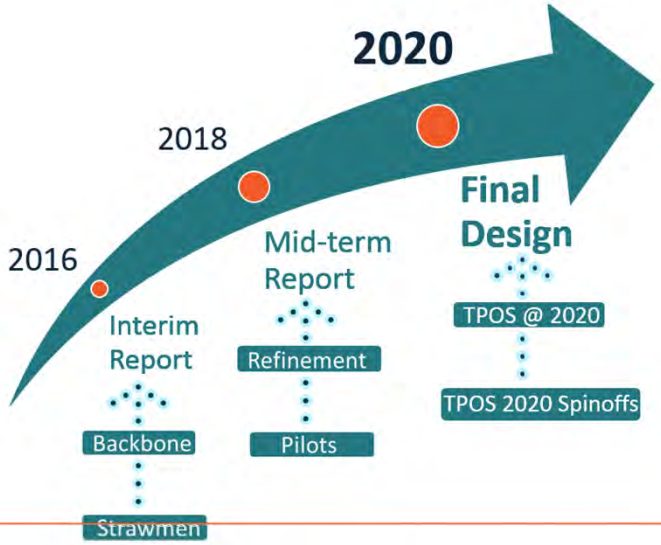


The TPOS 2020 process

TPOS 2020 comprises a Steering Committee and six Task Teams and is supported by stakeholders. A series of reports will be produced to provide the justification, requirements and possible solutions for TPOS. The Reports will be informed by research and pilot experiments which will refine the design.

The 1st draft of the Interim Report is currently out for expert review. A broader stakeholder / user review will take place for the 2nd draft (August 2016).

The Mid-term Report may be the basis of input to Congress in 2019.



The TPOS Backbone

The TPOS Backbone is the basic (core, fundamental) part of the design.

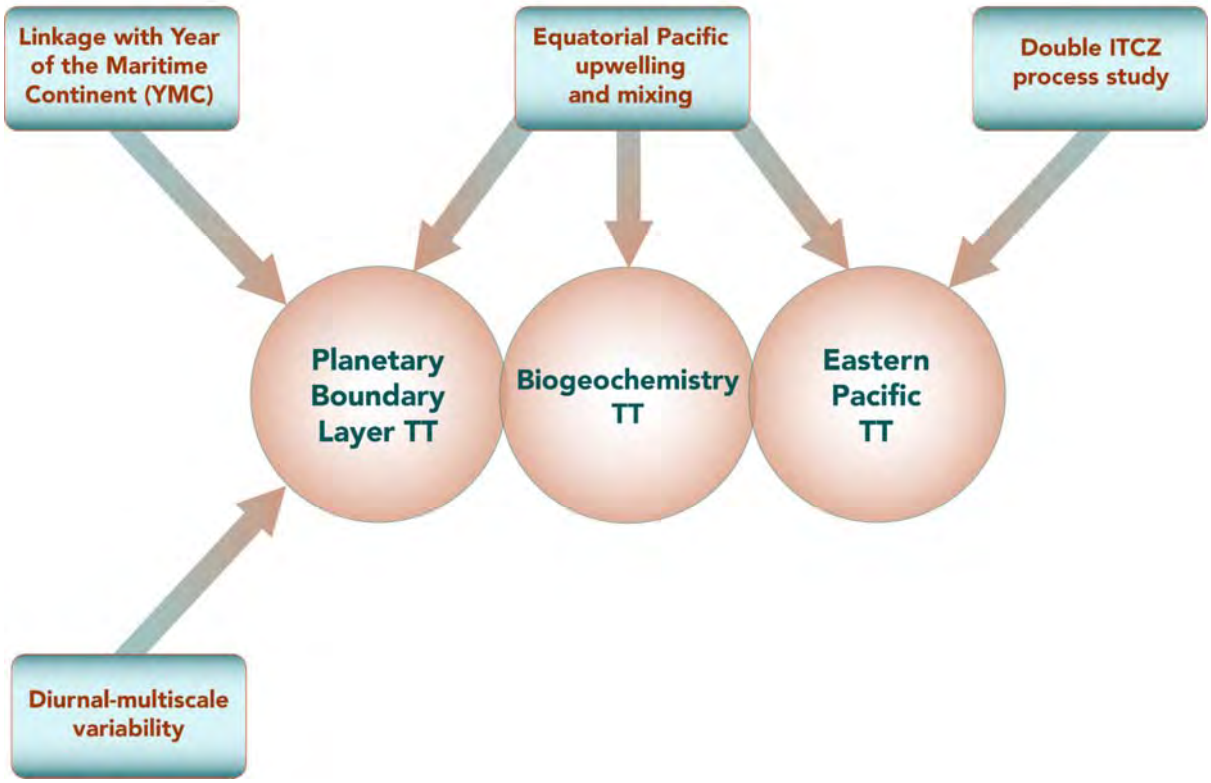
There are five broad objectives:

