of 1,139 kilometers. The topography is high in the east and low in the west, with mountains, hills, basins, terraces, and plains as the main features.

Taiwan has a subtropical and tropical oceanic climate and is located in the Asian monsoon region. In winter, it is affected by the northeast monsoon due to the continental cold high, and in summer, it is affected by the southwest monsoon due to the monsoon low. Taiwan's temperature shows a continuous upward trend of a magnitude that is more obvious than the overall rise in global temperature. 2020 was the warmest in Taiwan's meteorological records, with an annual average temperature of 24.6°C, about 1°C higher than the climatic average. The main sources of rainfall include spring rains, East Asian monsoon rains, typhoons, southwesterly flow rains, and northeast monsoons. The average total annual rainfall in 2020 was 1,742.4 mm, 464.7 mm lower than the climatic average and only 78% of the climatic average of 2,207.0 mm. 2020 was the seventh least rainy year in the country's meteorological records. Especially in the central mountain area, rainfall was only about 50-70% of the climatic average.

III. Impact, Adaption and Risks

In response to the latest scientific data of the Sixth Assessment Report (AR6) released by the Intergovernmental Panel on Climate Change (IPCC), the National Science and Technology Council (NSTC) and other government agencies jointly released a report presenting the historical climate change

data and the latest future projections for Taiwan, and presented the results of research carried out by scientific teams on the impact of climate change to help the public understand how climate change will affect the country.

According to local observation and analysis, the annual average temperature in Taiwan increased by about 1.6°C from 1911 to 2020.. This temperature increase has accelerated in the past 50 years and the past 30 years (Figure 1).

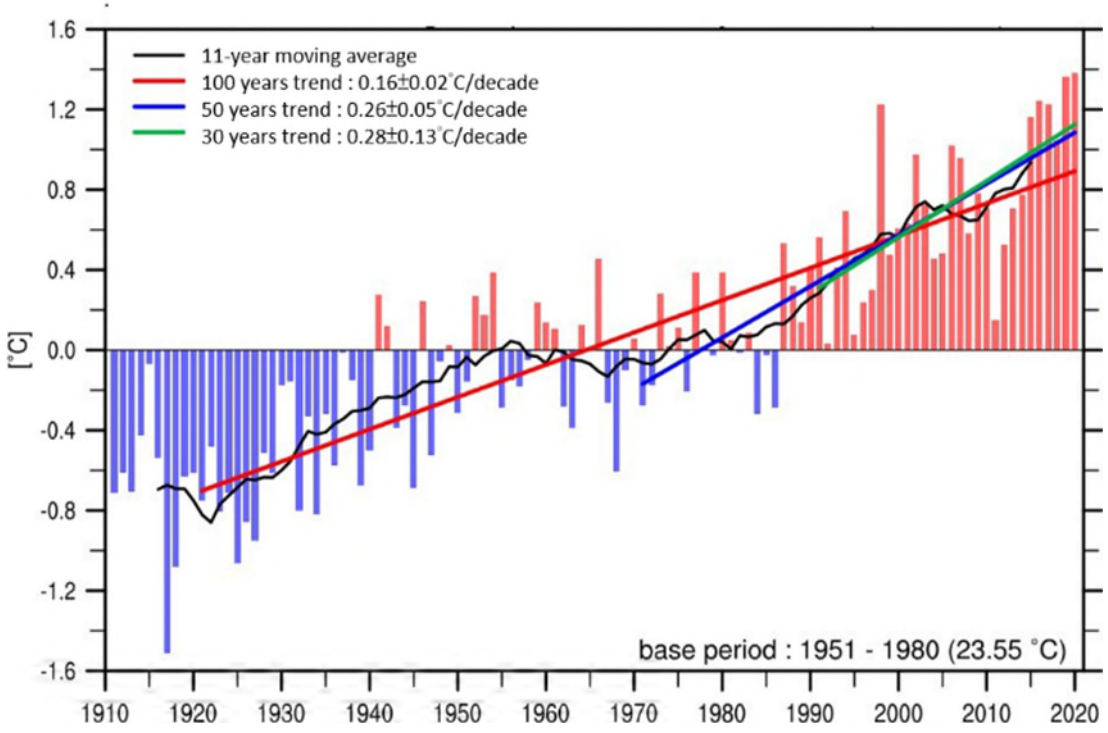

Fig. 1 Annual average temperature trend in Taiwan

Image source : NSCT

In terms of the distribution of seasons, the length of summer has increased to about 120-150 days in the early 21st century, while the length of winter has shortened to about 70 days and to about 20-40 days in recent years (Figure 2).

