

# Using unmanned aerial vehicle (UAV) photogrammetry for monitoring seasonal changes of barrier island in the southwestern coast of Taiwan

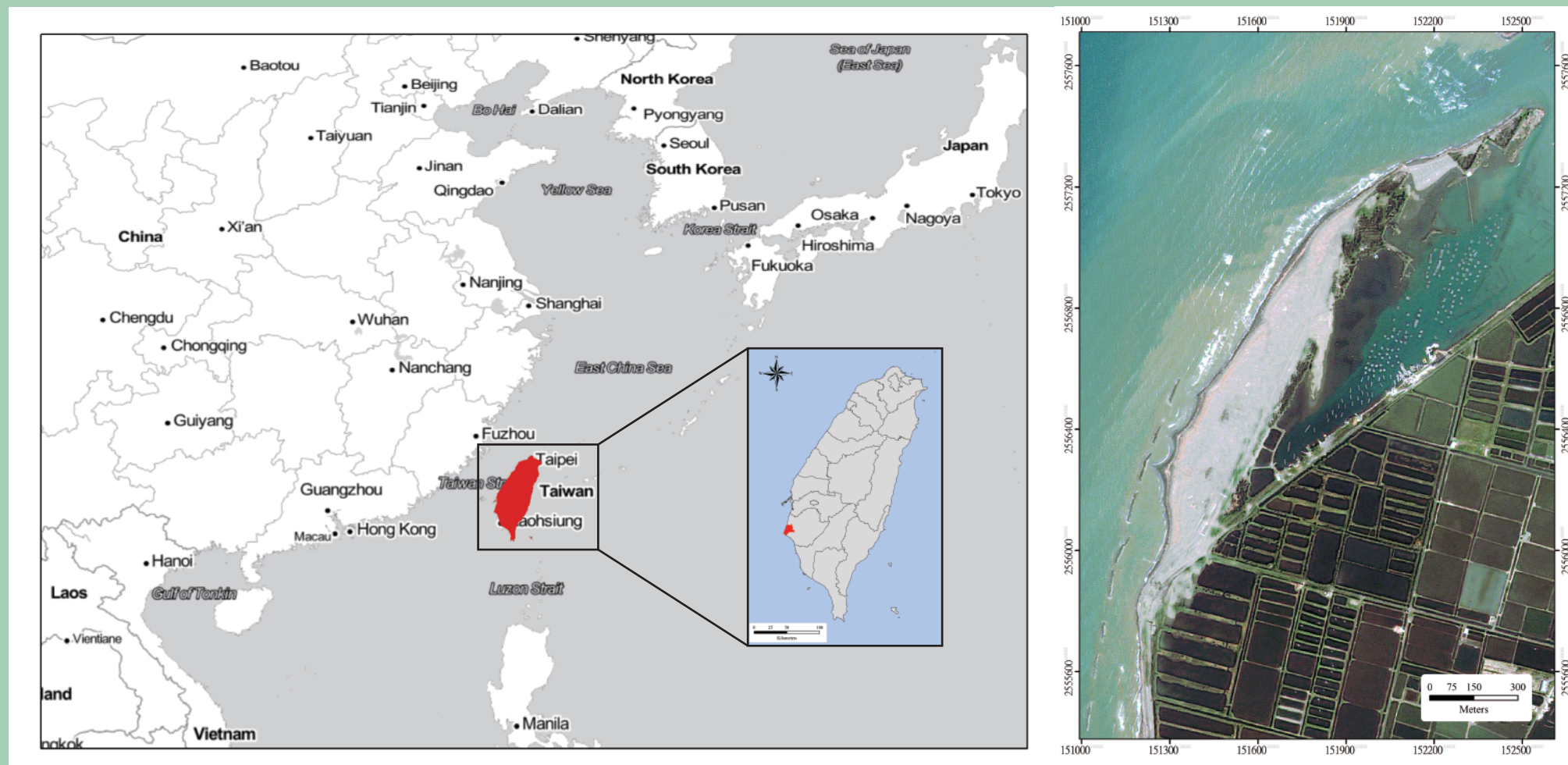
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## Introduction

Reduction in area and volume of the landward-migrating barrier islands along the southwestern coast of Taiwan has become an important coastal management issue recently. This study aims to understand the seasonal changes of the barrier island "Dingtoue", which is 1.3 km in length and 30.5 ha in area in the southwestern coast of Taiwan.

