EOF and SVD Analysis of SST and SLP in the Persian Gulf

S. Hassanzadeh*, A. Kiasatpour and F. Hosseinibalam
Physics Department University of Isfahan, Isfahan ٨١٧٤٦ Iran

Keywords: Singular Value Decomposition, Atmospheric Pressure, Persian Gulf, Lag

Abstract:

The atmosphere and the underlying ocean are closely coupled. The ocean plays an important role in establishing and changing the earth's climate. Both the ocean and the atmosphere transport energy and exchange it with each other and their dynamics are coupled through exchange processes at their common interface.
The main goal of this paper is to investigate the air-sea interactions on interannual and decadal time scale in the Persian Gulf.
٣٤ years of data (١٩٦٧-٢٠٠) are used to investigate air-sea interaction in the Persian Gulf. An Empirical Orthogonal Function (EOF) and Singular Value Decomposition (SVD) analysis are applied to determine the coupled modes of variability of monthly Sea Surface Temperature (SST) and Sea Level Pressure (SLP). We find that the

The four leading EOF patterns of SST are found. These modes together account for ٩٩,٨٪ of the total monthly SST variance. Individually they explain ٩٠,٩٪, ٧,٥٪, ١٪ and ٠,٤٪ of the variance. According to the North el al. (١٩٨٢), the difference between the forth and fifth eigenvalue is comparable to the magnitude of the sampling errors, which means that the error in the EOFs is comparable to the size of the EOFs themselves. The temporal variability of each EOF, obtained by the expansion coefficient of spatial patterns .
EOF١ exhibits a generally southeast-northwest gradient over the entire region. This mode accounts for up to ٩٠,٩٪ of the variance. This is due to the principal features of the long time Persian Gulf circulation driven by the Oman Sea waters through the strait of Hormuz along the Iranian coasts. This cyclonic gyre before turning around the central Gulf basin forms a second cyclonic gyre. The front which separate these gyres is denoted by the zero contour in the EOF١ isotherms.
EOF٢ displays a monopole pattern locating in the central basin of the Gulf and extending over the middle portion of the Gulf. By and large, the second EOF resembles west and east of this monopole a copy of the meridional isotherm pattern of the first EOF.
The third EOF is mainly associated with north-south gradient and isotherms extend zonally. This mode explains ١٪ of the variance. The forth EOF shows a dipole like structure with one pole centered around the front separated the gyres. This mode account for ٠,٤٪ of the variance and it is not significant.
The time series of EOFs are obtained and characterized by a different time variability. The four spatial patterns of EOFs for SP fields which account for ٩٤,٣٦٪ of the total variance are calculated as well.
EOF١ has northeastward gradient, which is in the direction of Shomal wind (northwesterly). This mode account for ٥٣,٠٪ of the variance. The second EOF of SLP has a structure which is related to west-east changes in the direction of the pressure