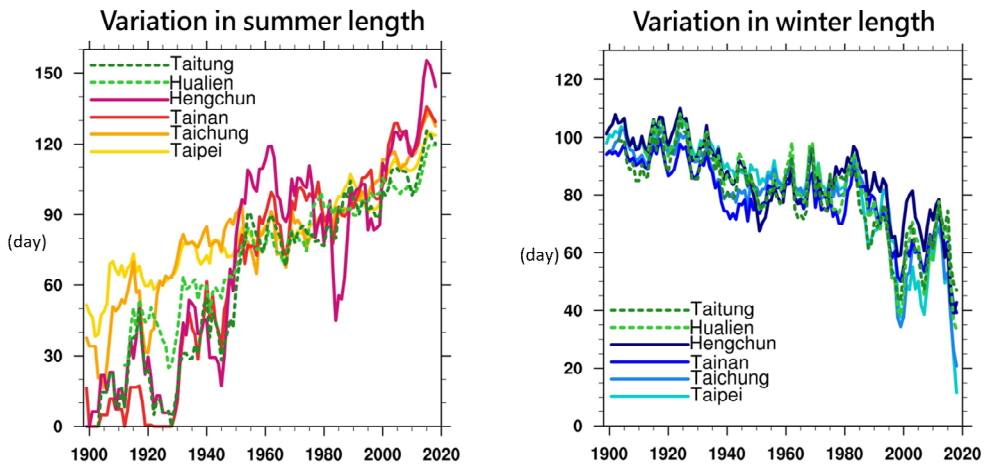

Fig. 2 Long-term change trend of the length of winter and summer in

Image source: NSCT

In terms of rainfall, the trend of total annual precipitation did not change significantly. Still, the annual max 1-day precipitation amount shows a significant increasing trend from 1991 and 2020 (Figure 3), and the trend of maximum yearly consecutive dry days changed markedly, with an increase of about 5.3 days per century (Figure 4).

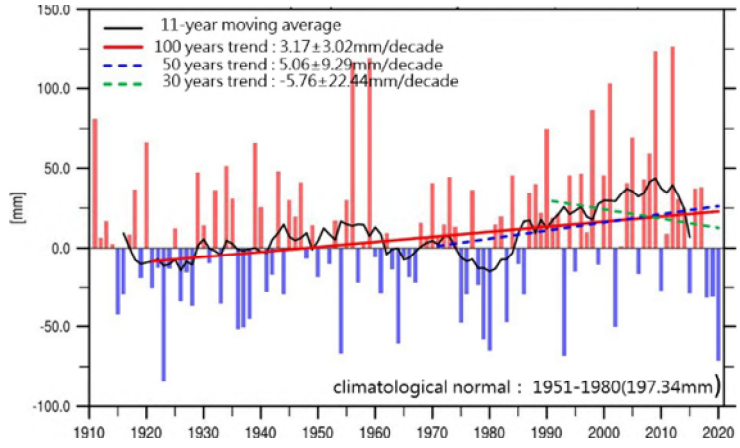

Fig. 3 Annual maximum 1-day precipitation amount change trend in Taiwan

Image source: NSCT

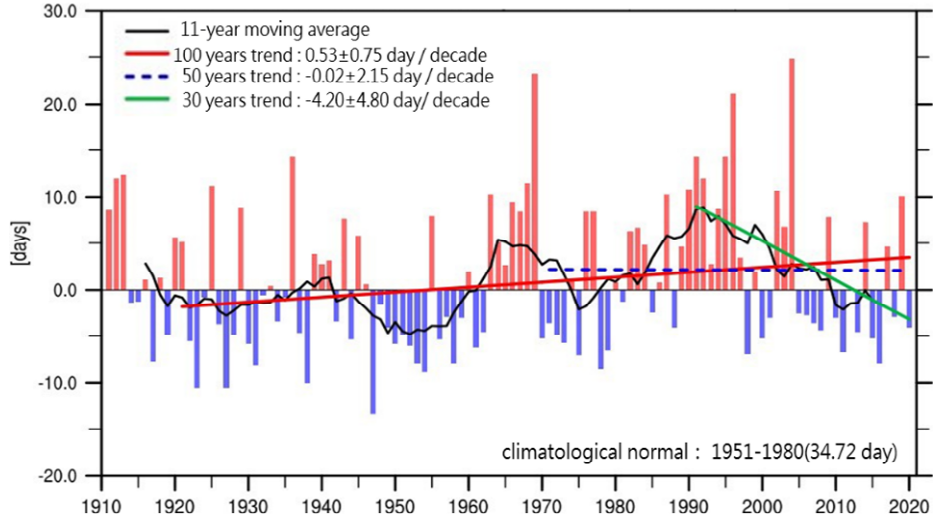

Fig. 4 Annual maximum consecutive dry days trend in Taiwan change trend in Taiwan

