The *Blue*CARES Project and the EAS Initiative

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Blue Carbon: Biological carbon captured by coastal-marine organisms through photosynthetic process in mangroves, seagrass, salt marsh, etc.

Main components of
"Blue carbon ecosystem"

55% of total organic carbon stock on the globe is owned by marine organisms. However, annually its 0.5-3% has been lost due to degradation of coastal environment and others (Pendleton et al. 2012).

Carbon release back to atmosphere

Rapid declining of coastal ecosystems

Coral Triangle as world richest area in biodiversity

*Blue*CARES Project

'Comprehensive Assessment and Conservation of Blue Carbon Ecosystems and their Services in the Coral Triangle'

- **Period: 5 years from April 2017 to March 2022**
- **Joint scheme: Trilateral joint project among Philippines, Indonesia and Japan**

Funding: SATREPS Program jointly established by JST (Japan Science and Technology Agency) and JICA

Key questions on Blue Carbon:

- How to precisely assess blue carbon?
- Blue carbon has been well preserved or degraded?
- If degraded, what are causal relationships behind?
- What will happen if no action will be taken?
- How to properly conserve blue carbon?
- How do we link blue carbon with coastal ecosystem conservation efforts?

Needs of "Blue Carbon Strategy" for implementing effective actions based on proper scientific knowledge

BlueCARES project aims at establishing and proposing 'Blue Carbon Strategy' as an effective scheme for enhancing local efforts to conserve coastal ecosystem and improve its resilience and thereby for contributing to mitigation of global warming.

Expected Outputs of BlueCARES Project:

1. Innovative integrated system of monitoring and modeling methodology on the blue carbon dynamics is developed
2. Blue carbon dynamics and associated ecosystem processes are elucidated, based on the monitoring and modeling methodology
3. Framework for effective conservation of blue carbon ecosystems is developed, based on comprehensive ecosystem service assessment
4. "Core-and-Network“ System is operationalized for nation-wide monitoring, implementation of Blue Carbon Strategy, and capacity building
5. Blue Carbon Strategy is proposed for policy making bodies in national and local levels

Key points for innovative blue carbon study

1) 'Flux (flow) + stock-based' assessment

2) 'Ecosystem-based' assessment instead of 'element-based' assessment

Blue carbon assessment of a coastal ecosystem as a whole, characterized as a 'mangrove-seagrass beds-coral' linkage system

3) 'Local + sub-regional + regional' multi-scale assessment

A coastal ecosystem should be treated as an open system having import from and export to the surrounding systems (watersheds, outer seas). Blue carbon therefore should be evaluated in an integrated Land-Coast-Ocean scheme. In this regard, 'green carbon' should be properly linked for blue carbon assessment. Advanced RS method like LiDAR should be introduced in a regional scale mapping.

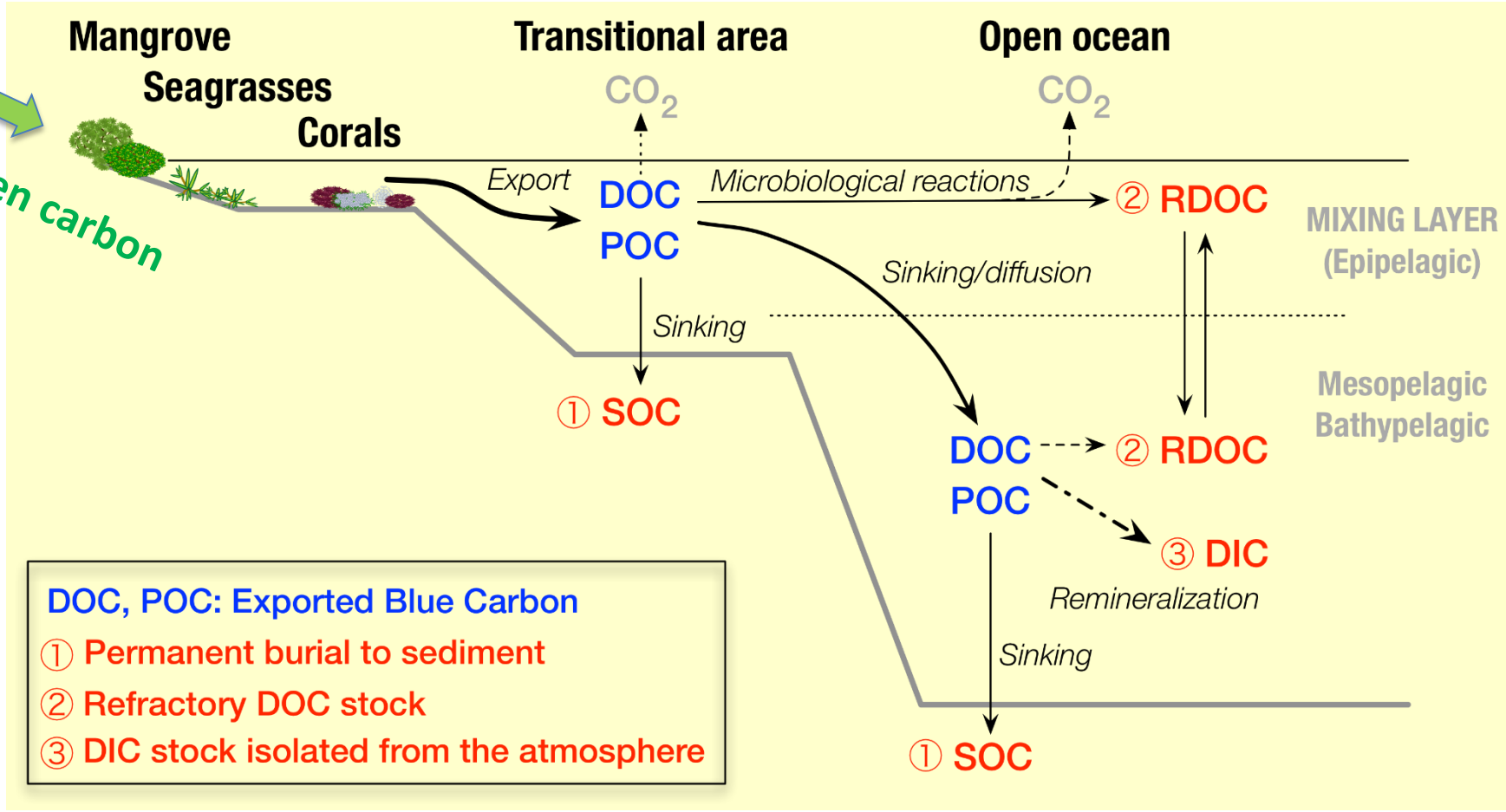
4) Future predictions for scenario analyses

Needs of developing an integrated model system for coastal ecosystems under combined local and global environmental threats

5) Effective scheme for properly conserving multiple ecosystem services including blue carbon

