

Ocean Climate Indicators: A proposed task force under GSOP

Rationale:

- Ocean Climate Indicators (OCI) are needed to monitor and understand the state of the ocean its relation to climate variability.
- Existing estimation of many OCIs are often ad hoc, not in near real time, not well coordinated, or not routinely & widely disseminated.
- A systematic, coordinated effort can enhance the benefit to the research community & bring greater awareness of societal relevance of the value of ocean observations.
- Existing OCIs are lack of circulation indices, esp. in the tropics.

Objectives of the envisioned CLIVAR Ocean Climate Indicator Task Team

To work closely with the ocean and climate research community as well as relevant stakeholders representing the general public to create a key list of Ocean Climate Indicators (OCI) based on observations & ensemble synthesis products

- that are important to monitor and understand the variability and change of the physical state of the ocean in relation to climate;
- that can be used to evaluate model/synthesis and climate models;
- that can be used to advocate for sustaining and enhancing observing systems;
- that are accompanied by description of societal relevance.

Important considerations for the OCIs include:

- Closely linked to CLIVAR's research foci.
- Not limiting to surface variables (e.g., SST), but quantities that can reflect subsurface changes as well, esp. circulation indices.
- Preferably scalar time series, but in some cases spatial pattern along with corresponding scalar temporal change indicator (e.g., EOF) can be used.
- Ideally some level of uncertainty estimates or S/N ratio.
- An important aspect is the relations among related OCIs.
- Emphasis of societal relevance.