- Observe and quantify the state of the ocean, on time scales from weekly to interannual/decadal;
- Provide data in support of, and to validate and improve, forecasting systems (climate, ocean, NWP);
- Support integration of satellite measurements into the system including calibration and validation;
- Advance understanding of the climate system in the tropical Pacific; and
- Maintenance and, as appropriate, extension of the tropical Pacific climate record.

Recommendations will inform the Rolling Review of Requirements in five applications areas: Global NWP, sub-seasonal to longer predictions, ocean applications and climate monitoring (GCOS)

TPOS 2020 offers a unique opportunity to examine the requirements and understand the impacts across all application areas, as well as the needs of research.

Key Activities and Potential Process Studies Coordinated through Task Teams



Changing requirements and design

The thrust of the plan is directed at three distinct but related goals:
• Improving sustained quantification of the ocean state
• Improving understanding of processes now poorly represented in models
• Preservation and improvement of the climate record

Consideration is also being given to the need for surface flux measurements and, in particular their role for testing and validating weather prediction and climate models, as well as satellite products. Satellite systems are many times more capable now c.f. the TOGA era and we have multiple forms of calibration between remotely sensed and in situ.

The value-add of models (or otherwise) is a particular challenge for the design. Systematic errors are often high in the tropical region and mitigate against using models for the design other than in terms of broad guidance.

The design looks to exploit the strengths of different approaches:
• the global coverage of satellites
• the cost-effective global 3D sampling of T and S by Argo
• the comprehensive rapid high-quality sampling by moorings

The TPOS 2020 Interim Report will likely include an increased focus on the atmosphere and ocean boundary layers and, in particular, mixing between the surface and the thermocline.

The emergence of coupled ocean-atmosphere systems for predictions beyond the medium-range to around a month is also an area of interest for TPOS 2020. Early results from coupled weather prediction systems would suggest heightened observation impact in regions where the ocean boundary layer is active.

Surface wind requirements

Uncertainty and bias in tropical Pacific surface wind and wind stress estimates has been identified as an issue. Many climate prediction systems suffer from seemingly incompatible wind and ocean state estimates.