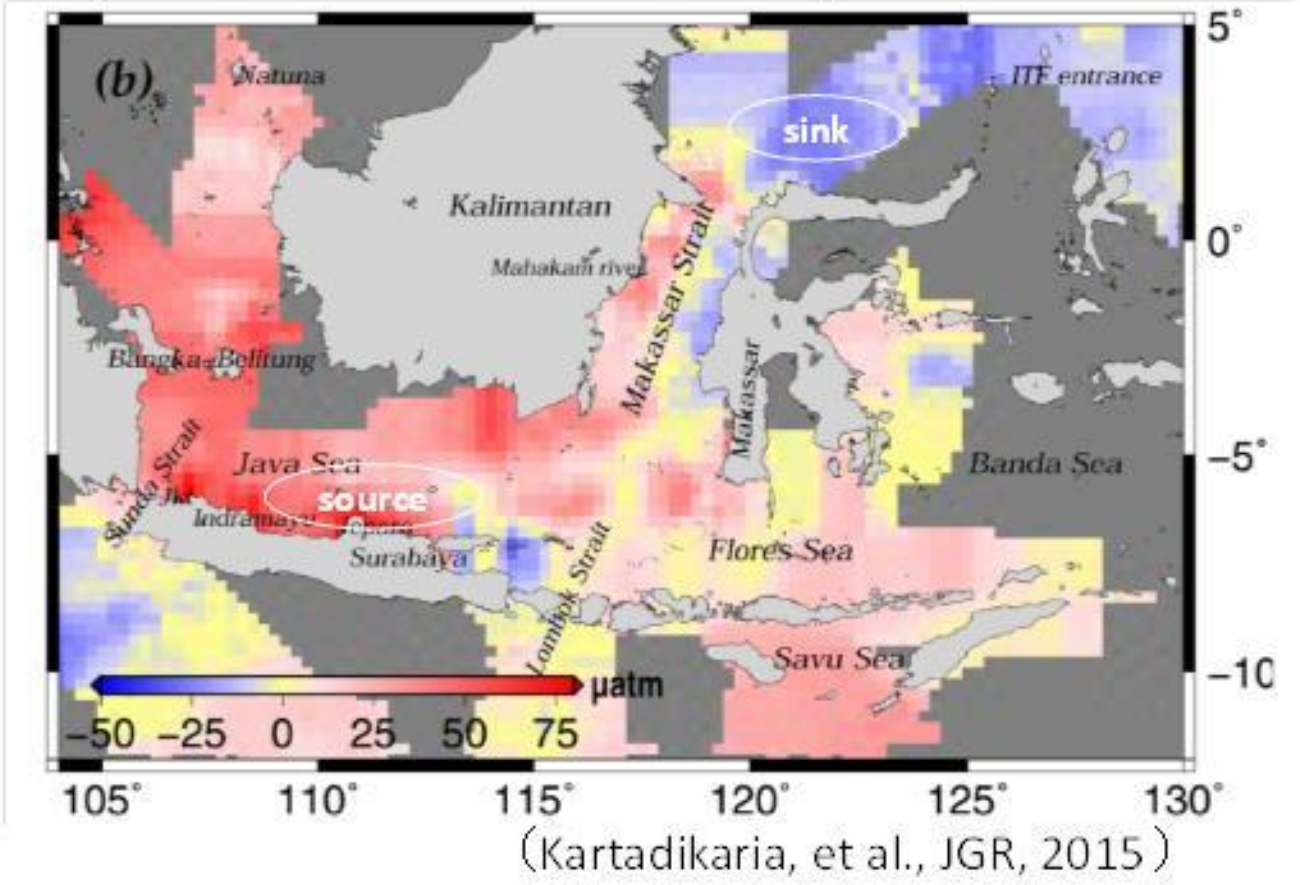
Major pathways of blue-carbon sequestration to the outer ocean

(Based on the figure by T. Miyajima)



More extensive scope is needed for accurate understanding of blue carbon dynamics!

"CO_2 sink/source characteristics in tropical Indonesian seas"

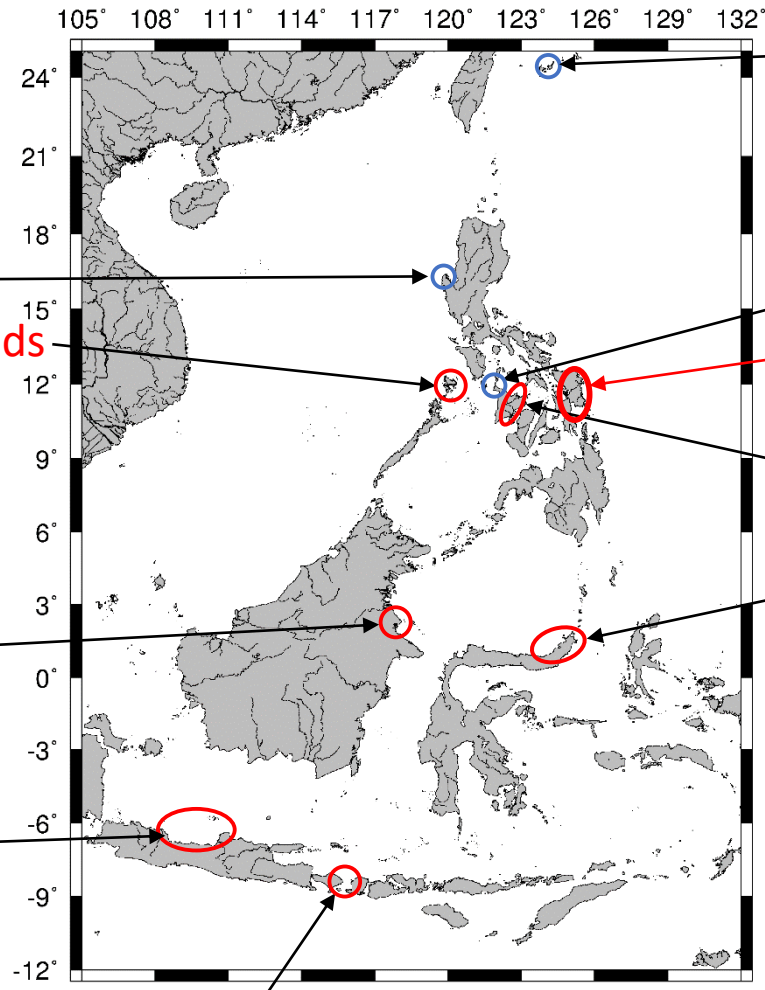


(Kartadikaria, et al., JGR, 2015)

Indonesian seas:

mostly releasing CO_2, especially in Java Sea

BlueCARES Project Sites



Yaeyama Islands

Bolinao

Boracay Island

Busuanga & Coron Islands

Samar & Leyte

Northern & eastern Panay coast

Northern Sulawesi

Berau-Derawan

Northern Java coast & Karimunjawa Islands

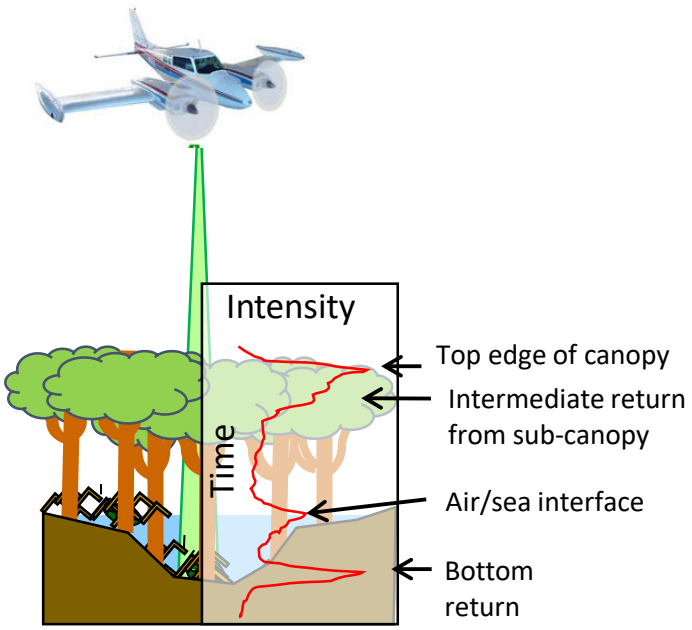
Nusa Penida Island

Main sites

Sub sites

Multi-scale mapping of blue carbon ecosystems

LiDAR system



Multi-scale mapping by sensor fusion

Satellite remote sensing : MSS, SAR, etc. for large-scale mapping

Airborne remote sensing : LiDAR, etc.
➔ Detailed 3D mapping of selected local areas