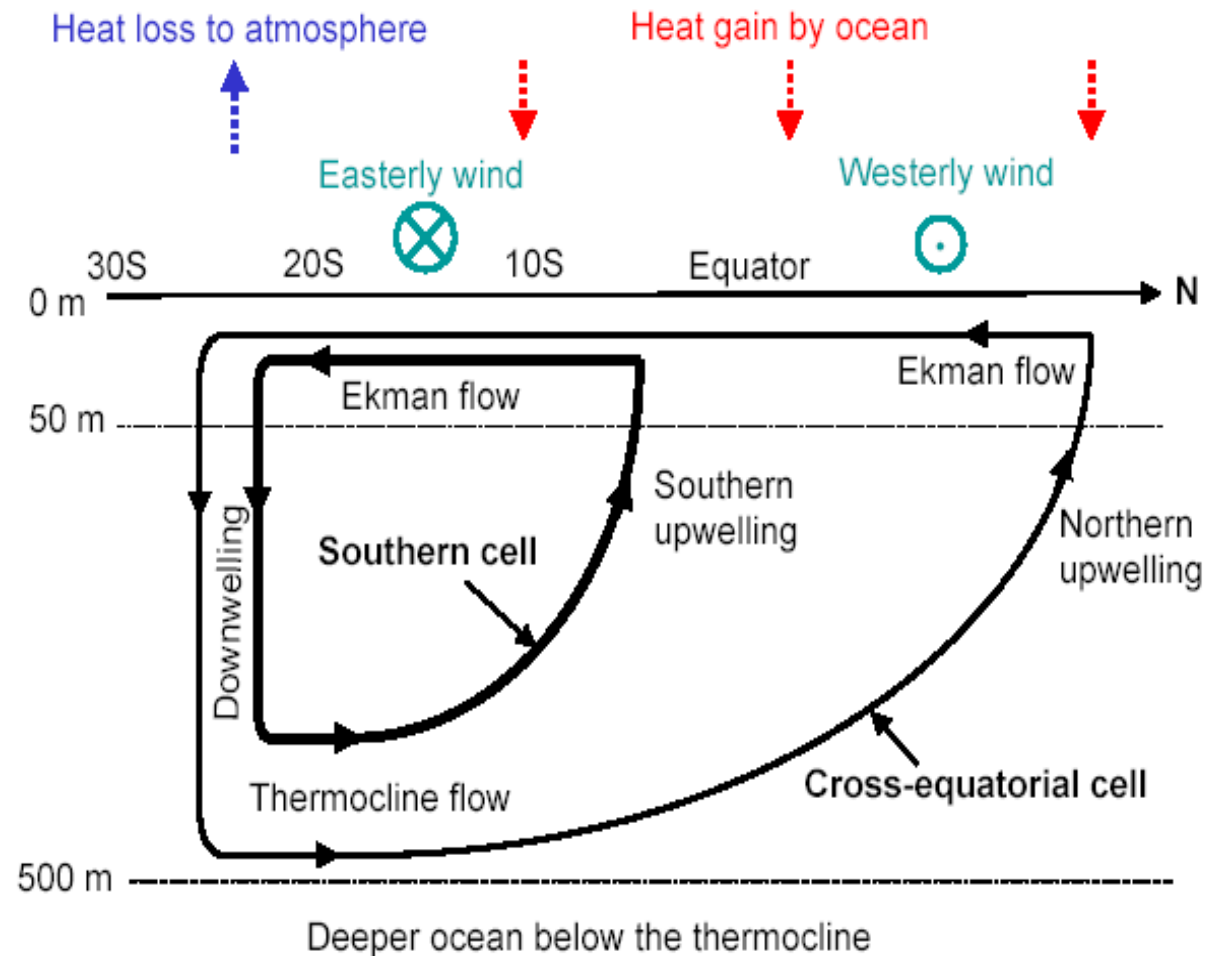
Some examples of possible OCI

- Global & regional heat content estimates.
- Tropical warm-water volumes (WWV).
- Circulation indices (e.g., AMOC transport, strength of subtropical cells – STC).
- Transports through major chokepoints (e.g., ITF, Agulhas leakage).
- Upwelling indices.

