United Nations
Educational, Scientific and
Cultural Organization

Organisation
des Nations Unies
pour l'éducation
la science et la culture

Organización
de las Naciones Unidas
para la Educación
la Ciencia y la Cultura

Организация
Объединенных Наций по
вопросам образования
науки и культуры

Intergovernmental
Oceanographic
Commission

Commission
océanographique
intergouvernementale

Comisión
Oceanográfica
Intergubernamental

Межправительственная
океанографическая
комиссия

Translating insights from observatories to policy

Dr. Luis Valdés
IOC/UNESCO

Ocean Carbon and Biogeochemistry
www.us-ocb.org

2015 OCB Summer Workshop - Woods Hole, 21/7/2015

Environmental success stories (not exhaustive)

DDT

Key dates: Rachel Carlson 1962 (Silent Spring). U.S. DDT ban in the early 1970s

Obs/monitoring network: YES

Proven Science: YES

Phaseout of substances: YES (with some exceptions

Progress in technology: YES

International protocols: YES/2001/UN

Recovery: YES

Acid rain

Key dates: The term "acid rain" was coined in 1872. Late 1960s that scientists began widely observing and studying. Clean Air Act Amendments of 1990

Obs/monitoring network: YES

Proven science: YES

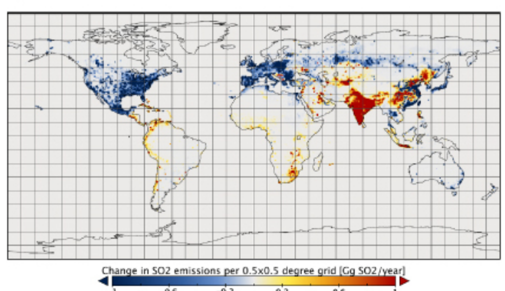
Phaseout of substances: YES

Progress in technology: YES

International protocols: YES/1979/UN

Recovery: Partially

Figure 3 from Z Klimont et al 2013 Environ. Res. Lett. 8 014003



Ozone Hole

Key dates: 1973 (detection CFC in atmosphere), 1985, 1991

Obs/monitoring network: YES

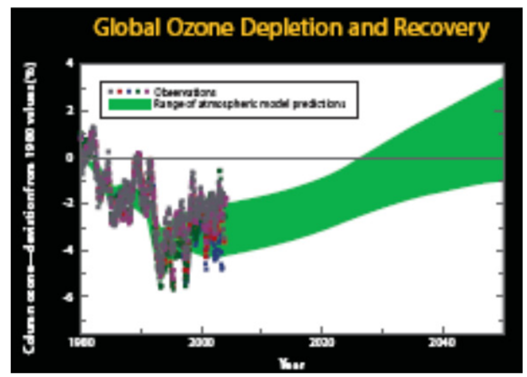
Proven Science: YES

Phaseout of substances: YES

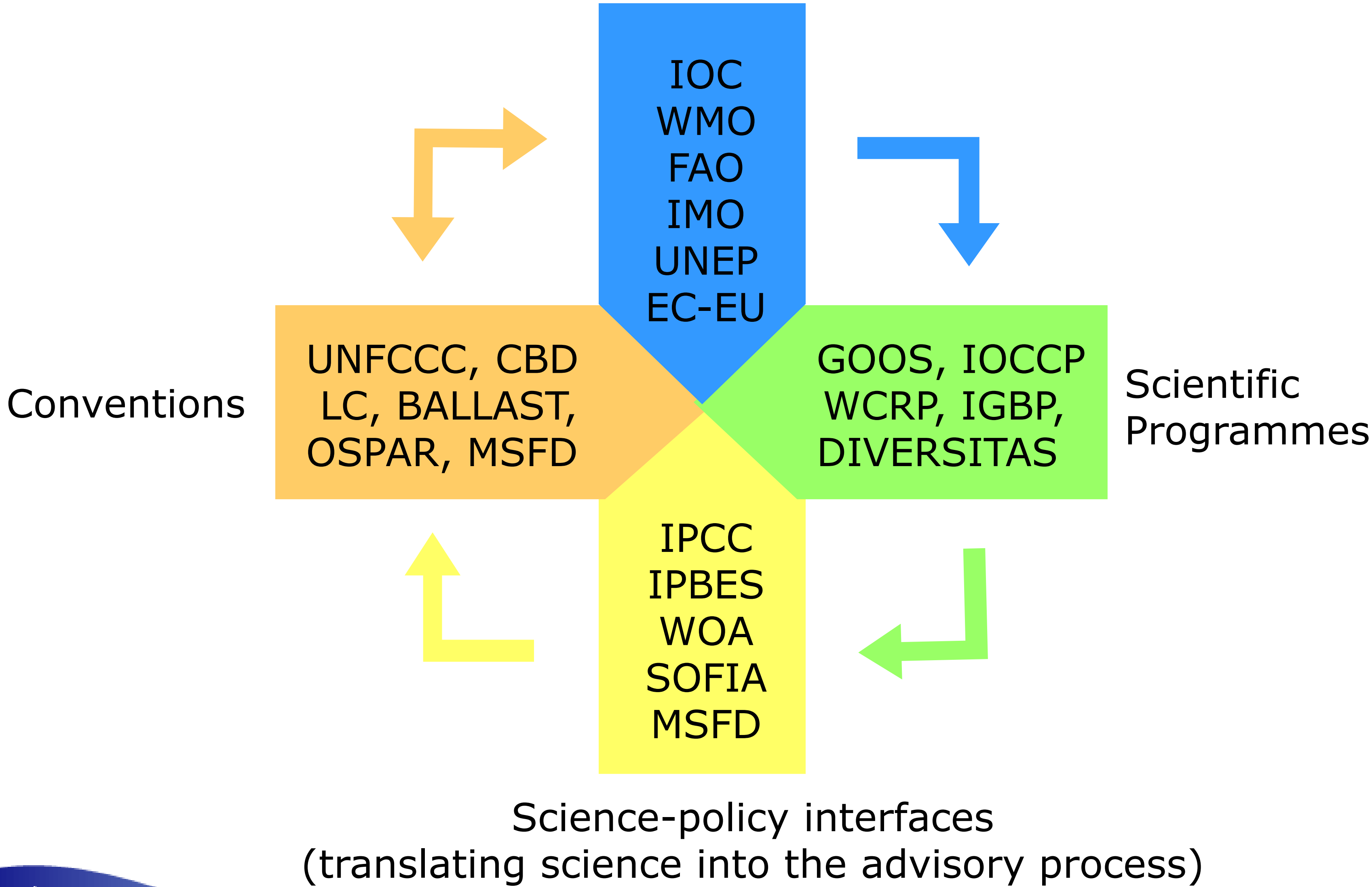
Progress in technology

International protocols: YES/1987/UN

Recovery: No yet

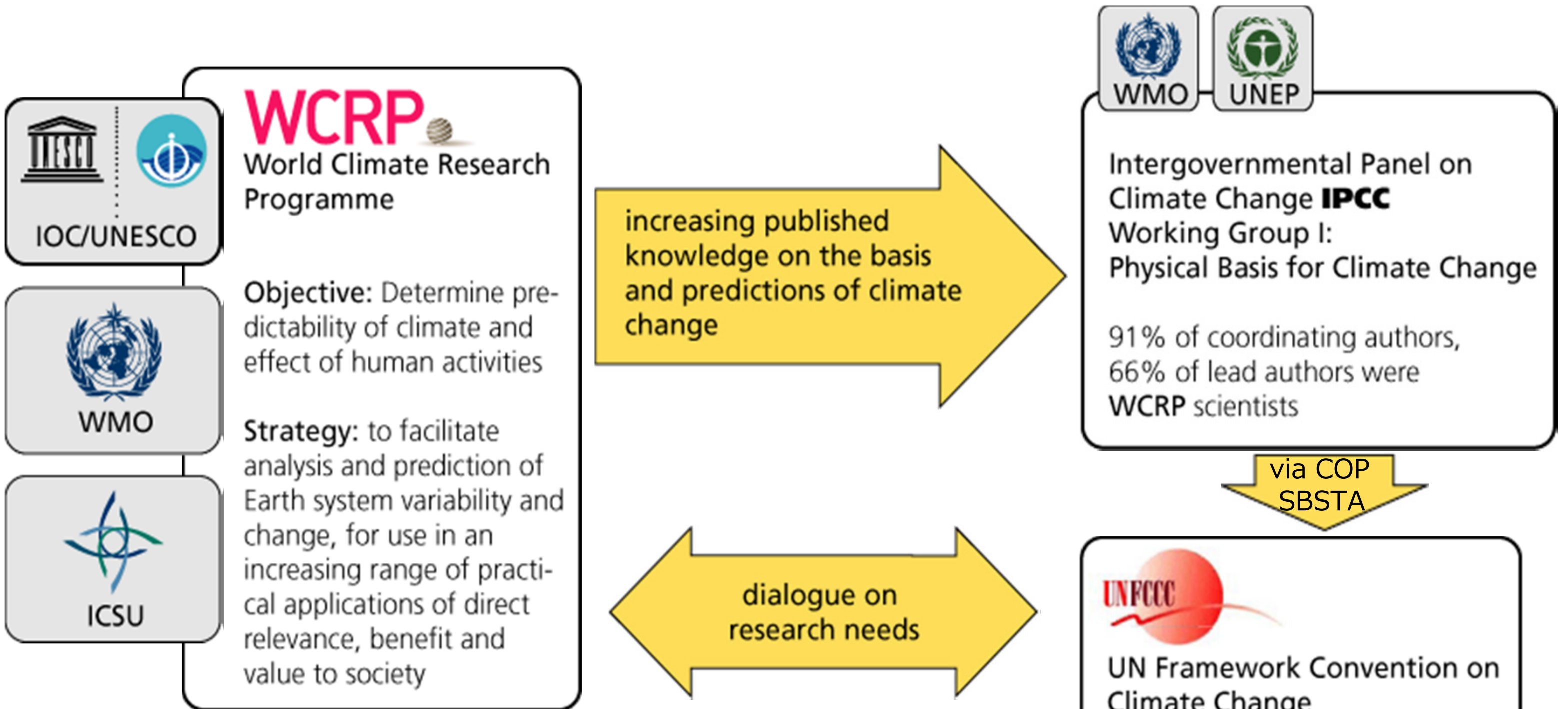


Scientific knowledge and policy interface



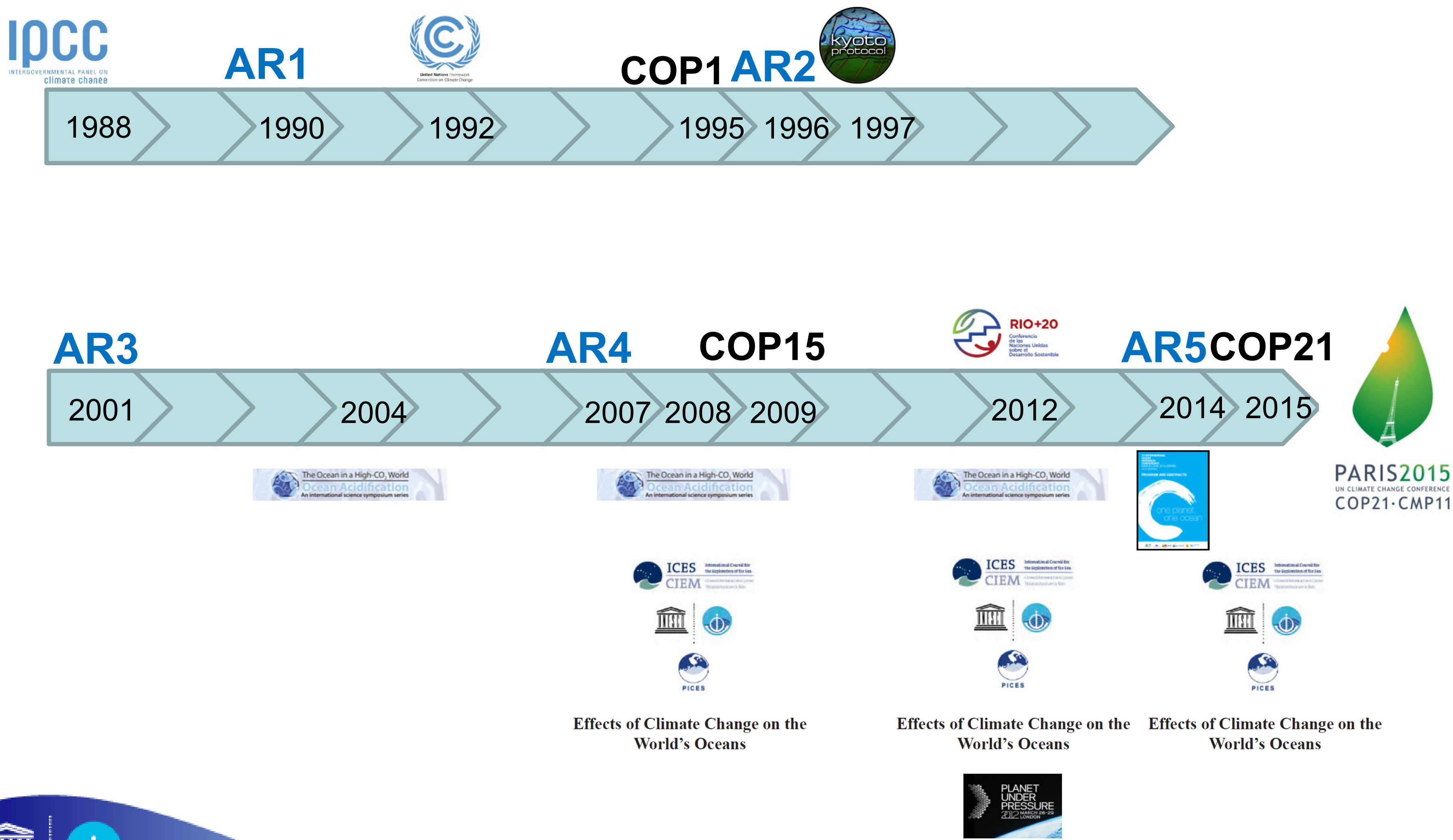
Scientific knowledge and policy interface

