Terms of reference

Empowered lives.
Resilient nations.

GENERAL INFORMATION

Title: Expert for Reconstruction and projection of the ocean climate by using an Oceanic General Circulation Model
Project Name : Third national Communication to the United Nations Framework Convention on Climate Change (TNC)
Reports to: National Project Manager (NPM TNC) and the Coordinator of Adaptation Working Group TNC
Duty Station: Home Based
Expected Places of Travel (if applicable): Jabodetabek areas approximately for 10 times
Duration of Assignment: 11 Months (210 man days)

REQUIRED DOCUMENT FROM HIRING UNIT

v	TERMS OF REFERENCE
5	**CONFIRMATION OF CATEGORY OF LOCAL CONSULTANT , please select :** (1) Junior Consultant (2) Support Consultant (3) Support Specialist (4) Senior Specialist (5) Expert/ Advisor **CATEGORY OF INTERNATIONAL CONSULTANT , please select :** (6) Junior Specialist (7) Specialist (8) Senior Specialist
v	APPROVED e-requisition

REQUIRED DOCUMENTATION FROM CONSULTANT

v	CV
v	Copy of education certificate
v	Completed financial proposal
v	Completed technical proposal

Need for presence of IC consultant in office:
☐ partial (explain),
☒ intermittent (meetings at Jabodetabek areas approximately for 10 times)
☐ full time/office based (needs justification from the Requesting Unit)

***P*rovision of Support Services:**

Office space:	☐ Yes	☒ No
Equipment (laptop etc):	☐ Yes	☒ No
Secretarial Services	☐ Yes	☒ No

If yes has been checked, indicate here who will be responsible for providing the support services: N/A

Signature of the Budget Owner:

I. BACKGROUND

Indonesia signed the Climate Change Convention (UNFCCC, United Nation Framework Convention on Climate Change) in Rio in 1992, which was then ratified in 1994 through Law no. 6/1994. Under this framework, Indonesia, which is a non-Annex 1 country, is committed to fully implementing the convention. Under one of the requirements of the convention, Indonesia has

to report its activities aimed at addressing the climate change to the UNFCCC through the National Communication on Climate Change. The National Communication contains information on national circumstances, GHG inventory and projection, mitigation action plan (including related cost, expected funding and relevant policies), vulnerability and adaptation assessment (including action plan for adaptation, related costs, expected funding and relevant policies), institutional arrangement, and plan for improvement of future national communication.

Sea level rise is one of the most potentially serious impacts of global warming and climate change. The sea level rise, however, cannot be projected with high confidential level using the physical models due to dynamics of ice sheets and glaciers and to a lesser extent of the oceanic heat uptake that is not sufficiently understood (Vermeer and Rahmstorf, 2009). Moreover, Vermeer and Rahmstorf (2009) also explained that the limited understanding was seen, e.g., in the fact that observed sea-level rise exceeded the predicted ones by models (best estimates) by ≈50% for the periods 1990–2006 and 1961–2003. Eventually, Intergovernmental Panel On Climate Change (IPCC) assessment report did not include rapid ice flow changes in its projected sea-level ranges, arguing that they could not yet be modeled, and consequently did not present an upper limit of the expected rise (IPCC, 2007).

The mass balance of the ice sheets is a topic of considerable interest in the context of global warming and sea level rise. If totally melted, Greenland and West Antarctica would raise sea level by approximately 7m and 3m to 5 m, respectively. Thus, even a small amount of ice mass loss from the ice sheets would produce substantial sea level rise, with adverse societal and economic impacts on vulnerable low-lying coastal regions (Cazenave and Llovel, 2010).

The IPCC projection is based upon the mass difference of ice melted and ice formed. Since the mass of the melting ice is bigger than that of the ice forming, Greenland ice sheet does contribute to the rise of sea level (Ridley, et al., 2005). On the contrary, Antarctica is projected to freeze more and undergo increased ice forming, thus the ice forming in Antarctica and the ice melting in Greenland will cancel each other, with no net contribution to the sea level rise. Thus most of the contribution to the changing mass (the difference between ice melted and ice formed) is limited to the melting of glaciers and mountain ice cover (Meehl, et al., 2007).

Rahmstorf (2007) used the relationship between the rise of the sea level and surface temperature to predict the sea level rise in the end of the 21st century. His estimate ranges from 50 cm to 140 cm, relative to the sea level in 1990. This prediction is higher than the projection of IPCC 4th Assessment Report (AR4). Moreover, the sea level rise before 1990, due to mass changing, is purely dominated by the glacial melting (Bindoff et al., 2007), thus Rahmstorf (2007)'s prediction excludes the changing of sea level due to the ice melting in Antarctica and Greenland. Abdalati (2006) argued that the glaciers and ice sheets of the world contain enough ice to raise sea level by approximately 70m if they were to disappear entirely, and most of this ice is located in the climatically sensitive polar regions. Fortunately changes of this magnitude would probably take many thousands of years to occur, but recent discoveries indicate that these ice masses are responding to changes in today's climate more rapidly than previously thought (Abdalati, 2006). To avoid the impact of ice melting, Bryan (1995) calculated the thermosteric sea level rise using the ocean model. The model results explained that average rise in sea level of approximately 15±5cm by the time atmospheric carbon dioxide doubles for 80 years model running. Furthermore, the thermosteric and halosteric sea level rise from 1955 to 2003 are estimated to be 0.31±0.07mm/yr and 0.04±0.01mm/yr, respectively (Ishii et al., 2006).

Due to the high sea level rise in the Indonesian Seas (Sofian, 2010), the estimation of contribution of ice melting (CIM) is inevitable to project the sea level rise in the future. The CIM estimation is conducted using the nested HYbrid Coordinate Ocean Model (HYCOM) on the global model. The nested Regional Ocean Modelling Systems (ROMS) has the spatial resolution of 5km, while the global HYCOM model has 16km of spatial resolutions.

