

Combined climate impacts and vulnerability index on coastal ecosystems in prediction of future scenarios: extended sustainable indicator tool for adaptive strategy

ABSTRACT

This study presents the coastal vulnerability due to the forecasted climate change impact on the marine environment, including the sea level rise physical trait of risk impact. A combined methodology using Representative Concentration Pathways (RCPs), which corresponds to the greenhouse gas emissions scenarios, is used in this research; combined with Climate Change Vulnerability Index (CCVI) to rank the relative risk for each of the marine ecosystem zones in relation to the potential hazard exacerbated by climate change and sea-level rise. This method presents vulnerability in numerical data, which cannot be calculated directly based on their physical properties. From the results, it shows that the coastal areas of the study area of Marudu Bay would experience a warmer atmosphere both under RCP 4.5 and RCP 8.5 with an increment of 1.0 °C and 1.7 °C; meanwhile, the climate projection for total exhibits of increase in total precipitation by 2.6 mm/day and 1.6 mm/day under RCP 4.5 and RCP 8.5 at the regional measure. At the same time, the projection simulates an increase of sea level by 0.21 m and 0.27 m over the northern region of Marudu Bay under RCP 4.5 and RCP 8.5, respectively. In addition, 43.84 ha and 57.02 ha of land estimated would be potentially inundated by the mid-century year 2050 under RCP 4.5 and RCP 8.5. By the end of the century 2100, the sea level is projected to increase locally at about 0.32 m under RCP 4.5 and 0.38 m under RCP 8.5, consequently resulting in a total of 66.84 ha and 79.78 ha of additional inundation coverage. Therefore, the result from this study can be used when making effective adaptive strategies and conservation planning despite its inherent uncertainties.