Example of Science-policy Architecture for Climate knowledge



Policy directed by science

IPCC AR, relevant COPs and scientific conferences



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Policy directed by science

Three characteristics converge in COPs and make them particularly complex process:

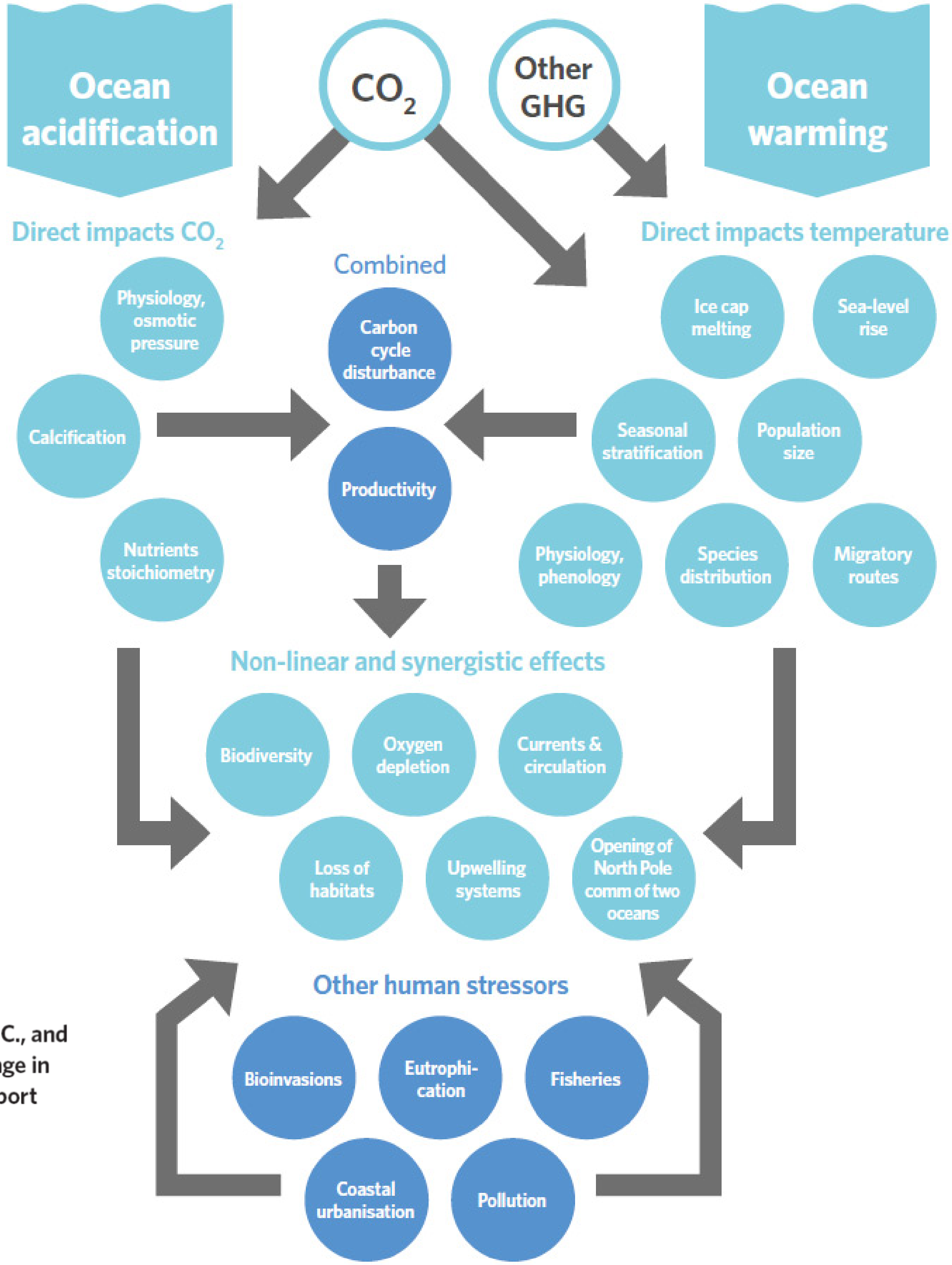
1. COP **negotiations are about sustainability**, meaning that management objectives should include social, economic and ecological concerns, requiring trade-offs. The exact needs and challenges, e.g. whether objectives and measures focus more on ecosystem/planet health, economic opportunities or human well-being (or a combination thereof), depend very much on the financial capacity, countries' priorities and political willingness.

2. COP **negotiations deals with different member states as well as institutional settings and political regimes, requiring multi-level and multilateral governance and authority** (i.e. UN system). Decision makers must understand that ecosystems are complex and often do not match existing policy scales or boundaries. A limited agreement which ignore the planetary dimension of climate change can result in policy recommendations that are not meaningful and can lead to institutional ambiguity and pose limitations to effective correction measures on CO_2 (and other GHG) emissions.

3. COP **negotiations require cross-sectoral coordination and the integration of sectoral concerns and management**. Oil and gas producers, agriculture, fisheries, ecological reserves and MPAs, tourism, etc. are all activities managed by different sectoral approaches. UNFCCC/COP agreements have to build institutional linkages with sectoral governance arrangements to avoid conflicts when implementing mitigation and adaptation measures to climate change.

Observations, measurements and uncertainties

Climate change is affecting many ocean physical, chemical and biological processsess key for the sustainability of climate, biodiversity, food security, economies, etc, at planetary scale



▲ Conceptual model of oceanic stressors (Reid, P. C., and Valdés, L. 2011. ICES status report on climate change in the North Atlantic. ICES Cooperative Research Report No. 310, 262 pp).

Key uncertainties remaining from AR5

- The extent of warming in deep water masses (below 700 m).

- While acknowledged as a critical process influencing ecosystem productivity, the likelihood of climate-induced changes to major upwelling systems was still uncertain.

- Ways in which climate-induced changes in the physiology and biogeography of an individual species may alter ecosystem structures, species interactions, and food webs.

- An improved understanding of climate sensitivity at the ecosystem level that considers multiple drivers (e.g., ocean warming, acidification, and hypoxia), multiple stressors and synergistic impacts

- The capacity for phenotypic and evolutionary adaptation over generations to respond to long-term climate change.

- Increased resolution of forecasted impacts and changes at national and ecosystem scales to fisheries food production and security, and potential adaptation responses.

