TIME-SERIES ANALYSES OF ATMOSPHERIC AND MARINE OBSERVATIONS ALONG THE TURKISH COAST

Ersin Tutsak [1]*, Emin Özsoy [1] and Y. sinan Husrevoglu [1]
[1] Institute of Marine Sciences, METU, Erdemli, Turkey - ersin@ims.metu.edu.tr

Abstract
Time series and spectral analyses are applied to surface atmospheric (wind velocity, air temperature, barometric pressure, relative humidity) and sea level data obtained from monitoring stations along the Turkish coast. Analyses of time series longer than a year identify main time scales of transport and motion while establishing seasonal characteristics, i.e. distinguishing, for instance, between winter storms and summer sea-breeze system. Marine flow data acquired by acoustic doppler current profilers (ADCP) are also analyzed to better understand the response of the dynamics along the Turkish coast to short-term climatic variability. Cumulative results obtained from these analyses determine temporal and spatial scales of coastal atmospheric and marine fluxes of momentum, heat and buoyancy as affected by the regional climate system.
Keywords: Time Series, Sea Level, Air-Sea Interactions

Introduction and Methods
The total of 12 atmospheric and marine coastal monitoring stations along the Turkish coast of the Mediterranean, Aegean, Marmara and Black Seas and the Bosphorus and Dardanelles Straits (Figure 1) traverse approx. 2500 km of coastline with a maximum separation of approx. 800 km. The stations were installed within the framework of the Turkish Meteorology and Oceanography Excellence Network pilot project coordinated by the Institute of Marine Sciences, Middle East Technical University. These automatic data acquisition systems collect surface atmospheric data (air pressure, wind, air temperature, and relative humidity) in addition to sea-level measurements acquired by electronic tide gauges.

The main objective for establishing this coastal monitoring network is to obtain long-term time series of surface atmosphere and ocean data in an attempt to understand and quantify regional climatic variability in the Turkish coastal system as well as the effects of such variability on the Mediterranean-Black Sea coupling through the Turkish Straits System (TSS). The TSS is sensitive to climatic changes and potentially causes such changes in the adjacent basins [1]. The sea level difference over the Bosphorus plays an important role for the overall flow. Sea level is highly variable through the Turkish strait system and is influenced by the Black Sea and the Mediterranean oscillations, but is not affected by the tidal oscillations [2]. Over the Black Sea strong winds can control the water flow of the Bosphorus strait, thus the mean sea level of the Black sea at intra-seasonal frequencies. The Mediterranean water flow into the Black sea can be blocked as the northerly winds blow. Also, sufficiently intense southerlies may cause to cease the upper layer flow from Black Sea [3].

Based on measurements, taken during longer than a year, time series and spectral (auto-, cross-, and rotary spectra) analyses are performed to exhibit the measurements in both time and frequency domains, which enable to detect temporal and spatial scales of phenomena, oscillations and correlations of the observations in distinct areas.

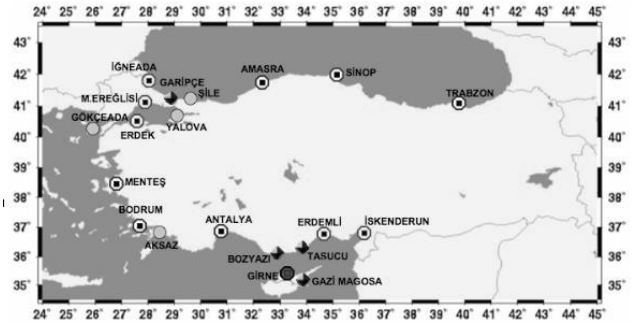

Fig. 1. Coastal observation stations along the Turkish coasts

Results
Spectral analyses of the sea level indicate basin oscillations of several days to weeks in addition to diurnal and semi-diurnal oscillations in sea level forced by the winds, barometric pressure differences and storm surges. Frequently, a sea level difference of about 40 cm is observed between the Black and Marmara Seas, which vanishes during some blockage events of the Bosphorus upper layer.

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