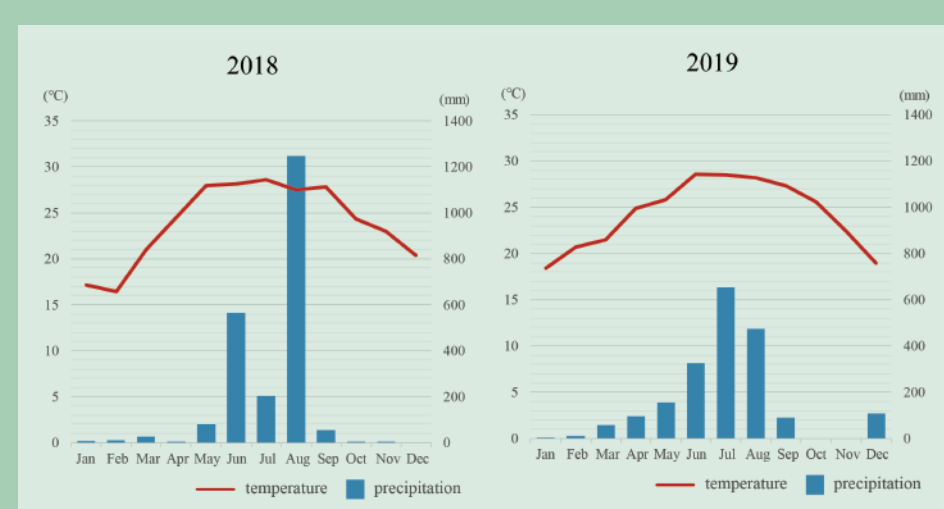


**Fig 1.** Taiwan is a state in East Asia and the barrier island ,Dingtoue, is in southwestern coast of Taiwan

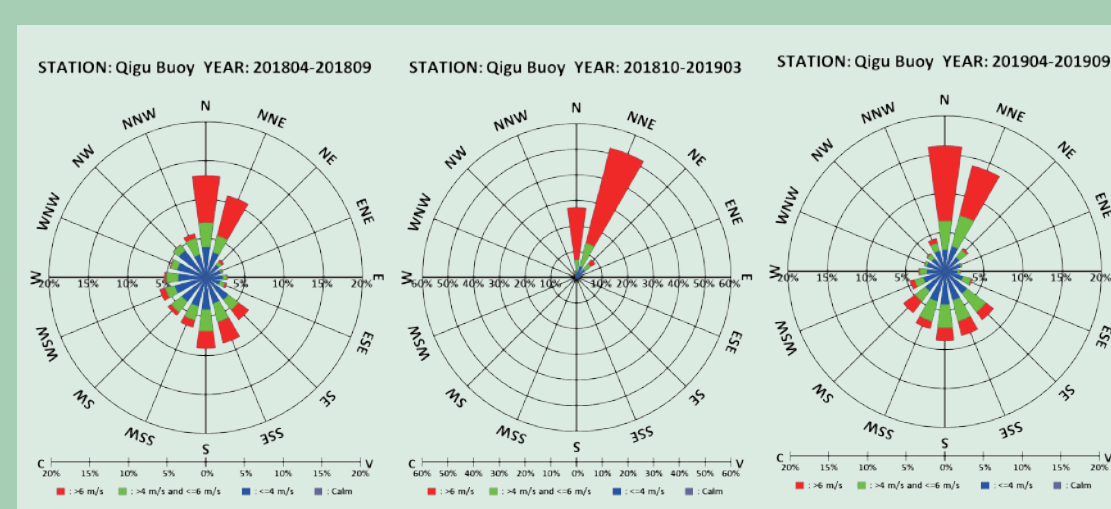
## Method

The study monitor the landform change by using UAV photogrammetry. We have already conducted 4 campaigns of UAV photogrammetry between March 2018 and September 2019, and they can reveal the landscape of the end of summer and winter monsoon. We use Agisoft Metashape to process the aerial photos for acquiring the DEM and orthoimage with the spatial resolution of 0.5 m and precision level of 0.04 m in both horizontal and vertical direction. We sub-divide Dingtoue barrier island into beach and sand dune zones for further analysis by using Arc GIS. The DEM of difference and areas will be obtained in beach and sand dune as well.