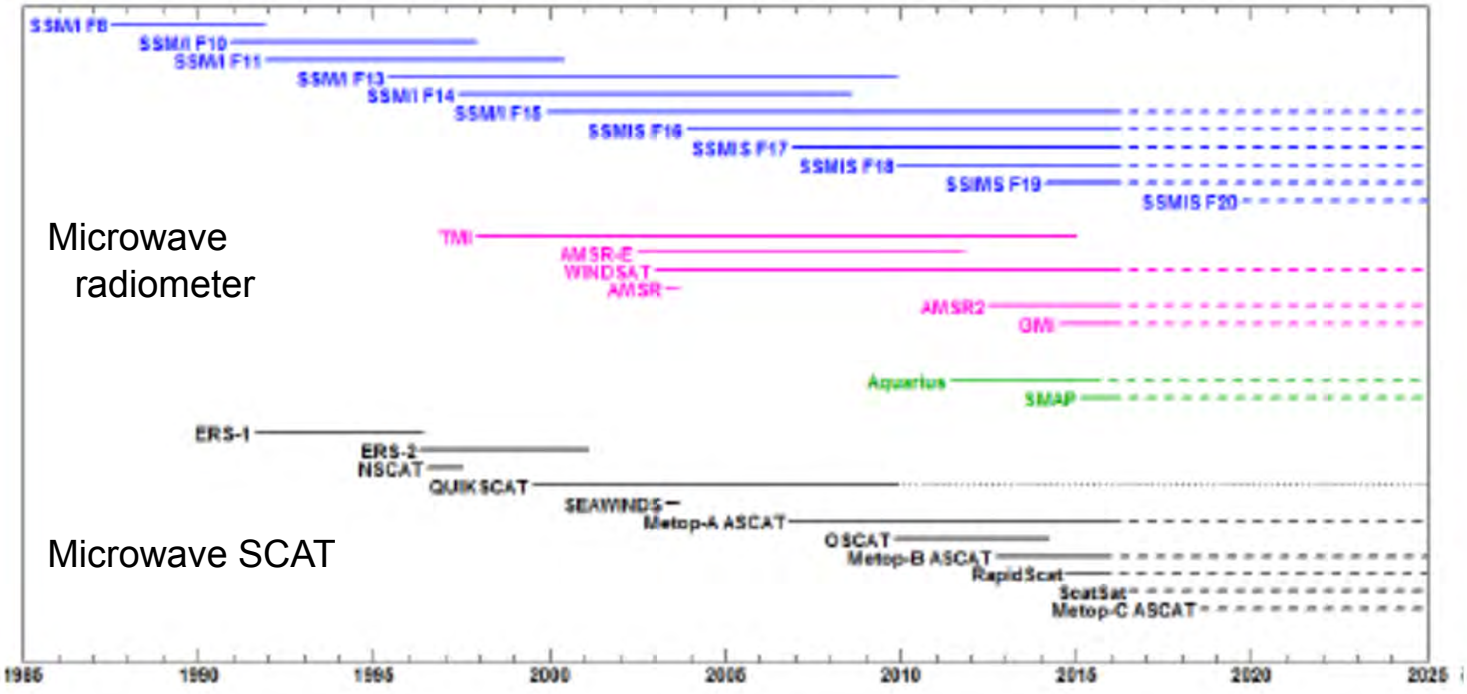


Figure from "Evaluating and Extending the Ocean Wind Climate Data Record", prepared for NASA Earth Science Division by the Ocean Vector Wind Science Team (OVWST) Climate Working Group