- Climate-related impacts to coastal sectors, such as tourism and aquaculture and its consequences in human well-being and in regional economies

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Key uncertainties remaining from Santos (Brazil)

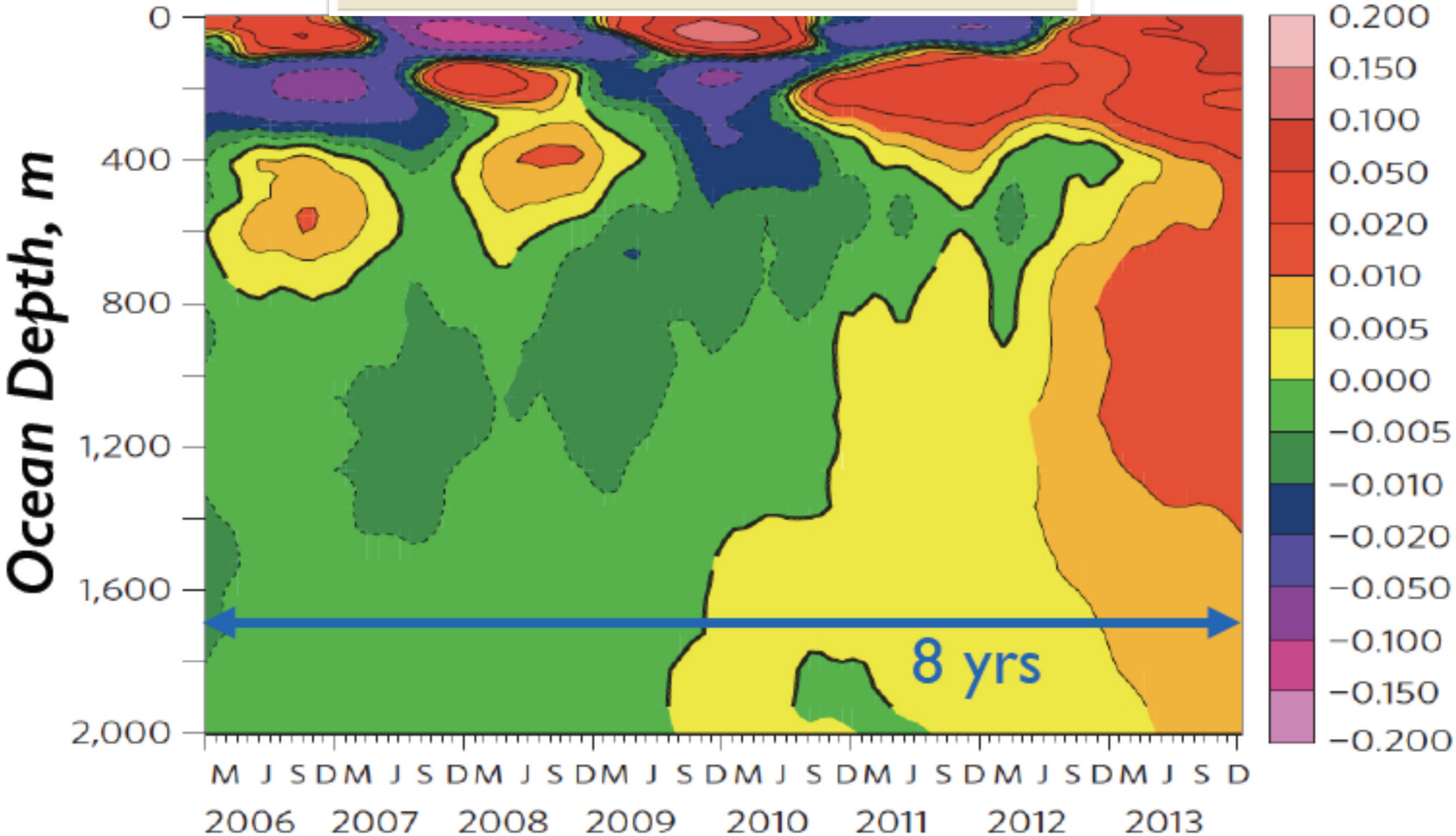
- Measurements: what and why?
- Physical understanding: non linearity and tipping points
- Decadal climate variability underlying the signal of CC
- Climate induced changes in upwelling systems
- Deoxygenation and hypoxia
- The expansion of oligotrophic gyres
- Impacts of OA in marine biota

Key uncertainties remaining from Santos (Brazil)

- Seasonality, phenology and match-mismatch
- Species sensitivity and response to climate change
- Genetic and phenotypic adaptation capacity
- Scaling up to ecosystems and cumulative synergistic effects
- Blue Carbon: a natural option to mitigate climate change
- Climate Change and economy: Human Activities at Risk
- A new narrative: delivering the message right

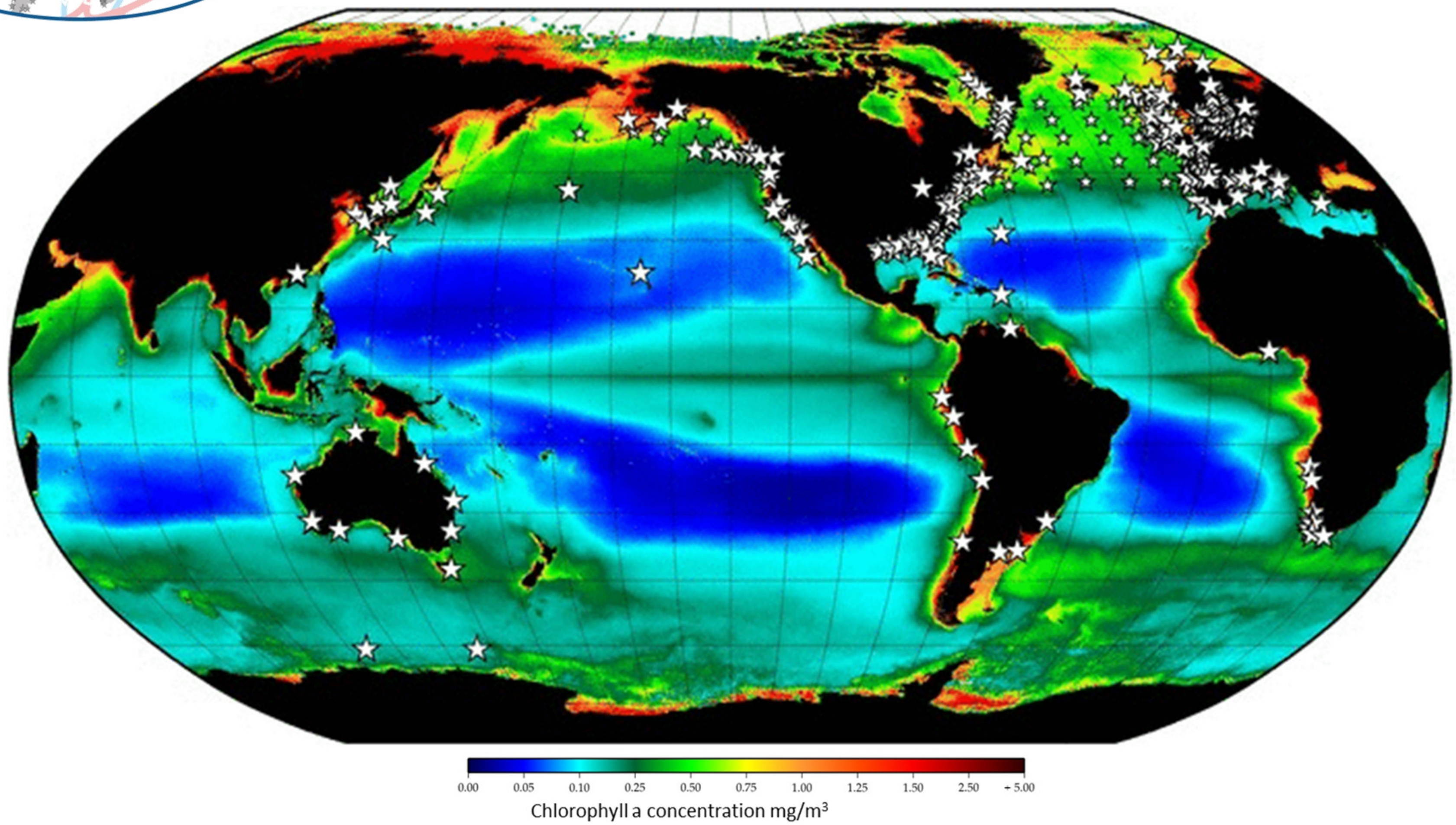
Key uncertainties: The extent of warming in deep water masses

