



From left: Prof. Ponnunmy Vethamony, UNESCO Chair in Marine Sciences, Prof. Fadhil Sadooni, Research Professor at Environmental Science Center, and Prof. Hamad Al-kuwari, Director of Environmental Science Center.

“UNESCO Chair in Marine Sciences at Qatar University” was formally launched in December 2020. The Science Plan of the award, viz., “Oceanography of the Arabian Gulf with particular reference to the EEZ of Qatar” includes the following components: Arabian Gulf circulation, Climate Change impacts, Sea level rise, Shamal winds and waves, Geomorphological changes due to coastal and offshore developments and Marine pollution. Though the main focus is on the EEZ of Qatar, oceanography of the Arabian Gulf cannot be separated from that of the Arabian Sea/Indian Ocean. Therefore, wherever required, especially in modelling, Arabian Gulf oceanography has been studied, considering the Arabian Sea.

The Environmental Science Center has carried out a number of scientific studies and activities aimed at achieving the objectives of the UNESCO Chair and its research plan. The applied scientific studies include: The Study of a multiscale ocean modelling system for the central Arabian Gulf. The study identified seasonal variability in currents and eddies in the EEZ of Qatar (Figure 1). For the first time in the Arabian Gulf, four prominent anti-cyclonic eddies have been identified in the Gulf of Salwa and south of Bahrain during winter, which were subsequently decayed during spring, re-built during early summer and partially decayed in autumn. At the structure scale, the flow is mostly tidally driven and can be intensified beyond 1 m/s through narrow passages such as between breakwaters or within artificial

waterways. The center also studied the role of Shamal and easterly winds on the wave characteristics along the coast of Qatar. Waves in the Arabian Gulf are dominated by Shamal winds during winter and early summer. Results indicate that Nashi winds influence the east and northeast coasts of Qatar with higher waves than those generated by Shamal winds. It has been found that exceptional easterly (Nashi) waves during March 2019 contribute to the highest monthly mean  $H_s$ , which is a deviation from the known long-term wave climate of the Gulf.

The Researchers at the Center found that the maxima in northerly wind speeds and wave heights over the Arabian Sea, the Arabian Gulf and the Red Sea. The analysis of climatology and trends of northerly maximum wind speed and significant wave height ( $H_s$ ) in the Arabian Sea, Arabian Gulf and the Red Sea, during non-monsoon season derived from 40 years of ERA5 wind and wave data shows that the northern Arabian Sea including the Sea of Oman exhibits significant decreasing trend in northerly maximum wind speed ( $-1.4$  cm/s/year) and  $H_s$  ( $-0.67$  cm/year), while the Arabian Gulf and the Red Sea exhibit a sectorial contrasting trend, indicating the dominance of localized effects in modifying the regional climate.

The Center also refers to historical accumulation and composition of polycyclic aromatic hydrocarbons in the sediment cores of Arabian Gulf: The results indicate that the concentration sums of 16 priority