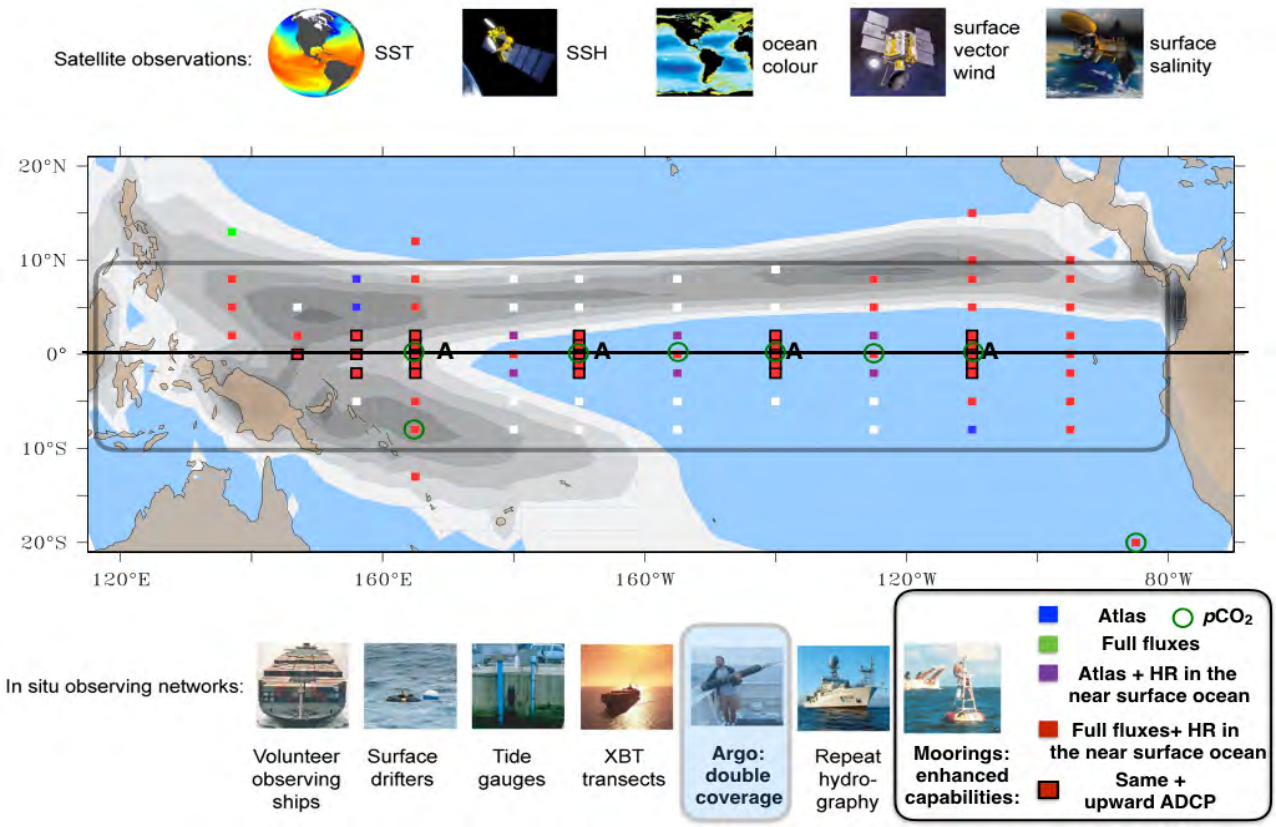
To address rain contamination and aliasing of the diurnal cycle, multiple missions supported by in situ calibration are needed. Such a combination appears capable of meeting TPOS requirements.

However products produced by different NWP centers, and by different techniques, differ significantly (this applies to fluxes as well) and it is not clear whether the in situ requirements are the same or different. The OVWST strategy for the ocean wind record does not draw on NWP capability.

The current global NWP Statement of Guidance notes that surface wind measurements are acceptable/marginal but does not explicitly address the issue of winds used by climate and ocean models, particularly in the tropics; there is no reference to the need for calibration, including for reanalysis products. TPOS 2020 will continue to examine both the requirement and the adequacy of current solutions, particularly from the point of view of sub-seasonal to decadal climate prediction.

Draft in situ design

The 1st Draft of the Interim Report suggests some significant changes to the Tropical Moored Array. One of the design options is shown below.



The major design changes include:

- greatly enhancing the tropical moored array's capabilities, focusing it on: high-frequency sampling in the near-surface ocean, and the ability to make co-located ocean, surface meteorology and full flux measurements;
- greatly enhanced high frequency circulation and property sampling along the equator;
- increased meridional resolution in the 2°S-2°N band at key longitudes;
- Argo to increasingly supplant moored subsurface temperature and salinity measurements outside these longitudes: a doubled coverage is proposed in the 10°S-10°N region.

The sampling design is guided by regimes cf gridded maps.

The data available to NWP from moorings will change: fewer locations but more comprehensive, and better transects through the convergence zones?