Roemmich et al. 2015
doi:10.1038/NCLIMATE2513



Key uncertainties: Measurements: what, why and where

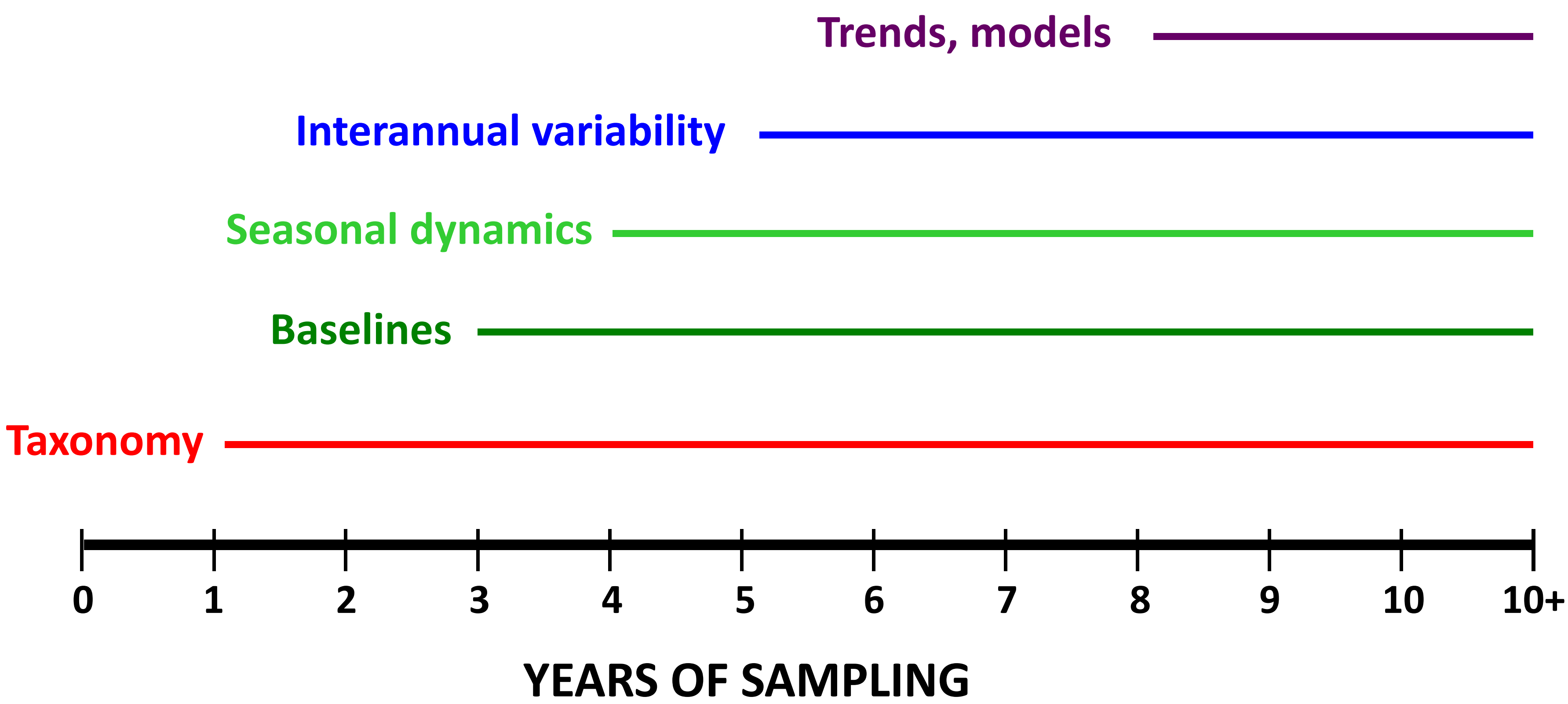
International Group for Marine Ecological Time Series
Ship-based ecological time series



Coupling biogeochemical with physical systems (big challenge)