Drone:
➔ Fine-scale mapping at selected sites

Target area to cover: More than 80% of the total area of blue carbon ecosystems in the Coral Triangle in each country

Mangroves carbon stock

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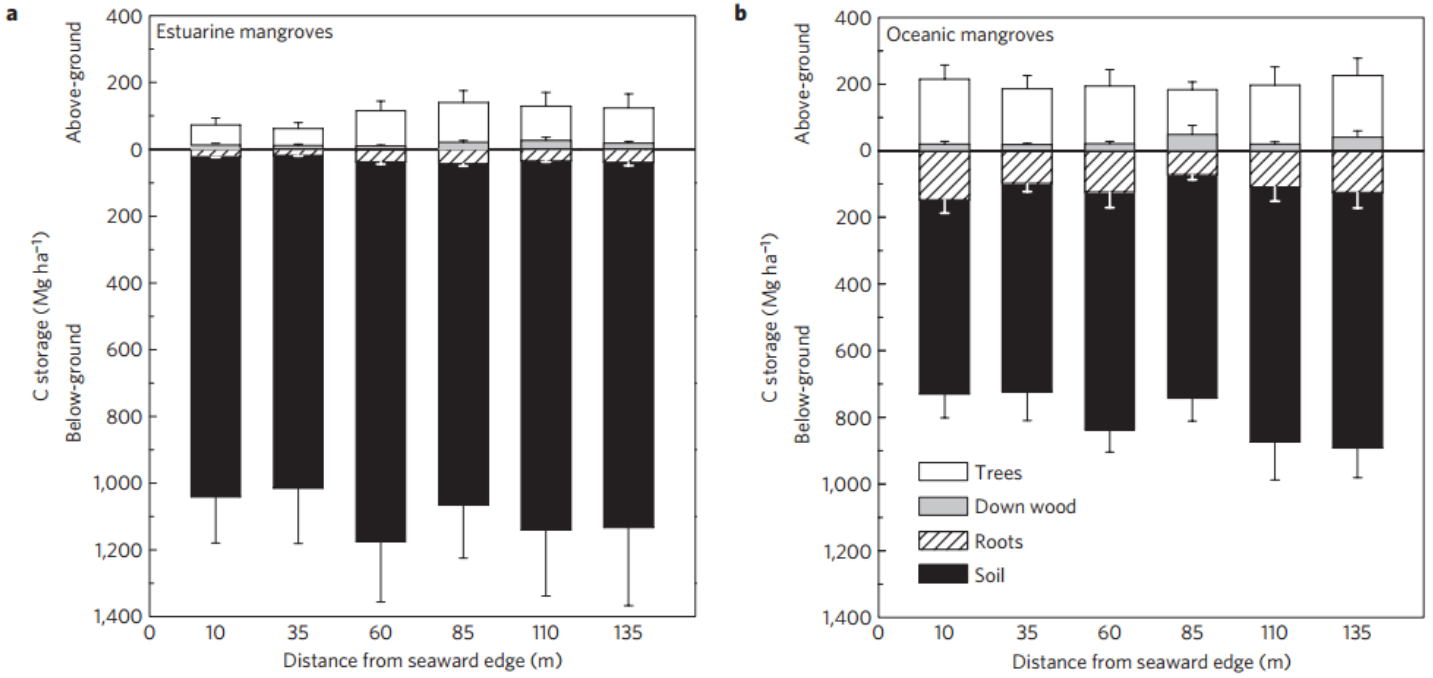


(Donato et al., 2011)

How to do mapping of below-ground parts like root system and SOM?

Points:

How to do nation-wide mapping of below-ground parts?

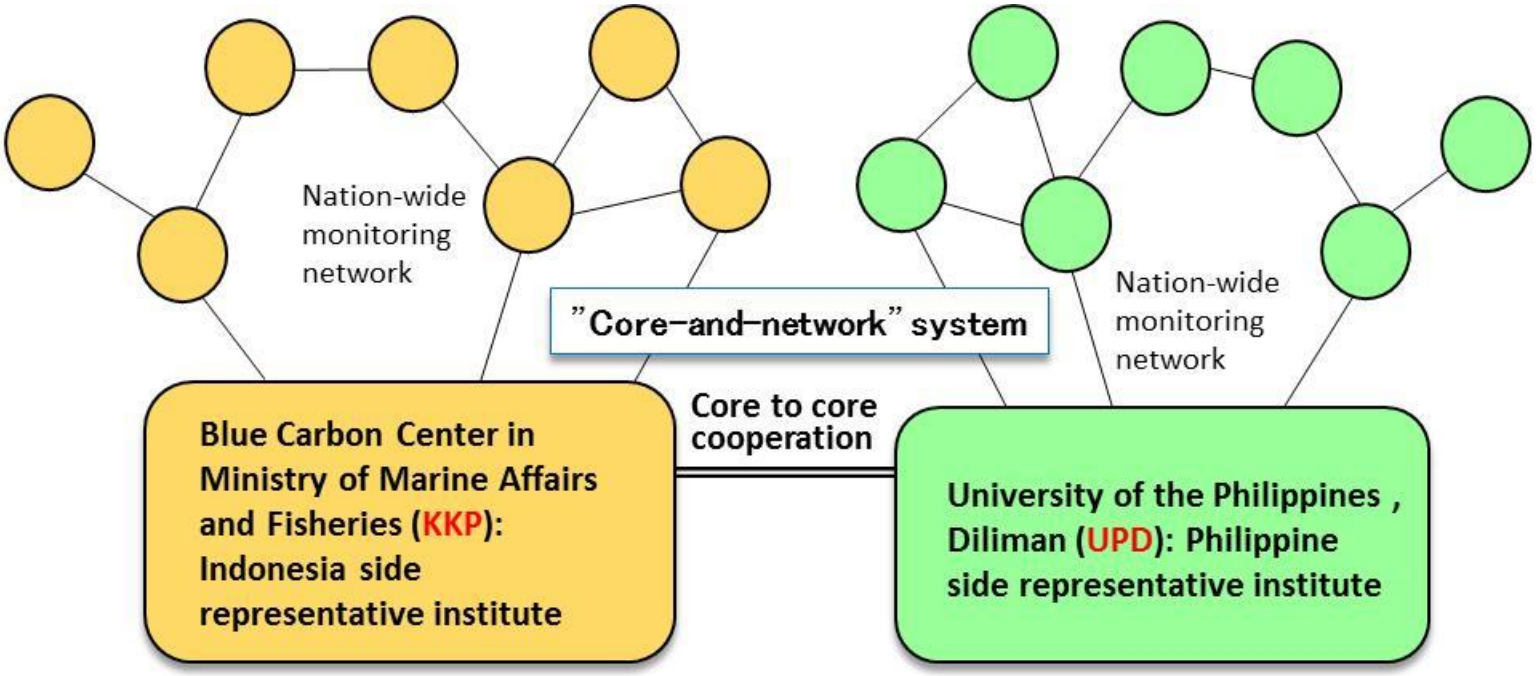
"Core-and-Network" System

How to analyze and predict blue carbon dynamics under various environmental impacts?