## Results

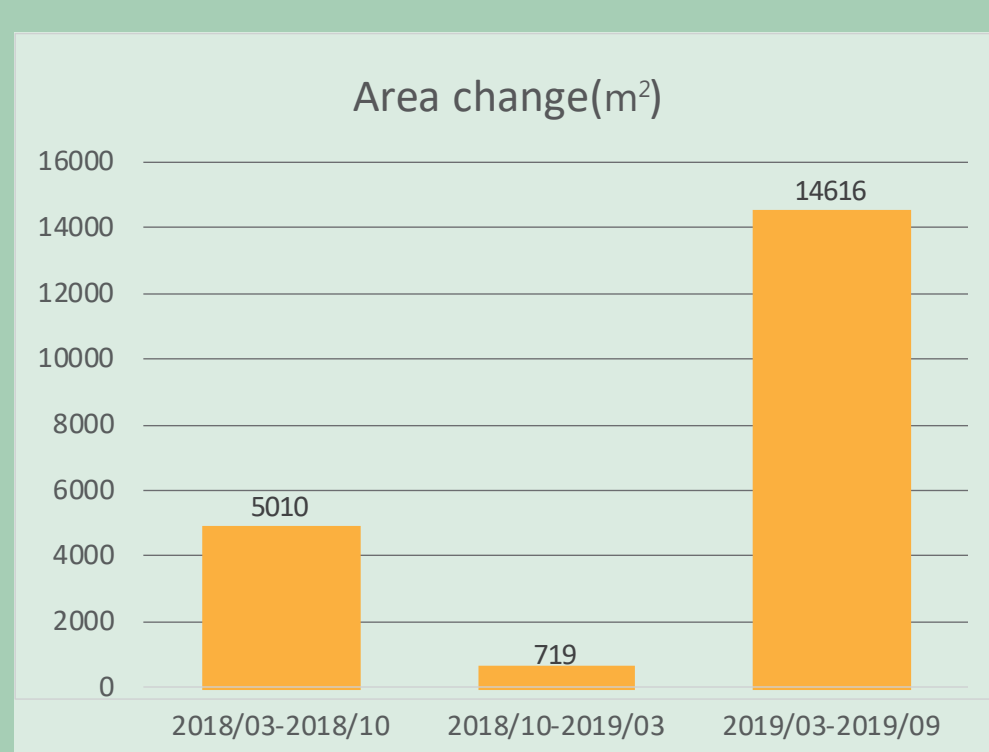


**Fig 2.** Temperature and precipitation of Qigu station in 2018 & 2019.

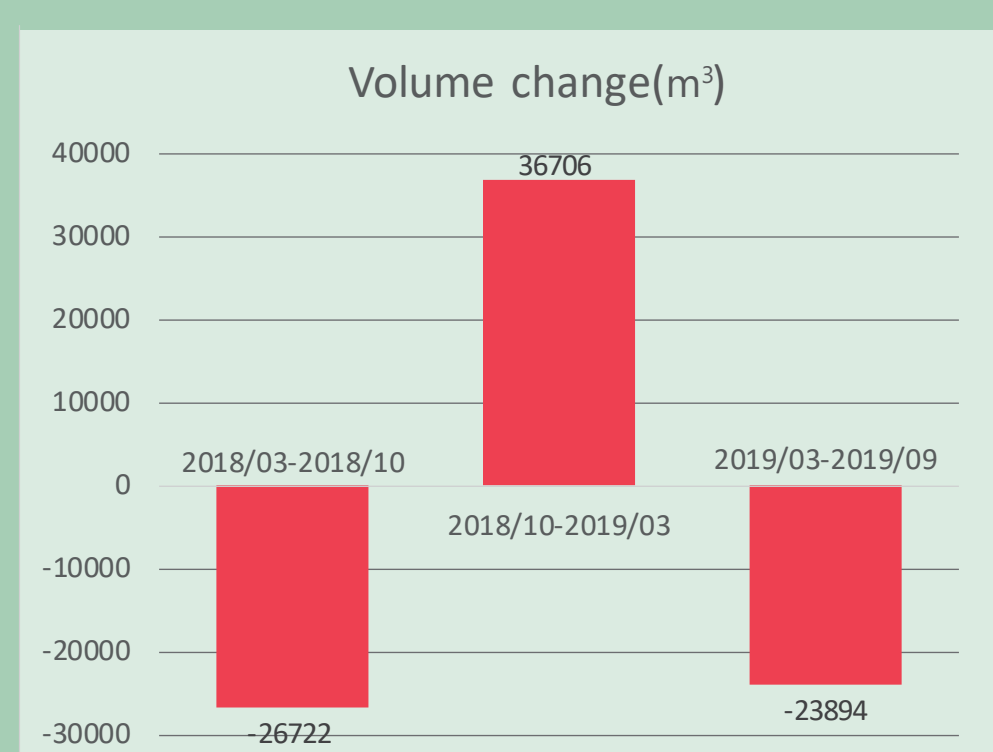


**Fig 3.** Rose Diagram of Wind

Area of Dingtoue barrier island is increasing 5010 m<sup>2</sup>, while volume of Dingtoue barrier island is decreasing 26722 m<sup>3</sup> between March 2018 to October 2018 (summer of 2018). The beach part is increasing in both area and volume, while the sand dune part is decreasing in both area and volume. The northern part of the beach is extending to east and the sand dune zone is retreating to further east. The southern part of the beach is extending to west part, which is the sea in the past.