Key uncertainties: Measurements: what, why and where

Levels of understanding – Need for continued sampling

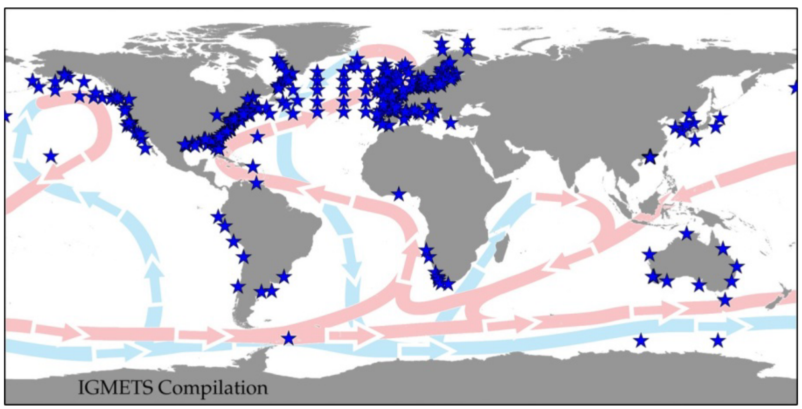


Key uncertainties: Measurements: what, why and where

Individual TS analysis

I. Identification of temporal patterns.

II. Understanding of local processes.



Joint TS analysis

I. Identification of temporal and spatial patterns.

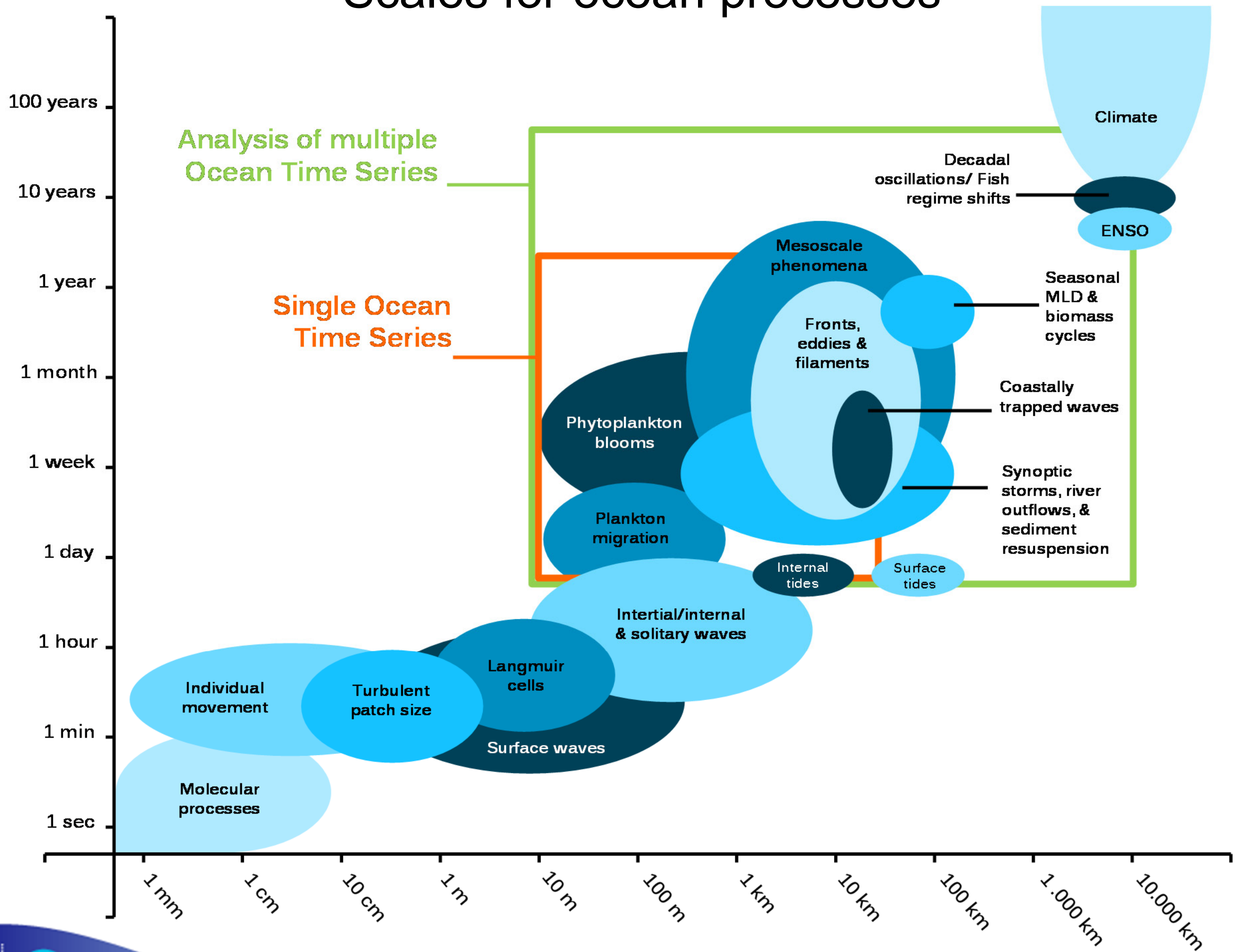
II. Establishment of baselines.

III. Understanding of regional and global processes - insights on linkages between climate variability and ocean biogeochemistry at regional, basin and world ocean scales can be gained from several time-series geographically distributed.

IV. Separation of stressors.

V. Projection and Forecasting.

Scales for ocean processes



Modified from Dickey 2002

IGMETS

nternational Group for
Marine Ecological Time Series

Version: 2015-May-22

See legend below main map.

Active TIME WINDOW

5 year (1998-2012)

[World | Arctic | **ATL-all** [N S] | Southern | Indian | **PAC-all** [N S] | N-America] [* RESET-Interface *]

Symbol Layer: ***Choose a variable below***
No Symbols (*turn off symbol layer*)

Time Windows & Salinity Ranges

Background Fields
Trends SST-vs CHL-vs

Hydrography	Tr	Ct	Cc	Ci
Temp				
PSal				
D-Oxy				
SST(R)				
PSAL (H)				
WIND(I)				

Chemistry / Carbon	Tr	Ct	Cc	Ci
N-NO3				
P-PO4				
Si-SiO4				
CHL(S)				
Chl-a				
Chl+PCI				

Biology	Tr	Ct	Cc	Ci
Copepods				
ZooMass				
ZooCombo				
Diatoms				
Dinoflags				
DiaDinRatio				

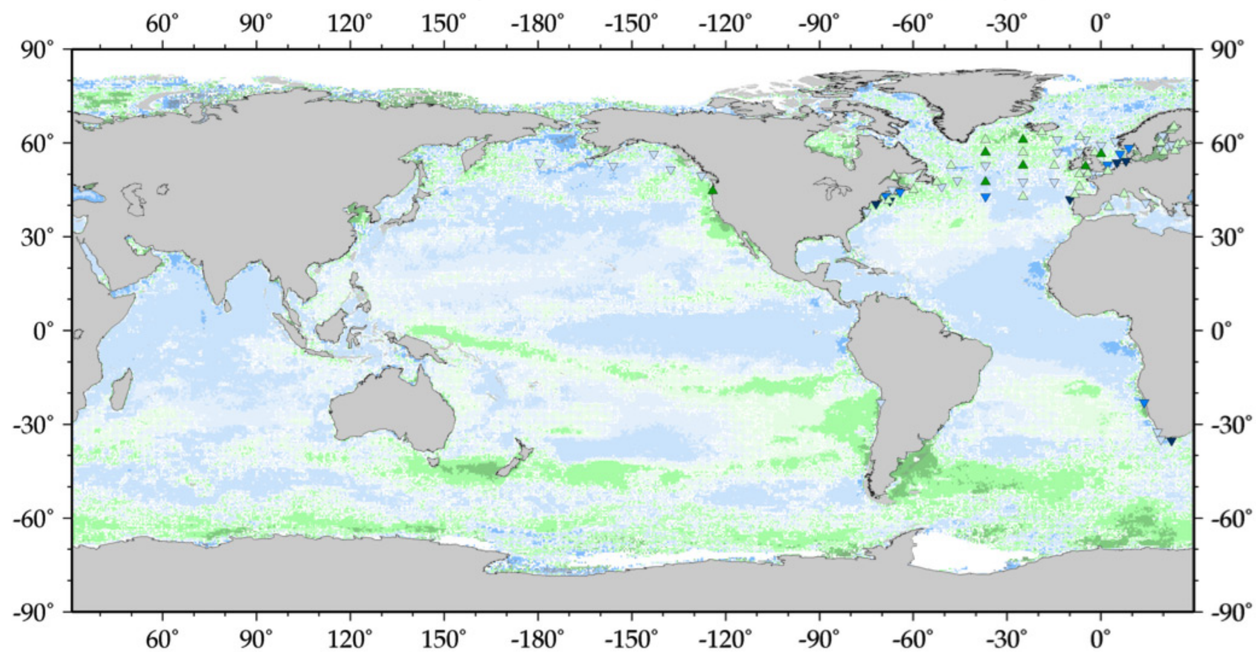
TWin: 05yr, 10yr, 15yr, 20yr, 25yr, 25yr

Salinity: *Any/All* 00-40; *Ranges* 26-39, 01-26, 00-01

Temporal Trends			
Var	*	S	n
SST			
CHL			
Rain			
AirTemp			

BackFade: NONE, FADED, LITE, MED, DARK, DARK!