Integrated multi-scale model system

“Core-and-Network” System (CNS)

1. A platform for **sustainable periodical nation-wide monitoring** as a basis for **updating Blue Carbon Strategy**
2. Selected communities among the network members may act as the **implementation bodies of Blue Carbon Strategy**



(More than 20

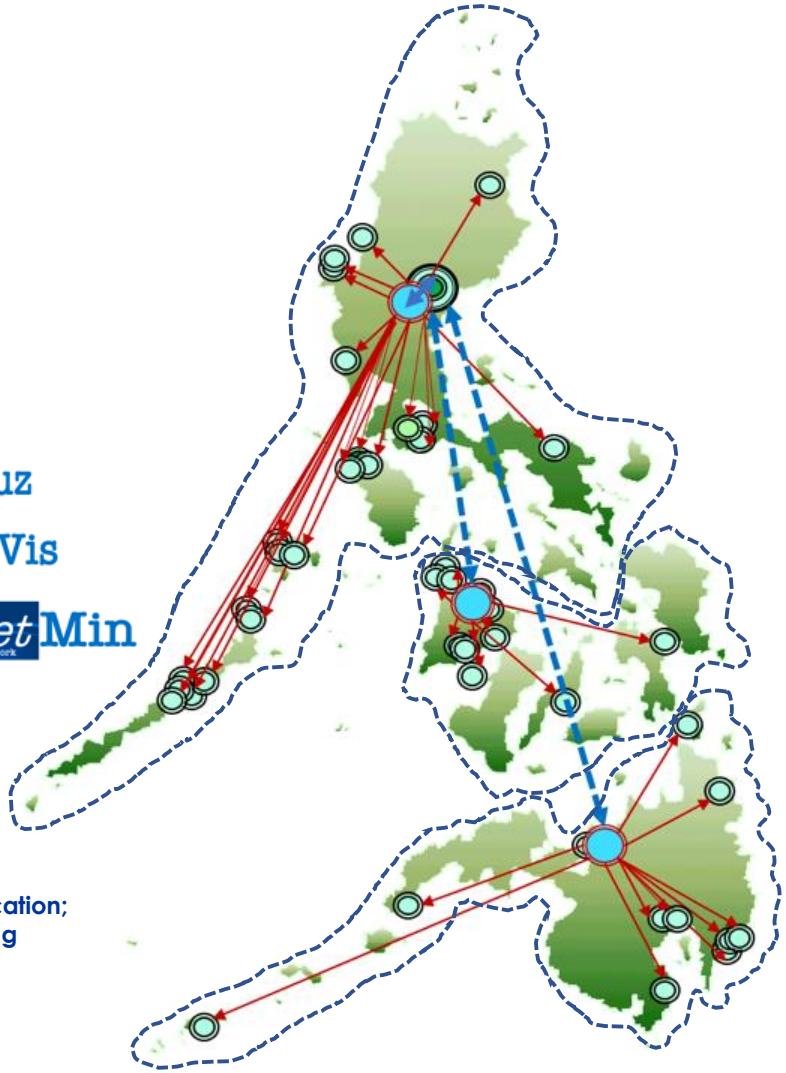
(More than 15

Core-and-Network System in the Philippines

BCnet
The Blue Carbon Network

3 Clusters:

- Luzon Cluster BCnetLuz
- Visayas Cluster BCnetVis
- Mindanao Cluster BCnetMin



Program Management Office (PMO)
Cluster Coordinating Office (CCO)
Network member
Arrows are two-way lines of communication;
Broken arrows are the main lines among the PMO & the CCOs

COMPOSITION

Categories	No.
Cities/Municipalities	34
Agencies/Institutes	64
Government	45
Non-Gov. Org.	10
Peoples' Org.	2

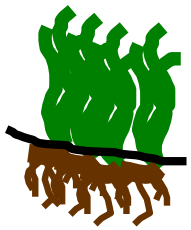
Sector	No.
Environment	13
Education	15
Tourism	4
Fisheries	9
Business	3
Culture	3
Social	3
Energy	1
Legal	1
TOTAL	52

(by M.D. Fortes)

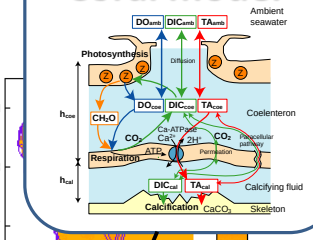
Integrated multi-scale model system

Local-scale blue carbon dynamics model

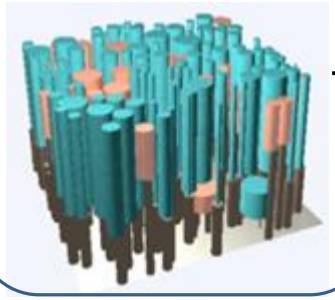
Seagrass model

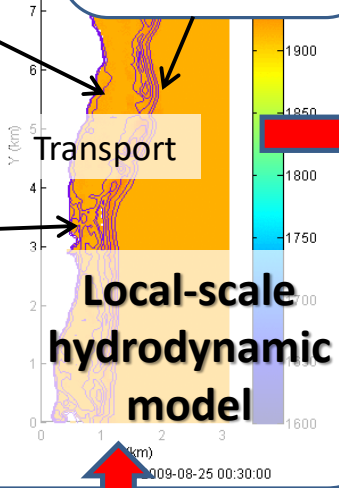


Coral model



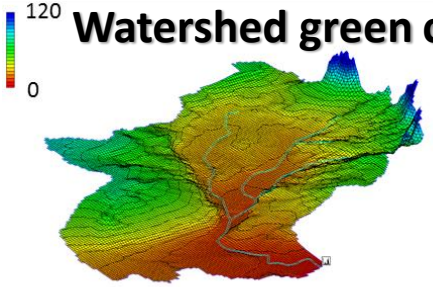
Mangrove model





Discharge

Watershed green carbon dynamics model



Characteristics of organic matter/nutrients discharge are affected by land use or 'green carbon' dynamics.