Image source: NSCT

It is estimated that the worst global warming scenario with high greenhouse gas emissions (SSP5-8.5) will have a more significant impact on the country than the ideal mitigation scenario (SSP1-2.6). In terms of temperature, under the worst-case scenario, the number of days with daily maximum temperatures above 36°C will increase by about 48 days by the end of this century; under the ideal mitigation scenario, the number of days will only increase by 6.6 days (Figure 5).

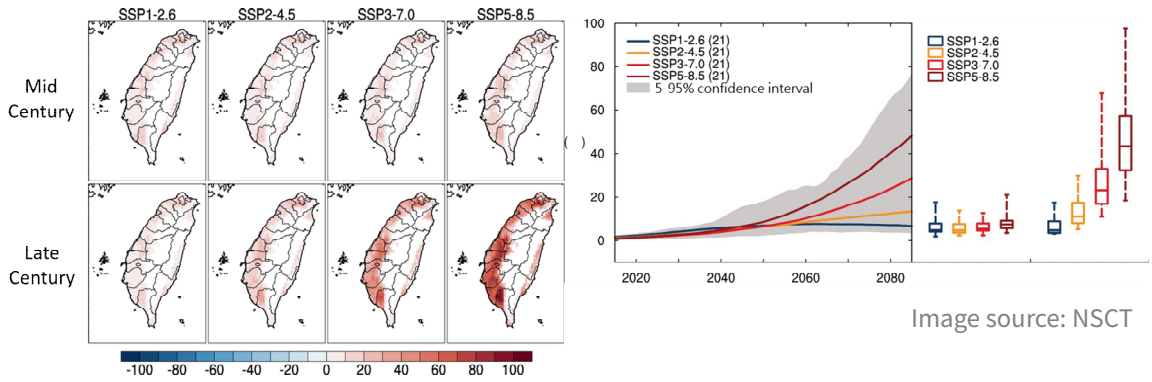

Image source: NSCT

Fig. 5 Estimation of future spatial distribution and number of days

Considering the seasonal length change, the length of summer will increase from about 130 days to 155-210 days, while winter will decrease from about 70 days to 0-50 days. The changing trend was significant in the worst-case scenario and relatively moderate in the ideal mitigation scenario (Figure 6).

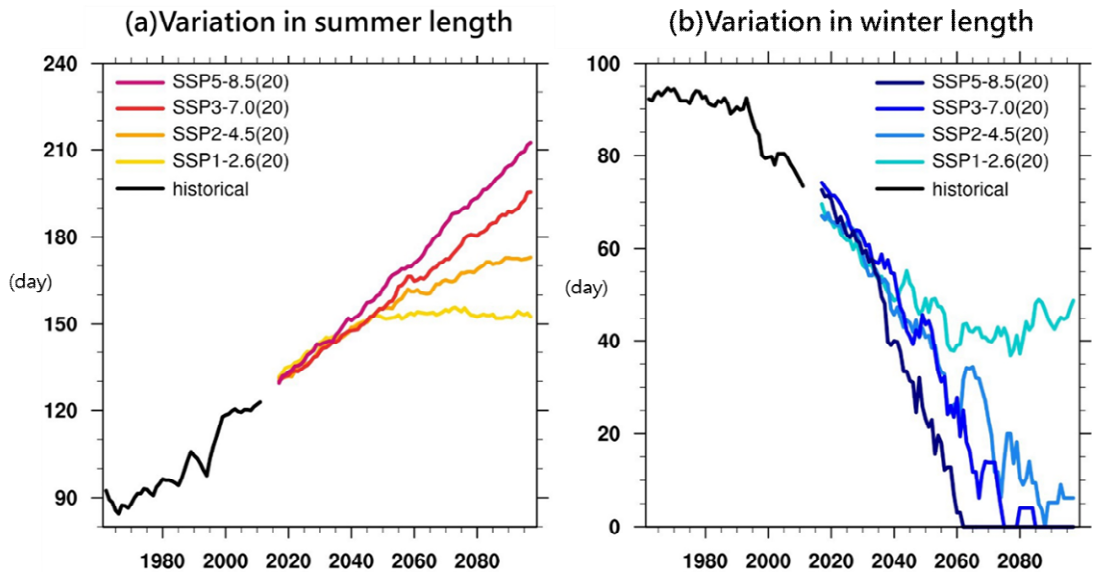

Fig. 6 Estimation of future length of seasons in Taiwan

Image source: NSCT

The annual maximum 1-day precipitation associated with disaster impact will increase by about 41.3% at the end of the 21st century under the worst-case scenario and by about 15.3% under the ideal mitigation scenario (Figure 7).