IGMETS Trends 2015-May Sites-in-plot = 81 [TRENDS : ztotc : 15yr : p0040]



SYMBOL LAYER:
15 year (1998-2012) temporal-trends in Total Copepods.

NEG (p<0.01) NEG (p<0.05) NEG (non-sig) POS (non-sig) POS (p<0.05) POS (p<0.01)

Trends over Time (biologically-related variables)

BACKGROUND FIELDS:
15 year (1998-2012) rates of change in Chlorophyll (mg/m3/yr). SeaWiFS/MODIS-A

< 0.05/yr < 0.01/yr < 0.001/yr < 0.00/yr > 0.00/yr > 0.001/yr > 0.01/yr > 0.05/yr

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‘Ocean TS Heritage’

I. No substitute exists for adequate observations

II. Observations which are not made today, are lost forever!

III. Existing observations are useless if are not made accessible.

IV. Collective value of data sets is greater than its dispersed value.

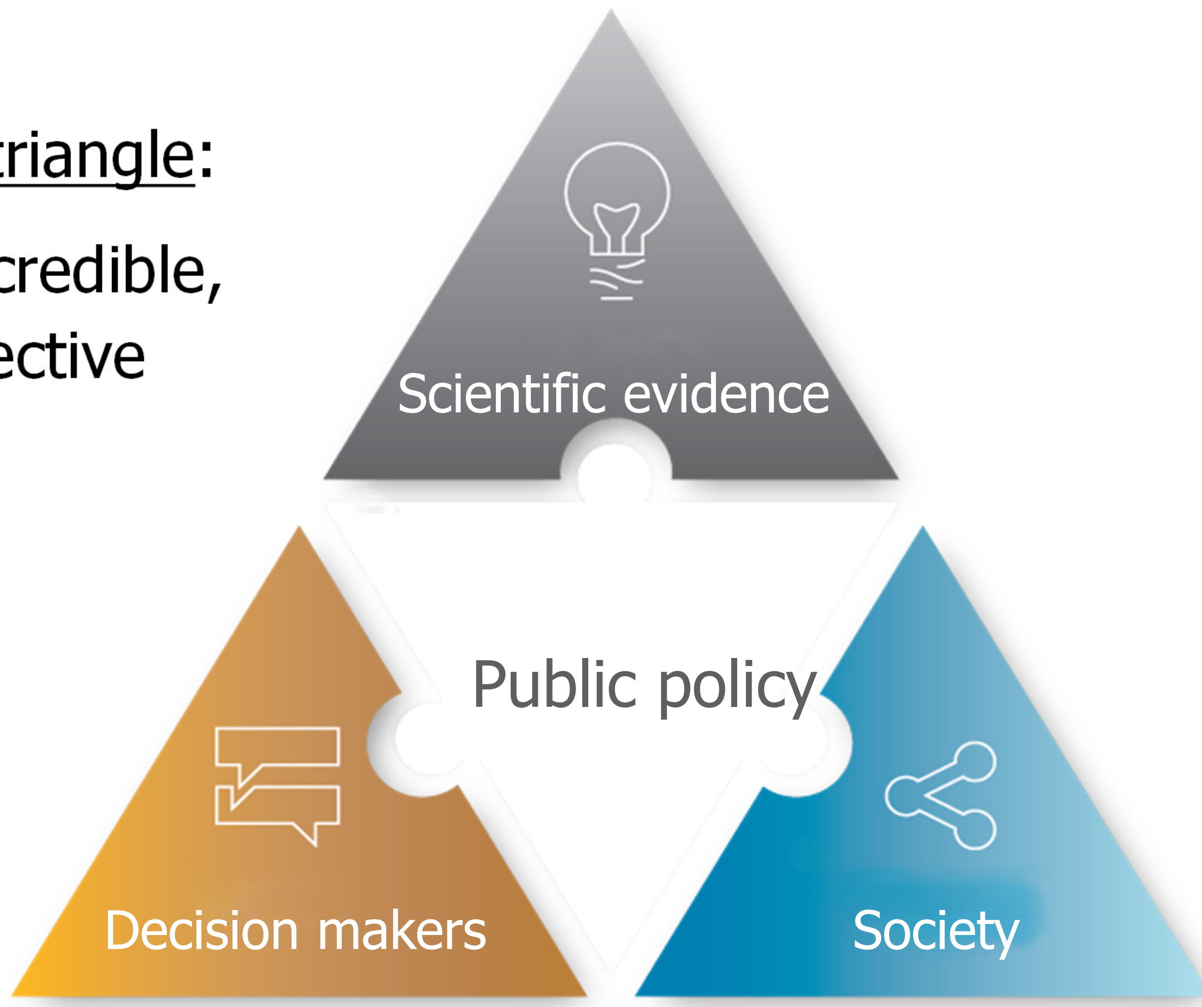
V. Models will evolve and improve, but, without data, will be untestable.

VI. Today’s climate models will likely prove of little interest in 100 years. But adequately sampled, carefully quality controlled and archived data for key elements of the climate system will be useful indefinitely.

A new narrative: delivering the message right

The interaction triangle:

Making science credible, salience and effective



Modified from Röckmann et al. 2015. Marine Policy, 52:155–162

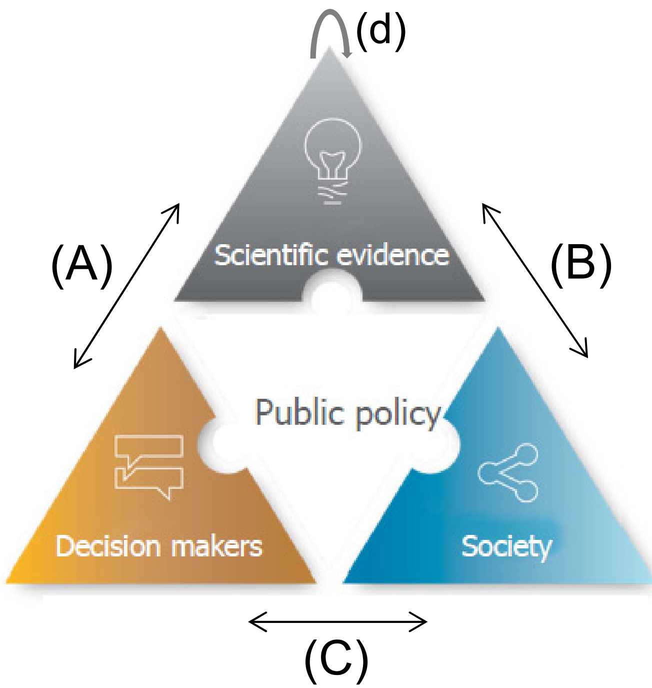
A new narrative: delivering the message right

(A) Interaction between scientists and decision makers to transform science into policy output.