The climate change not only affects on the sea level characteristics, but also affect on the other

ocean parameter, such as ocean acidification, temperature, desalination and others. Due to the lacking of ocean data, it is inevitable to simulate the ocean climate from 1960 to the present by using the ROMS. The model will be nesting on the Simple Ocean Data Assimilation (SODA) and HYCOM model output, and driven by the NCEP reanalysis and ECMWF interim data. Furthermore, the reconstruction of ocean climate not only limited on the physical parameters such as salinity, temperature and ocean currents, but also the biogeochemical data such as nitrate, phosphate, chlorophyll-a and others. Finally, the biogeochemical model output can be used to analyses the ocean acidification impacts on the coral reef as the one of the most important habitat in the coastal regions.

OBJECTIVES

Under the supervision of the National Project Manager (NPM) or her/ his delegate and the Coordinator of Adaptation Working Group TNC, the selected individual consultant will be responsible to reconstruct the ocean climate data from 1960 to present time, and to develop projection of the climate change impacts on the sea level rise, temperature and other ocean parameters until 2040.

II. SCOPE OF WORK, RESPONSIBILITIES AND DESCRIPTION OF THE PROPOSED ANALYTICAL WORK

The Individual Consultant will assist the National Project Manager (NPM), and the Coordinator of the Working Group (WG) on Adaptation TNC. The position includes tasks as follow:

1. To reconstruct the ocean climate by using *Regional Ocean Modelling Systems* (ROMS) and nesting on the *Simple Oceanic Data Assimilation-Parallel Ocean Program* (SODA-POP) from 1960 to 2008. From 2008 to the near real time the ROMS will be nesting on the HYCOM model output. (ROMS shall be part of the technical proposal provided by the consultant).
2. To investigate the *decadal variability* impact on the temperature, sea surface height and other biochemical characteristics.
3. To develop projection of climate change impacts on the sea level rise, temperature and other ocean parameters change until 2040.
4. To investigate the physical mechanism of the ocean upwelling, down-welling, coral bleaching phenomena by using the ocean model results.
5. To provide comprehensive ocean data set for the stakeholder to adapt on the climate change impact on the coral reef and other coastal ecosystem.

DELIVERABLES

1. Reconstruction of the ocean climate by using *Regional Ocean Modelling Systems* (ROMS) and nesting on the *Simple Oceanic Data Assimilation-Parallel Ocean Program* (SODA-POP) from 1960 to 2008. From 2008 to the near real time the ROMS will be nesting on the HYCOM model output.
2. Analysis of the *decadal variability* impact on the temperature, sea surface height and other biochemical characteristics.
3. Projection of climate change impacts on the sea level rise, temperature and other ocean parameters change until 2040.
4. Analysis of the physical mechanism of the ocean upwelling, down-welling, coral bleaching phenomena by using the ocean model results.
5. Comprehensive ocean data set for the stakeholder to adapt on the climate change impact on the coral reef and other coastal ecosystem.

Indicative Workplan

Items	Months										
	1	2	3	4	5	6	7	8	9	10	11
Approved methodology											
Model Configuration											

Preprocessing of Model Input Data											
Interim report											
Running and validating model											
Analysis of model results											
Final report											

REPORTING AND MONITORING

For administrative and operational matters, the selected individual consultant will report to the Project Assistant of the TNC.

For substantive matters and to ensure overall cohesiveness of the data collection process, the selected individual consultant will also need to communicate regularly with the National Project Manager (NPM) of TNC Project and the Coordinator of Adaptation Working Group of TNC Project.

III. REQUIREMENTS FOR EXPERIENCE AND QUALIFICATIONS

The successful Individual Consultant shall have the following qualifications:

1. PhD education with background study on engineering, oceanography, physical science, or environment;
2. Demonstrated professional competency in climate change adaptation and or ocean climate modelling at least for 6 years;
3. Having experiences working with government institutions, particularly with the Ministry of Environment, Bappenas, LAPAN, or BMKG;
4. Having experiences working with UN agencies or other international organization would be preferable;
5. High quality report writing skills in English and Bahasa Indonesia.

IV. REQUIREMENTS

- Demonstrates commitments to the organization's mission, vision and values
- Focuses on result for the client and responds positively to feedback
- Consistently approaches work with energy and a positive, constructive attitude
- Remains clam, in control and good humoured even under pressure

V. EXPECTED RESULTS

Duration of Assignment: 210 man days (December 2014-November 2015)

Milestones	**Time frame**	**Payment**
Approved methodology and framework to perform ocean climate reconstruction and projection of climate change impacts to sea level rise sea level rise, temperature and other ocean parameters change.	30 Dec 2014	21 man days (10%)
Interim report consist of the following: 1. Configuration of ROMS for Indonesian Seas and HYCOM for global domain with spatial resolution of 5km and 16km, respectively. 2. Analysis of the *decadal variability* impact on the temperature, sea surface height and other biochemical characteristics.	30 May 2015	84 man days (40%) 30 man days 54 man days

Final report consist of the following: 1. Stochastic analysis from the results of the model to determine the effect of climate change and its variability on sea level rise, temperature and other ocean parameters change. 2. Analysis of the physical mechanism of the ocean upwelling, down-welling, coral bleaching phenomena by using the ocean model results. 3. Comprehensive ocean data set for the stakeholder to adapt on the climate change impact on the coral reef and other coastal ecosystem.	30 Nov 2015	105 man days (50%) 40 man days 35 man days 30 man days

Interim report shall be submitted in Bahasa Indonesia or English.
Final Report shall be reported in Bahasa Indonesia and English.