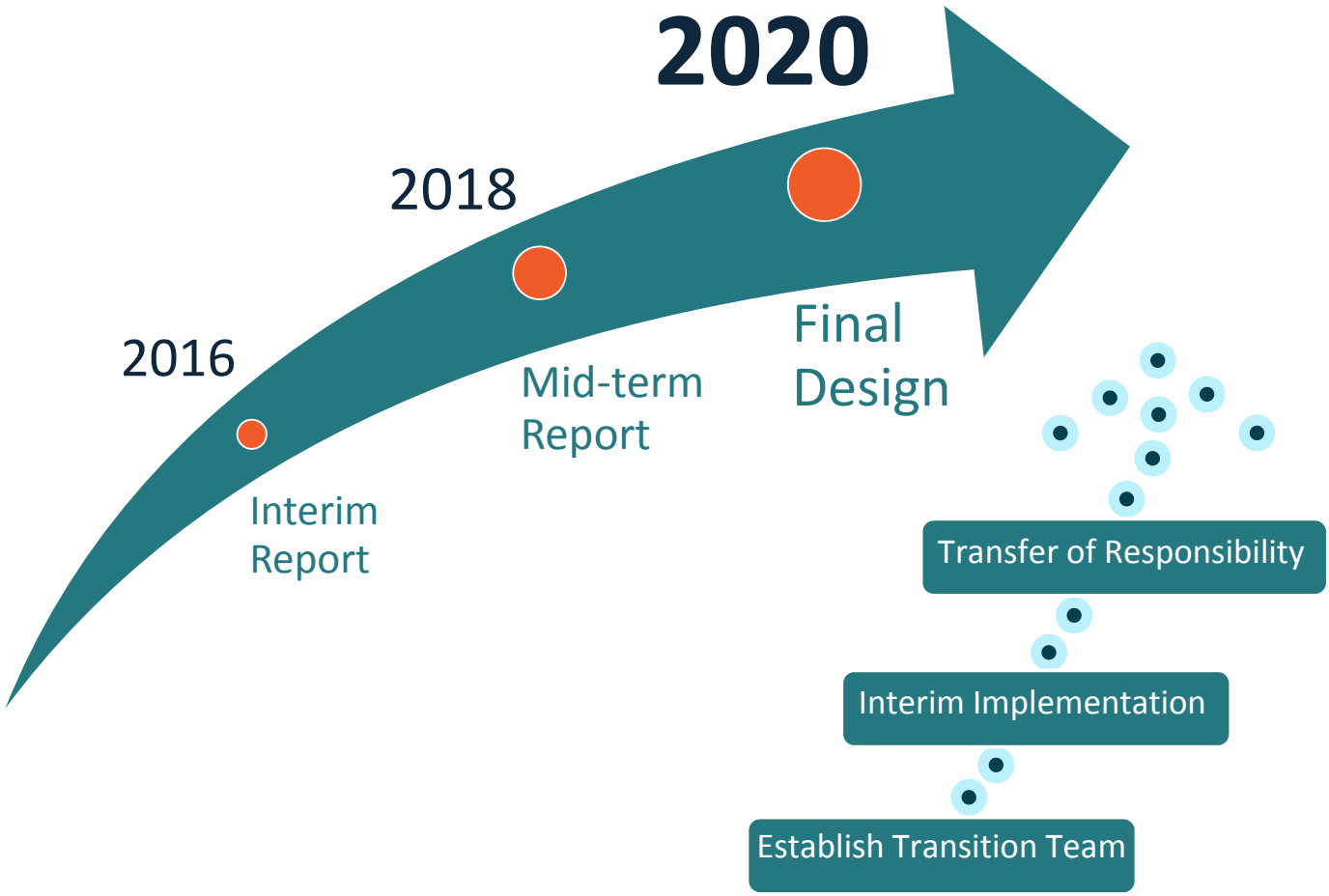
Will their be an impact on NWP? Will NWP research draw benefit? Should the fluxes be sustained or campaign based?

Transition and Implementation

Planning for transition has begun.

Key stakeholders like GCOS, JCOMM and WIGOS will be engaged for this process.

The transition process MAY lead to a permanent regional governance mechanism.



TPOS 2020 Transition Team → Permanent Coordination Mechanism?

For more information on TPOS 2020:

Website: www.tpos2020.org | Email: info@tpos2020.org

TPOS 2020 Tropical Pacific Observing System

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