(B) Interaction between scientists and public/social actors to enhance societal scientific knowledge and create mutual trust.

(C) Interaction Between decision makers and public/social actors, to shape participation processes to foster legitimacy of UNFCCC and COP processes.

(d) Interaction among scientists to foster best practices and new knowledge production



Rio+20 Follow up Document The Future we want

Decision on a set of global Sustainable Development Goals (SDGs)

Rio+20 launched an intergovernmental process to develop a set of SDGs, building upon the Millennium Development Goals, following these principles:

- Contribute to the full implementation of the outcomes of all major summits in the economic, social and environmental fields

- Focus on priority areas in the Rio Outcome document.

- Address in a balanced way all 3 SD dimensions

- Integrated into the United Nations development agenda beyond 2015.

- To be approved by UNGA 69th session (2014)

SCIENCE FOR SUSTAINABILITY

Economy
Investing in new opportunities, innovation & sustainable activities

+

Society
Promoting well-being & equal access to services & resources

+

Environment
Preserving ecosystems and their potential

+

Science
Producing new knowledge, common understanding & an integrated vision

Space equity
Developing geographical balance in access & use of marine resources

+

Time equity
Managing the means of subsistence for inhabitants of today & generations to come

Policy making
Fostering good ocean governance

BLUE SOCIETY
Oceans of new opportunities for all

No Science=
No Sustainability

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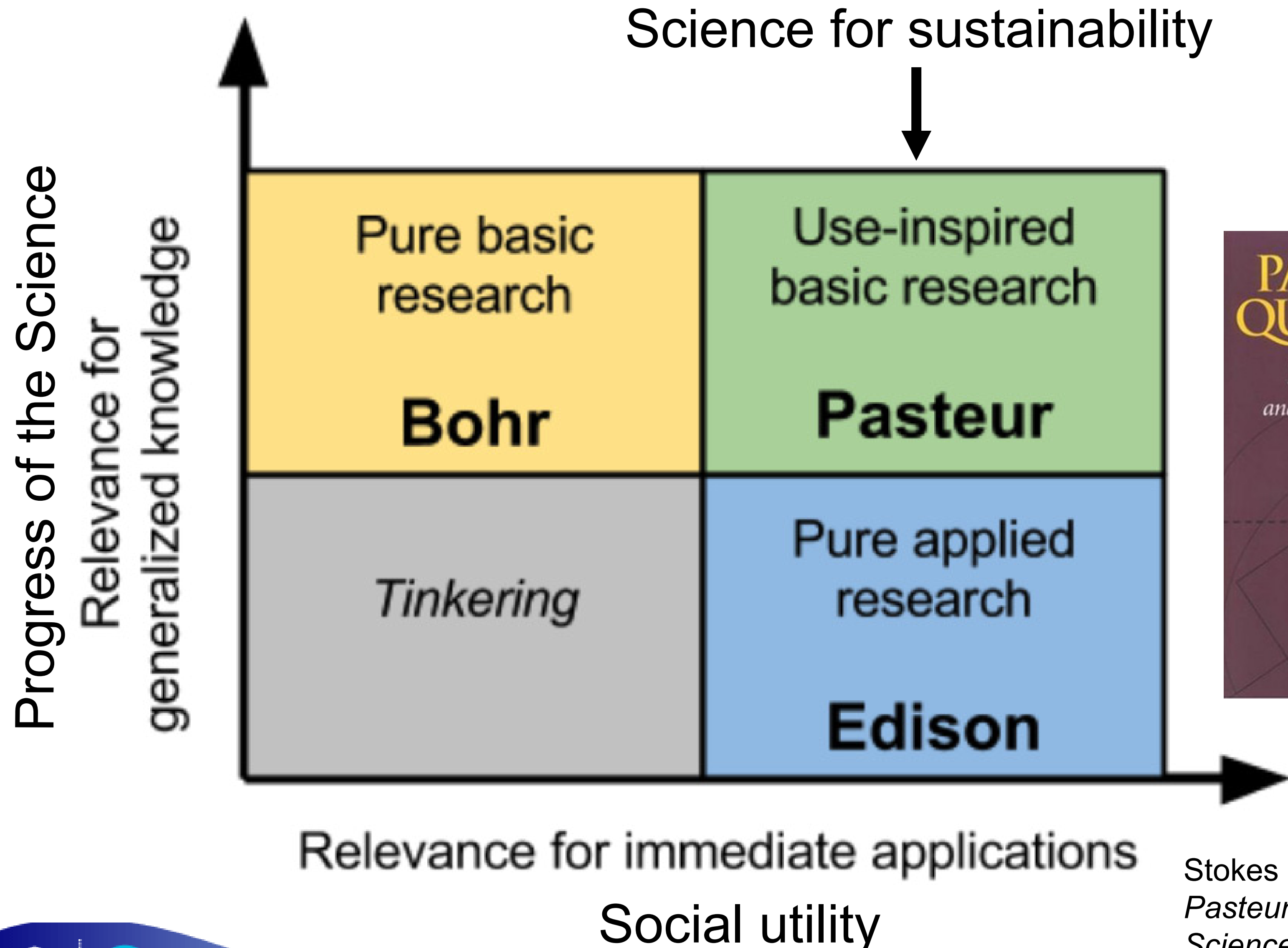
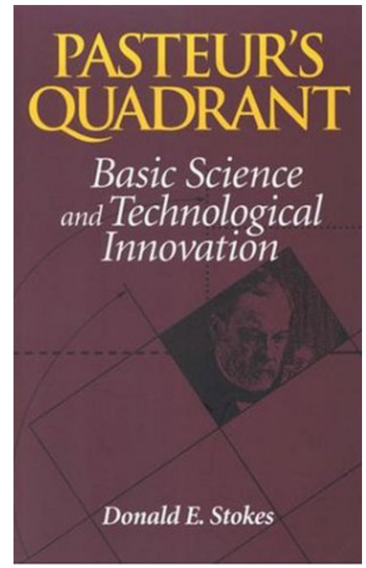
Pasteur's quadrant: Coupling knowledge to action





Stokes D. E. 1997. *Pasteur's Quadrant: Basic Science and Technological Innovation.*

Final Remarks

- There is a need for increasing translation of scientific knowledge into specific policy action (e.g. in Climate change)
- Long time gap between scientific findings and policy responses
- Scientist must follow "best practice" to ensure high quality, independent and policy relevant information, and therefore legitimate scientific knowledge and advice.
- It is necessary to continue developing strategic interfaces (e.g. IPCC, IPBES, WOA, SOFIA) to strengthening science-policy links among organisations (e.g. IOC, FAO, WMO, EC, etc.) and Convention/ multilateral environmental/sustainable development agreements (e.g. CBD, UNFCCC) at the regional and global levels.
- It is necessary to strength research and science for sustainable development and on global environmental change and support developing countries to build capacity in science and technology, as well as in science for policy processes.

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