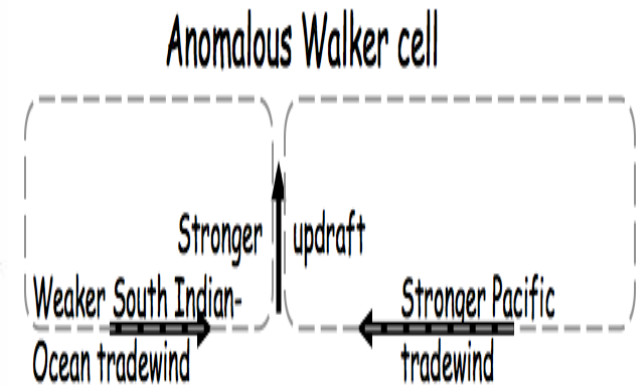
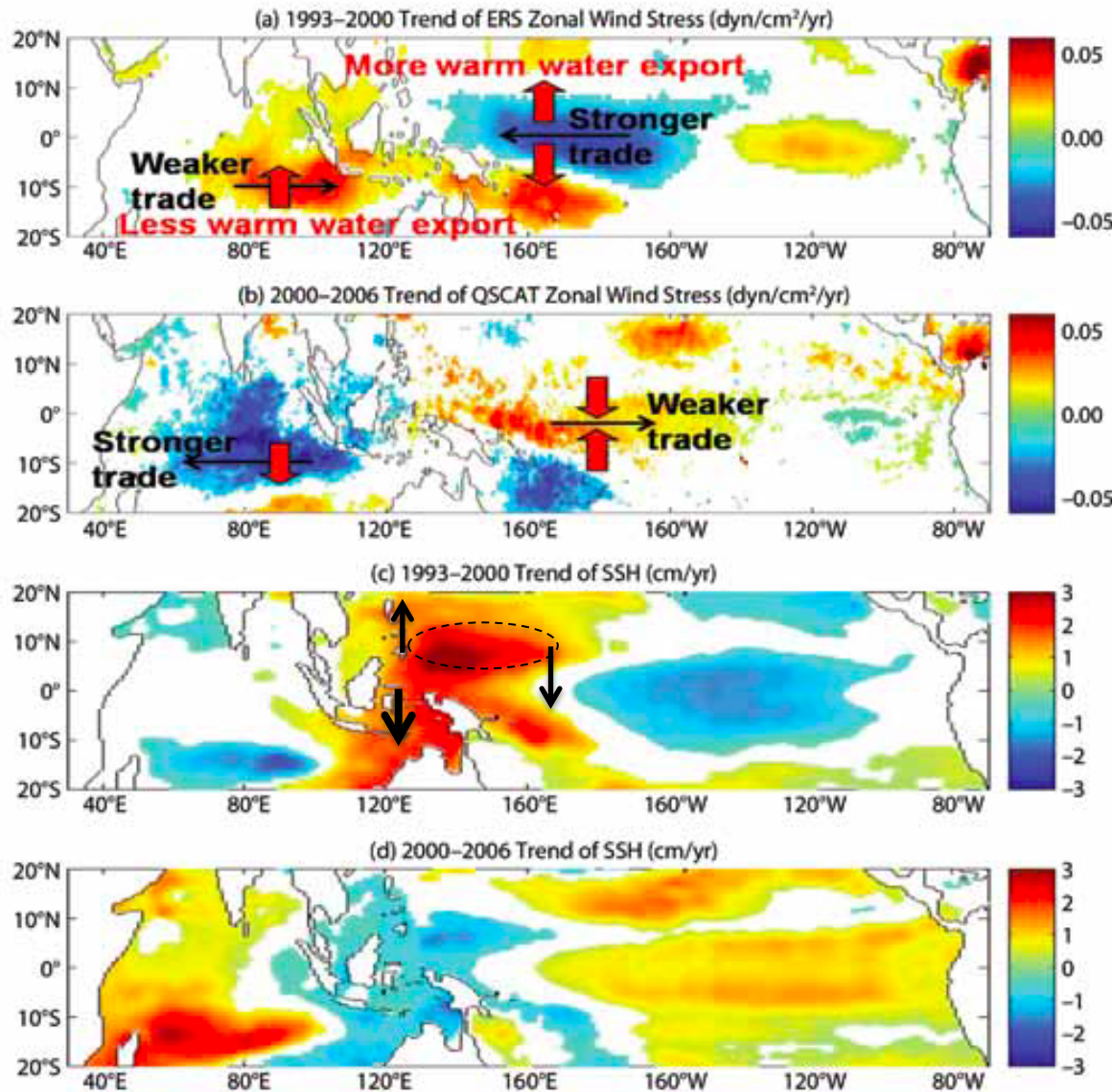
Initial Efforts (1)

- A proposed effort to be funded by NOAA:
PI: T. Lee (NASA JPL), Co-Is, M. McPhaden (NOAA/PMEL) and D. Zhang (Univ. Washington).
- To develop a set of observation-based, inter-related, climate & societal relevant indices for the tropical Pacific & Indian Oceans (based on past & ongoing research by the PI/Co-Is & other knowledge from existing literature).
- Include strength of various branches of the shallow meridional circulation (subtropical cells or STC) in the Pacific & Indian Ocean, trade wind indices & ITF index that link the Pacific & Indian Ocean STCs, and WWV that they control.
- Characterize the relations among these indicators, and their relations to the well-know climate mode indices and parameters with more direct societal relevance (e.g., regional precipitation).

Schematic illustration of the shallow meridional circulation of the Indian Ocean.
After Lee (2004). See also Lee and Marotzke (1997 & 1998).



Decadal changes in Indo-Pacific shallow meridional overturning circulations inferred from satellite wind & SSH data, the atmospheric bridge & oceanic connection via the ITF, and zonal structure of the Pacific STC (Lee & McPhaden 2008, Lee & Fukumori 2003)



Initial Efforts (2)

- An internationally coordinated effort for near real time estimates of regional ocean heat content from ensemble operational ocean analysis (led by Yan Xue, presented on July 13 & 14).

http://www.cpc.ncep.noaa.gov/products/GODAS/multiora_body.html

Real Time Multiple Ocean Reanalysis Intercomparison

(with contributions from [NCEP](#), [ECMWF](#), [JMA](#), [GFDL](#), [NASA](#), [BOM](#) based on 1981-2010 Climatology)