Discharge

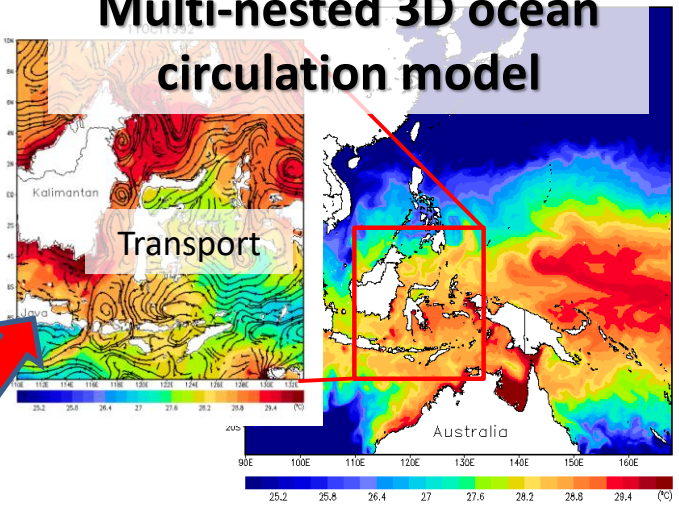
Simplified coastal export model for regional & sub-regional scale analysis

Export

Export

Export

Multi-nested 3D ocean circulation model

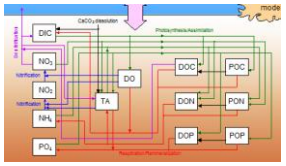


Horizontal transport

Vertical transport

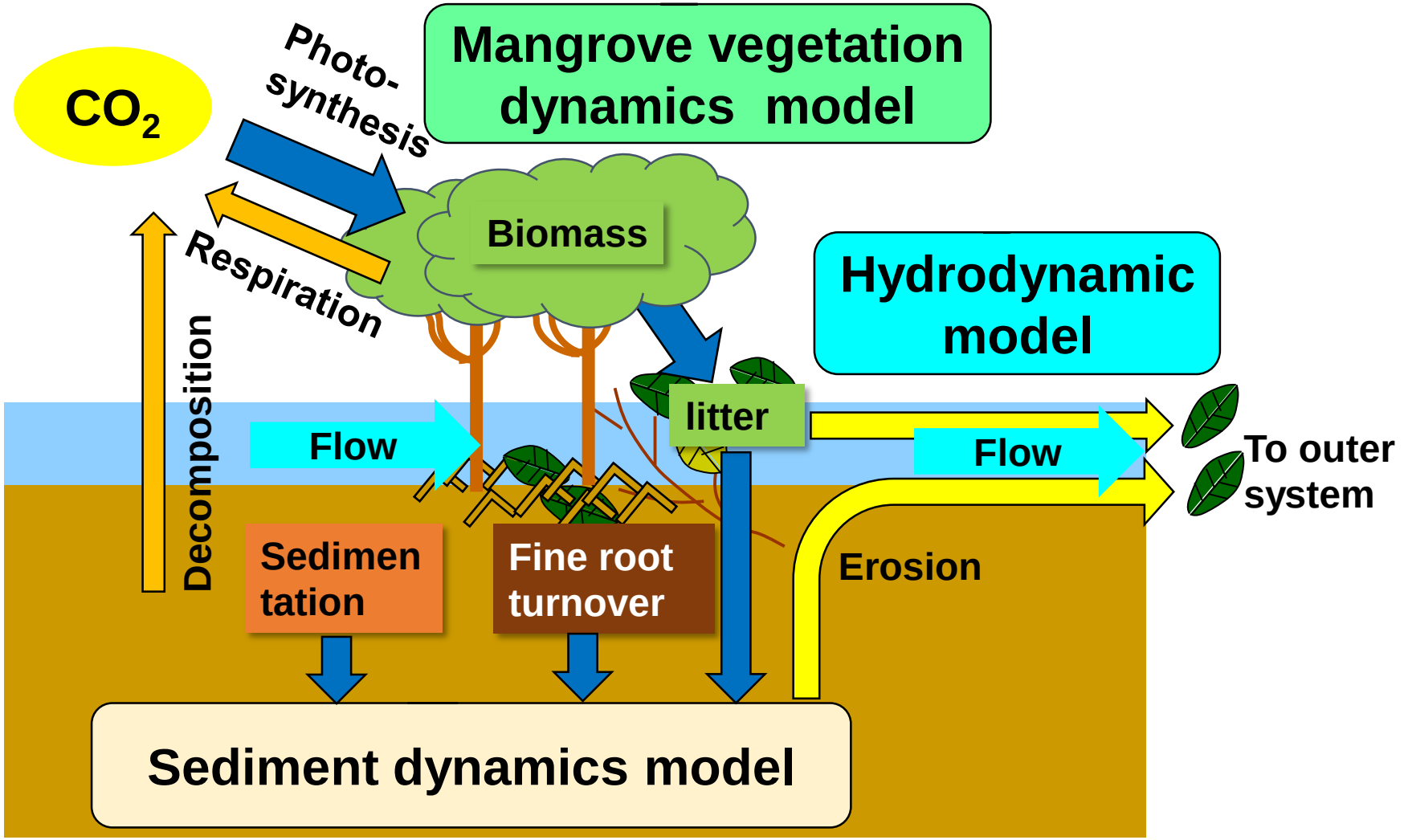
Sinking

Sediment model



Blue carbon dynamics model

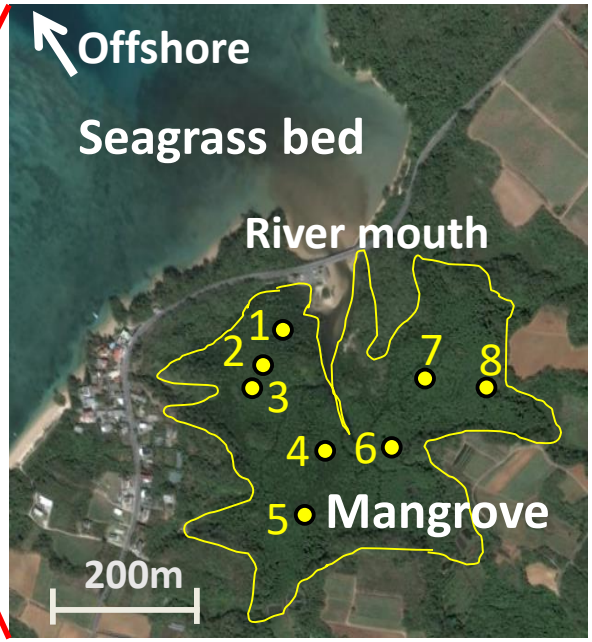
Model coupling of mangrove vegetation dynamics model, soil dynamics model and hydrodynamics model



Study site and field survey

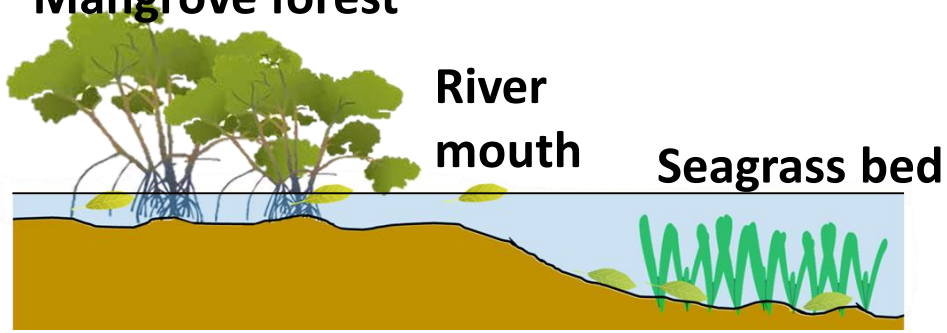
Study site

Ishigaki Island



Estuarine mangrove of Fukido River in the northern part of Ishigaki Island, Japan

