

An Analysis of the Steric Sea Level Change by Introducing Sea Surface Temperature

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Abstract In this paper, we use the optimum interpolation sea surface temperature (OISST) provided by the National Center for Environmental Prediction (NCEP) to replace the temperature in the top three layers in the ISHII data, and make use of the modified ISHII temperature data to calculate the thermosteric sea level (called modified steric sea level (SSL) hereafter). We subtract the modified SSL and the steric sea level (called ordinary SSL hereafter) derived from the ISHII temperature and salinity from the steric sea level (SSL) provided by the Gravity Recovery and Climate Experiment (GRACE), respectively, and find that the rms error of the difference of the former is obviously smaller than that of the latter. Therefore we reach the conclusion that under the assumption that the GRACE SSL is accurate, the modified SSL can reflect the true steric sea level more accurately. Making use of the modified SSL, we can find that the modified SSL in sea areas of different spatial scales shows an obvious rising trend in the upper 0 – 700 m layer for the period 1982 – 2006. The global mean SSL rises with a rate of 0.6 mm year⁻¹. The modified SSLs in sea areas of different spatial scales all show obvious oscillations with period of one year. There are oscillations with periods of 4 – 8 years in global oceans and with periods of 2 – 7 years in the Pacific. The Empirical Orthogonal Function method is applied to the sea areas of different spatial scales and we find that the first modes all have obvious 1-year period oscillations, the first mode of the global ocean has 4 – 8 year period oscillations, and that of the Pacific has 2 – 6 year period oscillations. The spatial distribution of the linear rising trend of the global modified SSL in the upper 0 – 700 m layer is inhomogeneous with intense regional characteristics. The modified SSL linear trend indicates a zonal dipole in the tropical Pacific, rising in the west and descending in the east. In the North Atlantic, the modified SSL indicates a meridional dipole, rising in the latitude band of 20°N – 40°N and 45°N – 65.5°N and descending obviously in the latitude band of 40°N – 45°N.

Key words GRACE; ISHII; OISST; steric sea level

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