([Background Information](#))

Tropical Pacific Ocean

- **Climate Indices**

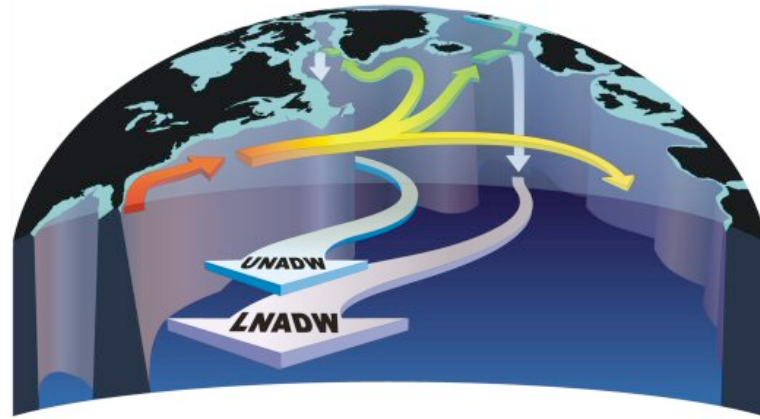
- Depth of 20C isotherm anomaly in NINO3: [last 4 years](#) [last 15 years](#) [1979-present](#)
- Depth of 20C isotherm anomaly in NINO4: [last 4 years](#) [last 15 years](#) [1979-present](#)
- Upper 300m heat content anomaly in NINO3: [last 4 years](#) [last 15 years](#) [1979-present](#)
- Upper 300m heat content anomaly in NINO4: [last 4 years](#) [last 15 years](#) [1979-present](#)
- Warm Water Volume: [last 4 years](#) [last 15 years](#) [1979-present](#)
- Warm Water Volume average in last two months ending in:
[Jan](#) [Feb](#) [Mar](#) [Apr](#) [May](#) [Jun](#) [Jul](#) [Aug](#) [Sep](#) [Oct](#) [Nov](#) [Dec](#)

- **Spatial Maps**

- Temperature anom. at z=5m (X-Y section): [last month](#) [month before last month](#) [1979-present](#)
- Temperature anom. at z=15m (X-Y section): [last month](#) [month before last month](#) [1979-present](#)
- Temperature anom. at z=35m (X-Y section): [last month](#) [month before last month](#) [1979-present](#)
- Temperature anom. at z=55m (X-Y section): [last month](#) [month before last month](#) [1979-present](#)
- Temperature anom. at z=75m (X-Y section): [last month](#) [month before last month](#) [1979-present](#)
- Temperature anom. at z=100m (X-Y section): [last month](#) [month before last month](#) [1979-present](#)
- Temperature anom. at z=150m (X-Y section): [last month](#) [month before last month](#) [1979-present](#)
- Temperature anom. in 1S-1N (X-Z section): [last month](#) [month before last month](#) [1979-present](#)
- Temperature anom. in 5N-10N (X-Z section): [last month](#) [month before last month](#) [1979-present](#)
- Temperature anom. in 10S-5S (X-Z section): [last month](#) [month before last month](#) [1979-present](#)
- Temperature anom. in 120W-90W (Y-Z section): [last month](#) [month before last month](#) [1979-present](#)
- Temperature anom. in 150W-120W (Y-Z section): [last month](#) [month before last month](#) [1979-present](#)
- Temperature anom. in 160E-150W (Y-Z section): [last month](#) [month before last month](#) [1979-present](#)
- Temperature anom. in 130E-160E (Y-Z section): [last month](#) [month before last month](#) [1979-present](#)
- Depth of 20C isotherm anomaly: [last month](#) [month before last month](#) [1979-present](#)
- Upper 300m heat content anomaly: [last month](#) [month before last month](#) [1979-present](#)

Examples of Other Effort to be Coordinated

- AMOC transport estimated from the RAPID-MOCHA array.



- NOAA/AMOL's estimate of hurricane heat potential.

Your input and contributions
are important!
Feedback welcome.