Mangrove forest



Field survey

Seven times (Aug, 2014～ Sep, 2016)

River

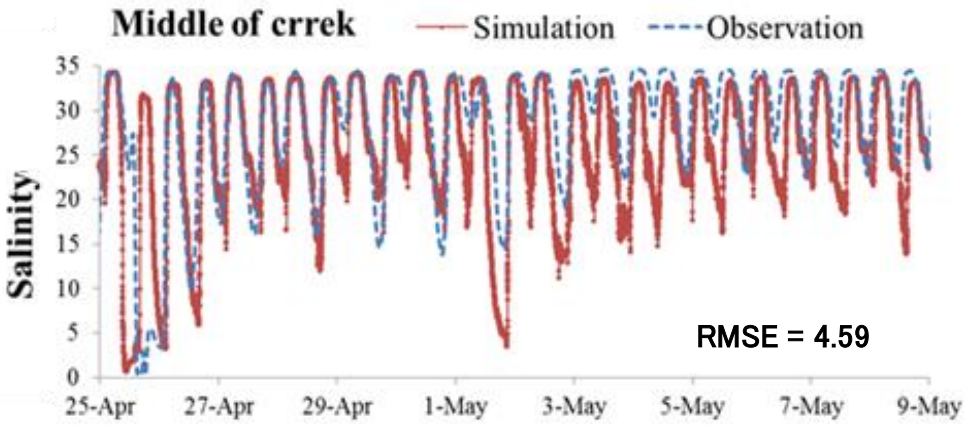
Observation of water level and velocity

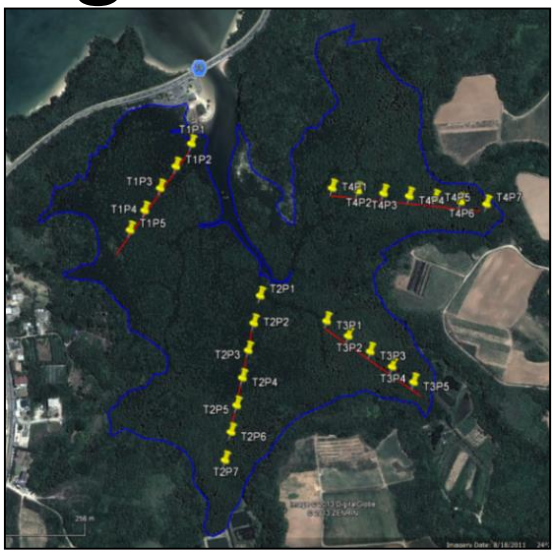
Observation of resuspension and settlement

Mangrove

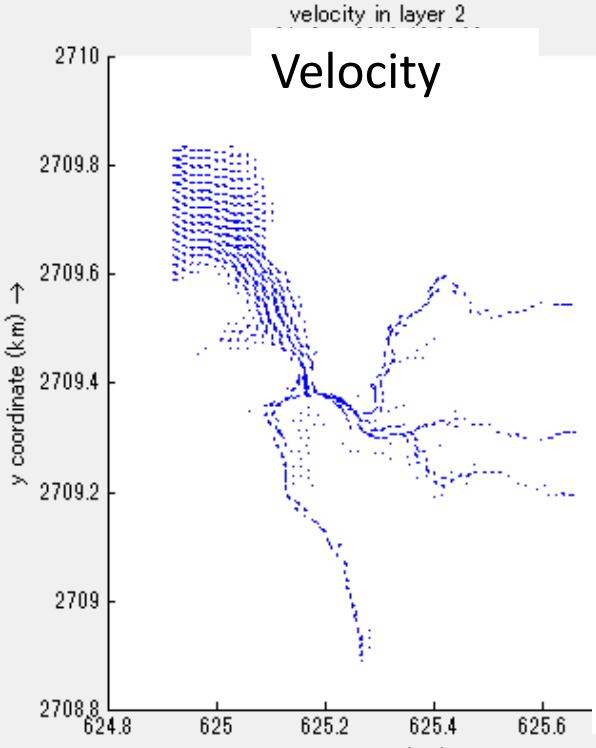
Soil core sampling for estimating soil organic matter and root biomass