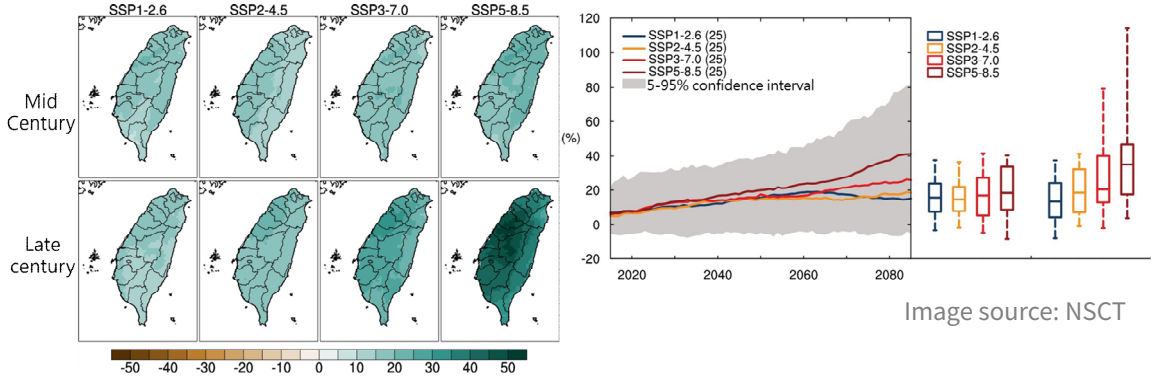

Image source: NSCT

Fig. 7 Spatial distribution and intensity estimation of future annual maximum 1-day rainstorm in Taiwan

Under the worst-case climate scenario (RCP8.5), the number of typhoons affecting Taiwan will decrease by 15% and 55% by the middle and end of the century, respectively. Still, the severe typhoons will increase by 100% and 50%, while the typhoon rainfall change rate will increase by 20% and 35%, respectively (Figure 8).

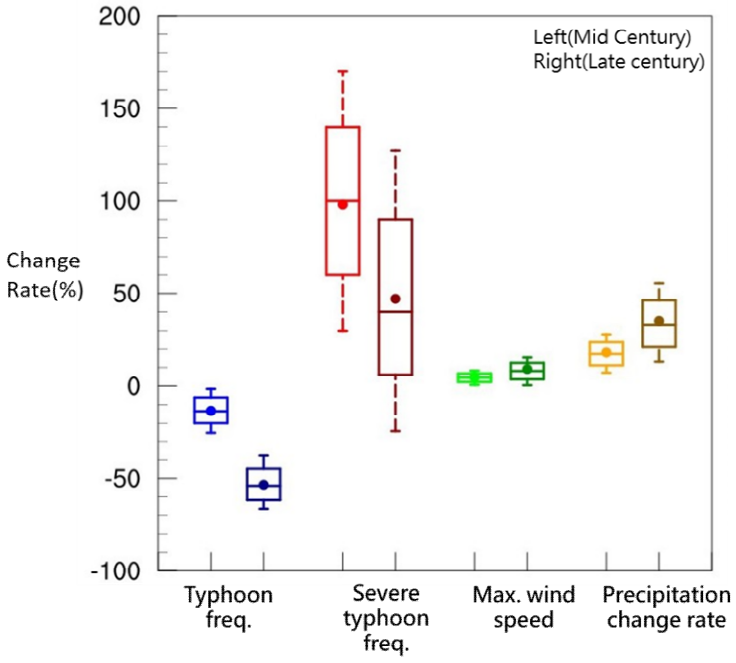

Fig. 8 Estimation of future changing trend of typhoon characteristics in Taiwan

Image source: NSCT

The various impact factors from climate change will affect sectors in Taiwan differently. Amongst all the factors, the ones with potentially significant impact on the country can be summarized as follows: temperature (hot and cold), rainfall (wet and dry), coast and ocean (sea level rise, marine heatwaves, ocean acidification, etc.). The following summarizes the potential impact on various sectors based on temperature, rainfall, and sea level rise changes.