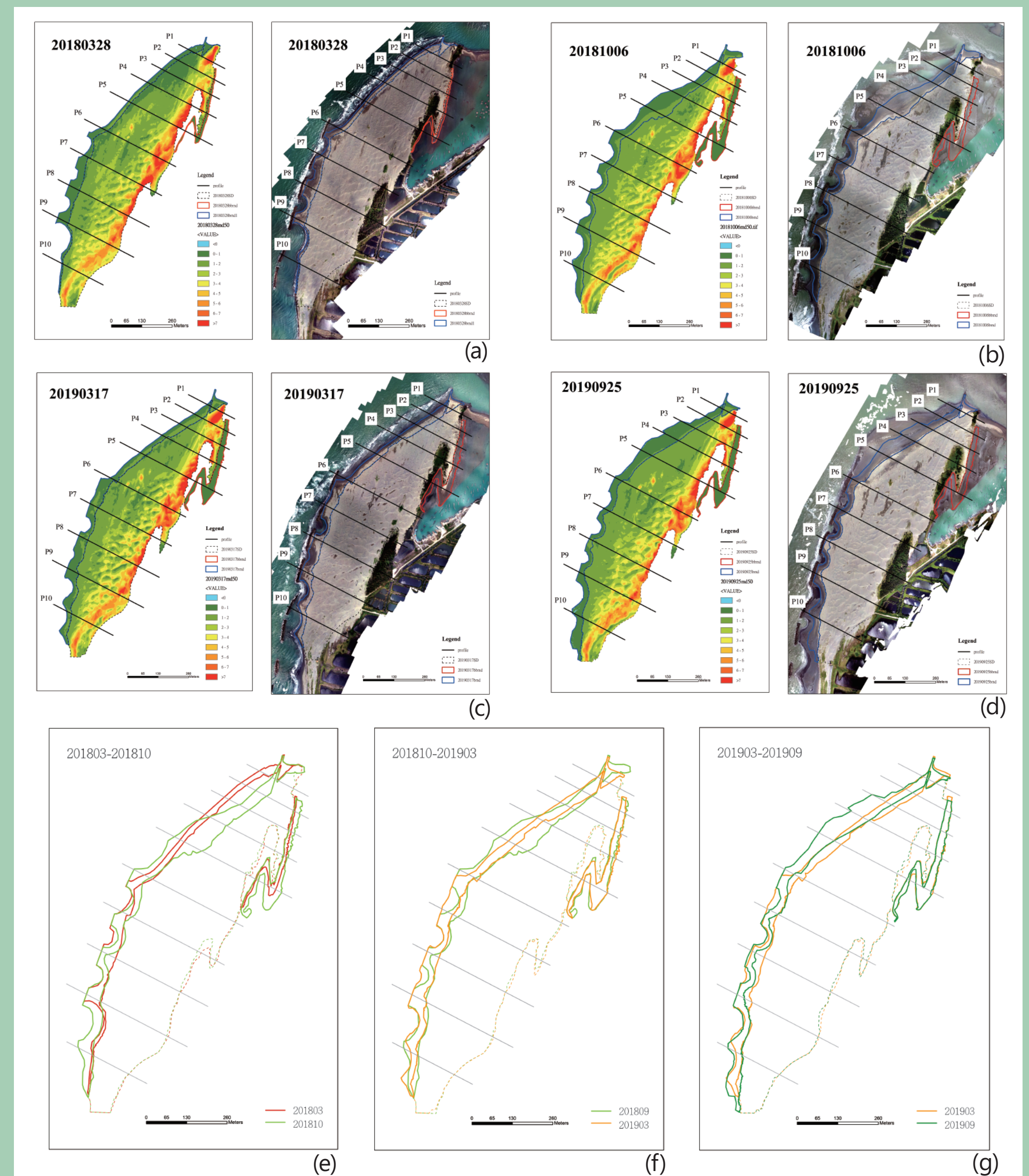
**Fig 4.** The area change of Dingtoue



**Fig 5.** The volume change

Area of Dingtoue barrier island is increasing 719 m<sup>2</sup>, while volume of Dingtoue barrier island is increasing 36706 m<sup>3</sup> between October 2018 to March 2019 (winter). Area of the beach part is relative the same as the previous period be with some minor changes in the northern and southern part. The sand dune part is increasing in both area and volume.

Area of Dingtoue barrier island is increasing 14616 m<sup>2</sup>, while volume of Dingtoue barrier island is decreasing 23894 m<sup>3</sup> between March 2018 to October 2018 (summer of 2019). Areas of beach and sand dune are both increasing while volume of the sand dune is decreasing. The mid-part of the beach is occupied by sand dune and the beach is recovering to previous shape.



**Fig 6.** (a)The DEM and orthoimage in March 2018 (b)The DEM and orthoimage in October 2018 (c)The DEM and orthoimage in March 2019 (d)The DEM and orthoimage in September 2019 (e)The boundary of beach and sand dune between 2018/03 and 2018/10 (f)The boundary of beach and sand dune between 2018/10 and 2019/03 (g)The boundary of beach and sand dune between 2019/03 and 2019/09

## Discussion & Conclusions

In general, Dingtoue barrier island increased by 7% in area and decreased by 13910 m<sup>3</sup> in volume between March 2018 and September 2019. The surface change is 0.05 m<sup>3</sup>/m<sup>2</sup> in this period. Furthermore, precipitation in April & May of 2019 is more than the same period of 2018. Moreover, the volume in summer of 2019 decreased less than in summer of 2018. The orthoimages apparently show that vegetation at west part of sand dune developed better in the summer of 2019 than it did the same time of 2018.

The trend shows that typhoons will increase area of Dingtoue barrier island, but decrease its volume. The winter will decrease area of Dingtoue barrier island but increase its volume. So the main change of area is at the beach part and the main change of volume is at the sand dune part. If the precipitation is enough for vegetation development before the strike of typhoons, the vegetation protects Dingtoue barrier island.