Hydrodynamic model for mangrove area

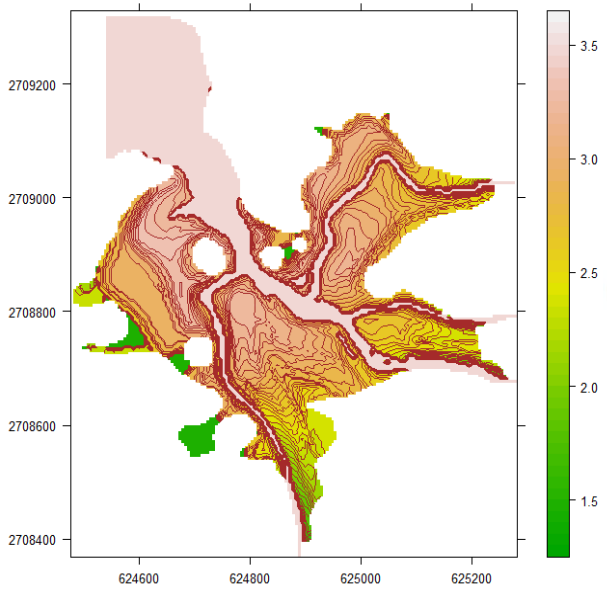




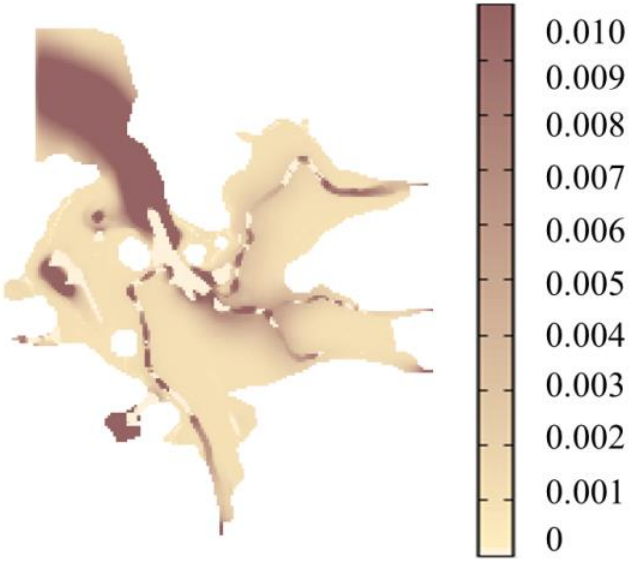
Velocity



Soil salinity



Deposition – erosion rate



SOM dynamics simulation results

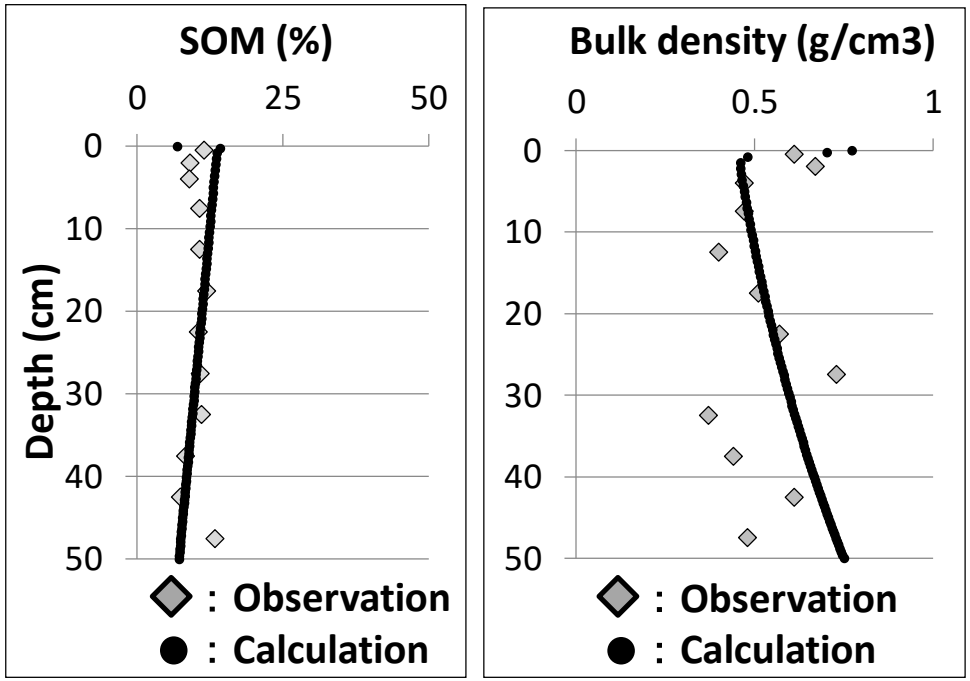
The field data of root biomass in this study was input to the model.

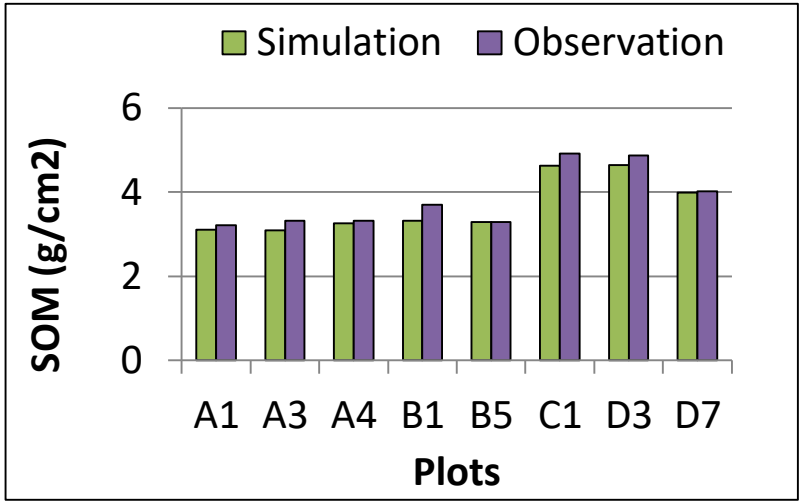
Roots from soil core sample

SOM content and bulk density were simulated well.

As a result, it was found that the litter which is supplied from above ground tree accounted for 65% of total organic matter in the soil.

〈 Result 〉At a plot near river mouth





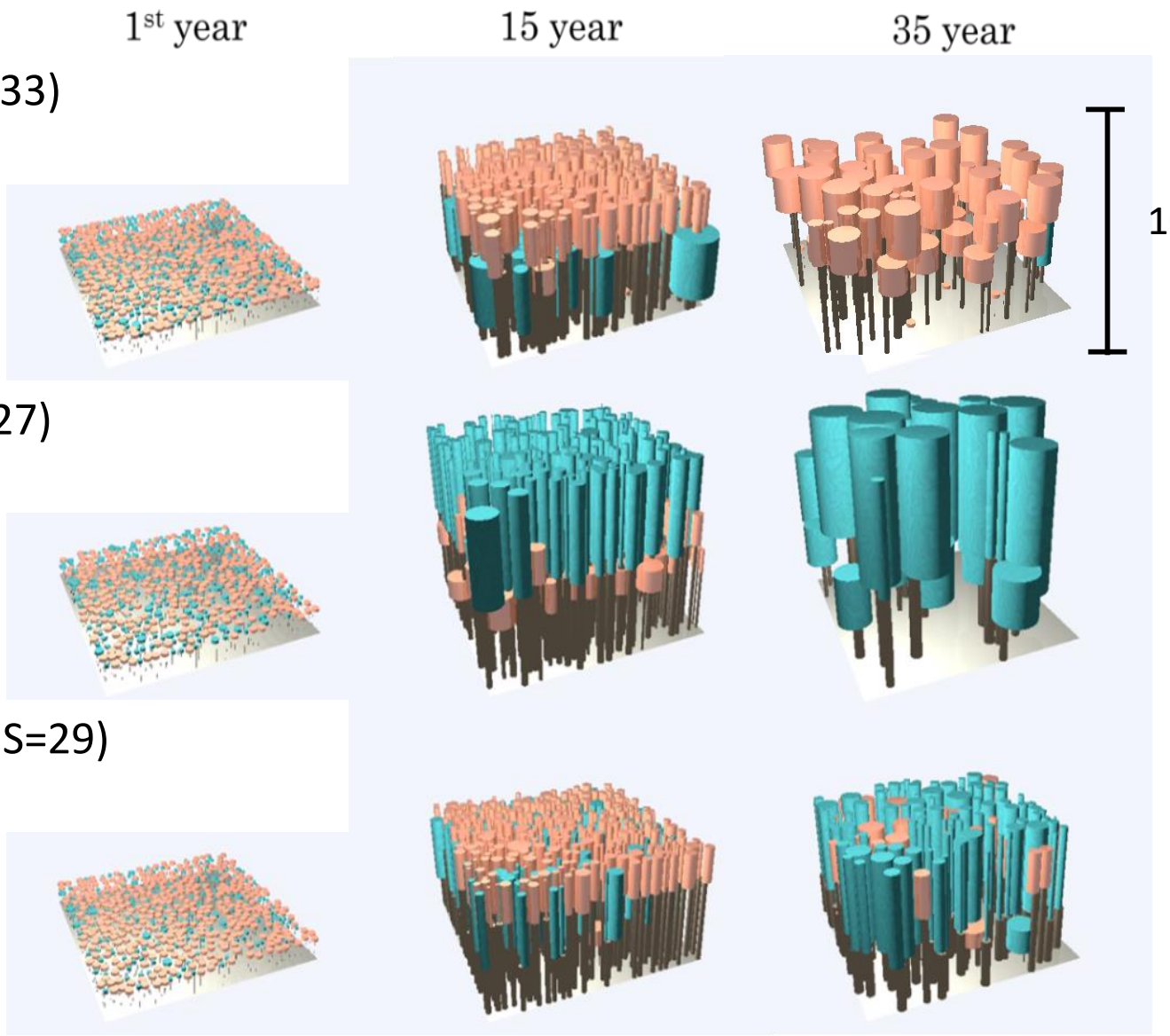
Simulation result of spatio-temporal mangrove change dynamics