Under the future warming scenario, rice production in Taiwan shows a decreasing trend in agriculture, and the average yield reduction of the second crop is more obvious than that of the first crop (Figure 9).

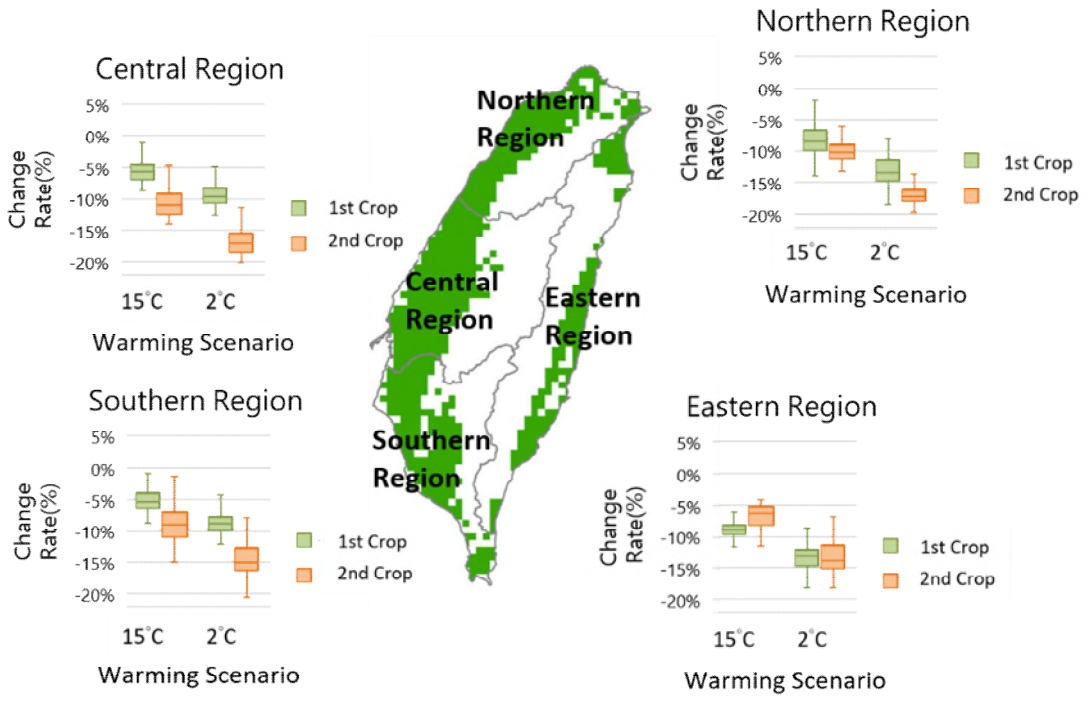

Fig. 9 Estimation of the future trend

Image source: NSCT

Under the future warming scenario, there will be an increase in extreme rainfall intensity, a decrease in the chance of typhoons hitting Taiwan, and a change in rainfall patterns. In terms of flooding impact, all regions showed an increasing trend except for the central region, which showed a slight decrease in the middle of the century. In terms of the impact of slope failure disaster, all regions showed an increasing trend in the middle of the century, except for the central mountainous areas. This increasing trend becomes more evident at the end of the century. In terms of water resources, the fluctuation of river flow between wet and dry seasons in catchment areas became more extensive, and the flow in spring generally showed a decreasing trend in the middle of the century. This change was more significant at the end of the century, which may increase the risk of drought (Figure 10).

