# MAPPING THE RESILIENCE OF THE CORAL REEF SOCIO-ECOSYSTEMS IN JAPAN

## Introduction

- Recently, IPCC has upwardly assessed the sea level rise (RCP 8.5: +74 cm in 2081-2100, 52-98 cm range)
- A direct consequence is a dramatic increase in coastal vulnerability: assets and human lives
- Shallow coral reefs provide ecological services: food and raw material, recreo-tourism, coastal protection
- However, coral reefs are undergoing severe threats with an unprecedented pace, which dramatically reduce their protection efficiency

## Objectives

We propose here to elucidate the spatial resilience of the Japanese coral reef socio-ecosystems in focusing on the socio-economic vulnerability and the coral reef resilience for both the 2002-2012 annual time series and the 2081-2100 period predictions

## Methods

- The study area encompasses the Nansel archipelago, ranging from Yonaguni to Tanega island (> 1000 km length) Study site of the spatial resilience (Nansel archipelago + six sub-areas)
- The evaluation of the spatial resilience is based on spaceborne and waterborne data as well as historical and geopolitical information
- Values of the socio-economic and ecological factors are retrieved from terrestrial and marine realms, respectively

## Description and Weighting of main stress/resilient factors involved in the coral reef socio-ecosystems

<table>
<thead>
<tr>
<th>Factors</th>
<th>Source</th>
<th>Resolution</th>
<th>Period</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cyclone Storm</td>
<td>Tropical Cyclone Storm Best Track Data</td>
<td>1 arc-minute</td>
<td>2002-2012</td>
<td>2</td>
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<tr>
<td>Tsunami</td>
<td>Global Historical Tsunami Database</td>
<td>1 arc-minute</td>
<td>2002-2012</td>
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<td>1 arc-minute</td>
<td>1951-2010</td>
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<td>Tsunami</td>
<td>Global Historical Tsunami Database</td>
<td>1 arc-minute</td>
<td>2000BC-2012</td>
<td>1</td>
</tr>
</tbody>
</table>

**Elevation**: GDEN v.2 1 arc-second 2011 3

A fuzzy logic membership function (logistic curve fitting a normal cumulative distribution function) is applied for each factor

- **Resilient**: Increasing logistic curve
- **Stress**: Decreasing logistic curve

## Maps and curve plots of the Asset, Population and Coral reef vulnerability/resilience indices

### 2002-2012 time series

- Okinawa’s assets are much more vulnerable than remaining cluster’s
- Okinawa’s and Miyako’s population are the most vulnerable but other sub-areas’ conspicuously differentiate across time
- SW followed by NE coral reefs are more resilient than central (Okinawa and Miyako) Extremes Southern and Northern Japanese coral reef socio-ecosystems are/ will be more resilient than middle Okinawa/Miyako

### 2081-2100 predictions

- Okinawa’s assets and population will be the most affected sub-area (both scenarios)
- SW assets and population will be the least affected sub-areas for RCP 2.6
- NE assets and population will be the least affected sub-areas for RCP 8.5
- SW followed by NE coral reefs will be more resilient for both scenarios than central (Okinawa and Miyako)