Bird-eye view

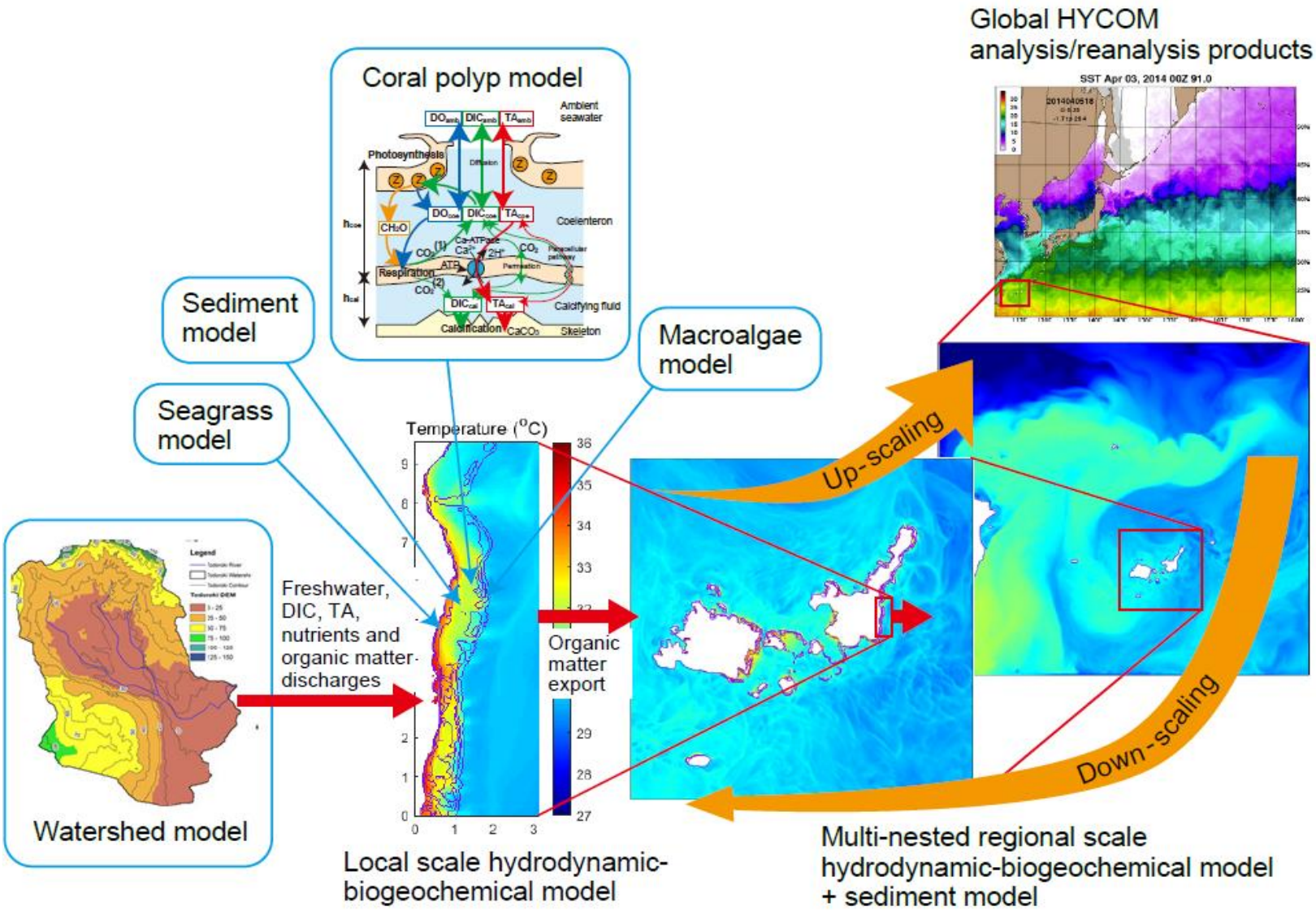
Rhizophora stylosa
→Salinity tolerant species.

Bruguiera gymnorrhiza
→Faster growth rate, salinity tolerance is weaker.

Simulation results for three different salinity conditions



Coupling of local and regional scale models



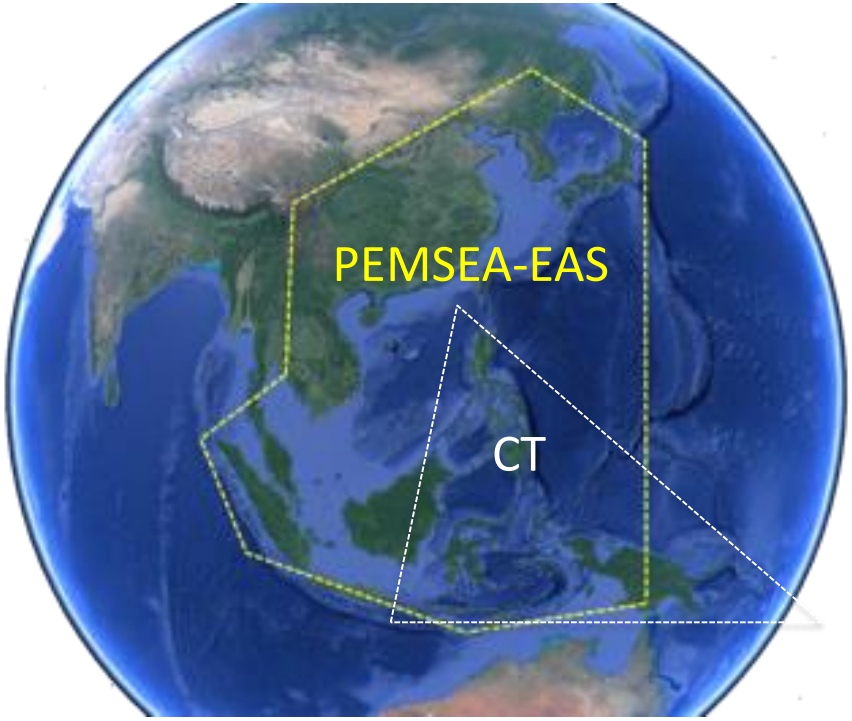
Chasing test case of DOC produced by corals on the Shiraho reef domain

Scenario Analysis for various threats in future

- **Climate changes**
  - **Air and water temperature rise**
  - **Ocean acidification**
  - **SLR**
- **Stronger & more frequent typhoon**
  - **Intensified terrestrial runoff**
  - **Stronger winds → fallen trees increase**
  - **Larger waves → increase in resuspension and blowout of bottom sediments**
- **Deforestation (↔afforestation/reforestation)**
  - **Change in runoff of sediment, etc.**

Sustainable Development Strategy for the Seas of East Asia (SDS-SEA)

"The SDS-SEA embodies the shared vision of the countries and other stakeholders for the Seas of East Asia, and the ways by which they will achieve that shared vision."



***Blue*CARES Project is aiming at developing and implementing Blue Carbon Strategy, which is in line with SDS-SEA. We are willing to link and collaborate with relevant regional programs to extend our scope to cover wider area in and around Coral Triangle.**


Thank you!