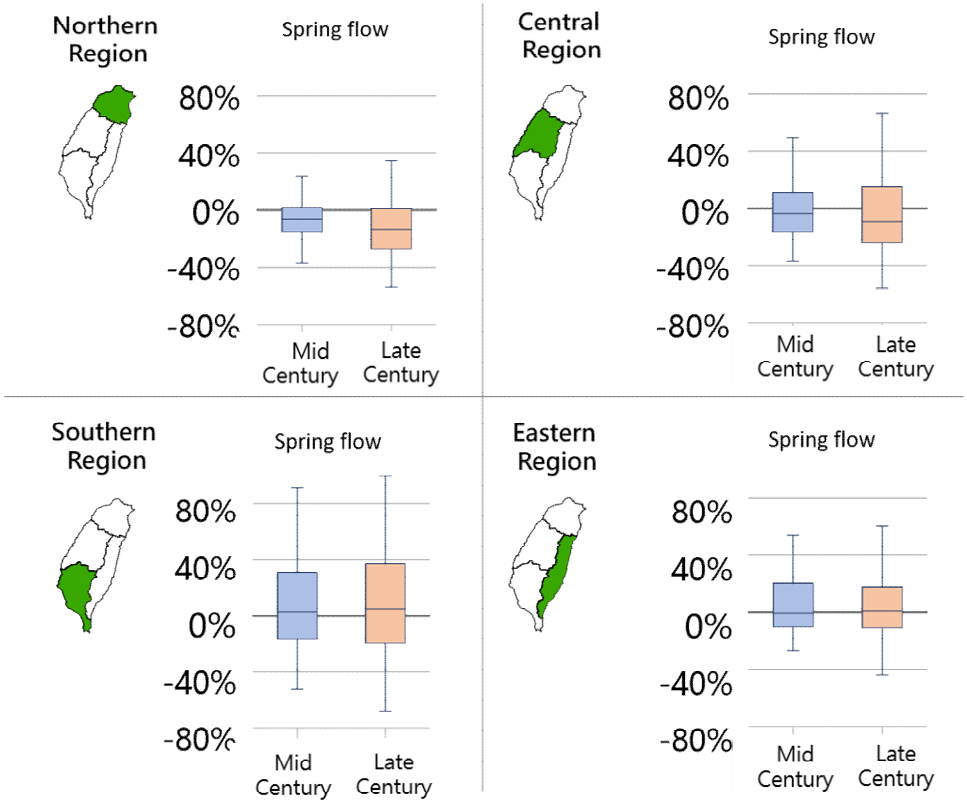

Fig. 10 Estimation of the maximum number of consecutive days without rainfall and the future trend of spring flow in the water resources division Image source: NSCT

Under the worst-case climate scenario (RCP8.5), the wind speed of typhoons will increase by about 2% to 12% at the end of the century, with an average increase of 8%. Due to its natural geography, the impact of typhoons and waves along the coast of Taiwan is more significant on the northeast and southeast coasts. In comparison, the impact of storm surges is greater on the north, northeast, and central coasts. Therefore the impact on these areas will be higher than other areas under the warming scenario. According to the IPCC AR6, in a 2°C warming scenario, the sea level around Taiwan will rise by about 0.5 meters, and in a 4°C warming scenario, the sea level will rise by 1.2 meters. Taking the Taipei metropolitan area as an example, sea level rise may lead to flooding in areas mainly located in the estuary of the Danshui River. Under the protection of existing dikes, the impact on urban areas will be relatively small. In southwestern coastal areas such as the Tainan area, sea level rise may cause an overflow in lowlands, especially in coastal fish farms, wetlands, and sandbars (Figure 11).

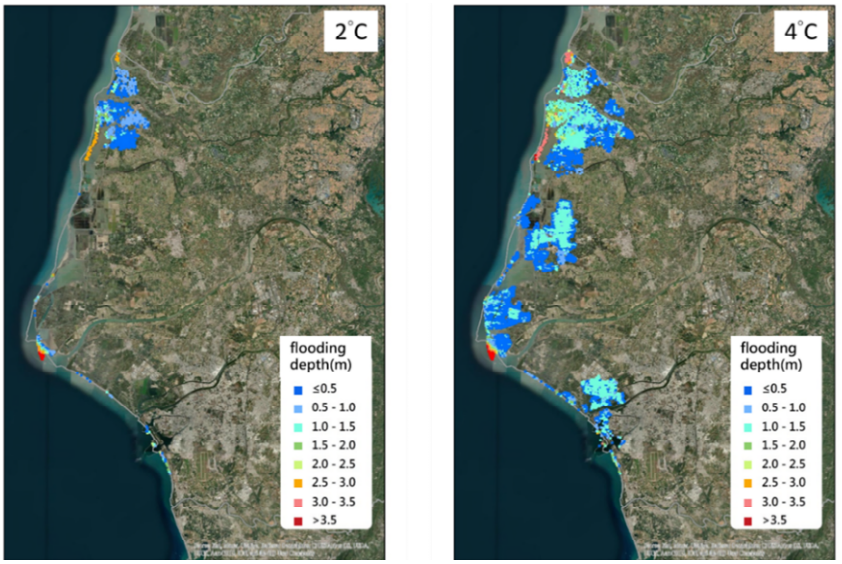

Fig. 11 Estimation of future sea-level rise change trend in Tainan area

Image source: NSCT