停课不停学：我院二年级硕士研究生在国际权威期刊Journal of Hydrology发表高水平论文

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近日，我院二年级硕士研究生罗小雅和陈娟分别在国际权威期刊“Journal of Hydrology”（影响因子：4.405）和“Regional Studies in Marine Science”（影响因子：1.462）以第一作者发表高水平论文“Evolution of reversal of the lowest low waters in a tidal river network”和“Impacts of tidal species on water level variations in Pearl River Delta channel networks”。

其中“Journal of Hydrology”为中信所一区期刊，论文发现：在常识中都认为大潮的低潮一般会低于小潮的低潮，但实际情况是在潮汐河道中，低低潮时常会发生在小潮期间，2005年国外学者首先指出这主要是有半月周期的分潮簇（D14）影响，但通过我们的研究进一步证明半月周期的分潮簇与半日周期的分潮簇（D2）的比值才是决定低低潮发生时间的关键因素，其中，Msf/S2是最核心的控制机制。世界范围的河口，高频的D2往往是最主要的分潮簇，但这类分潮簇沿程衰减较快，而低频的分潮簇D14由于波长较长，在径潮相互作用强烈的地方会沿程增加，随后的沿程衰减也非常缓慢，当河道中出现Msf振幅大于S2振幅时，这时就会出现低低潮出现在小潮期间。研究区域珠江河网由于地形下切，导致河床摩阻明显变化，从而对Msf和S2振幅产生了不同影响

过程和机制。

两篇论文都是在疫情期间收到修改意见，为了保证论文的顺利发表，指导教师张蔚教授和两位学生积极开展线上交流，通过学校开放的图书馆资源查阅文献，利用网络平台组织课题组讨论，真正做到“停课不停学”，保证了研究生培养质量不受疫情影响。经过师生的共同努力，最终两篇论文顺利发表。

发表在“Journal of Hydrology(2020)”的论文，是近三年内继“Ocean Engineering(2017)” “Journal of Hydrology(2018)”， “Hydrology and Earth System Sciences(2019)”， “Water Resources Research(2019)”， “Journal of Geophysical Research -Oceans (2019)”和“Coastal Engineering(2020)”，张蔚教授课题组围绕着河口三角洲潮波运动理论发表的第七篇一区论文。

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Research papers

Evolution of reversal of the lowest low waters in a tidal river network

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ABSTRACT

The lowest low waters usually occur during spring tides in tide-dominated coastal environments. However, they could also occur during neaps, rather than springs, at more landward stations, and this phenomenon is known as the reversal of the lowest low waters (RLLW). The RLLW greatly depends on subtidal and daily oscillations in the water level, the evolutions of which along a channel are of considerable importance in navigation safety and freshwater intake. Observations collected at an inland hydrological station (Shilong) in the networks of the East River, China, show that the lowest low water level previously occurred during neaps, but now occurs during springs. To elucidate the causes of this evolution, T_TIDE was used to extract constituents from water level records collected over the past fifty years at five stations in this river network system, including astronomical constituents, overtides, and fortnightly tides. The results show that the astronomical constituents were significantly amplified in the upstream stations, while the fortnightly tide Msf decreased slightly in the long term. Physically, channel deepening caused by excessive sand excavation has increased the water depth and reduced the effective drag in the friction term of the momentum balance. The reduced frictional effect, reflected by the residual water level slope, is responsible for the significant increase in the astronomical tidal amplitudes. However, they were not strongly influenced by long-term variations in river runoff and sea-level rise. The amplitude ratio between Msf and S_2 was used to analyze the spatiotemporal evolution of RLLW. This ratio at Shilong continuously decreased over time, and the location where the ratio was 1 moved upstream, indicating that the RLLW has traveled farther inland in recent decades. The evolution of the RLLW in the East River network implies that the tidal-dominant zone has enlarged in recent decades.

1. Introduction

Several studies conducted on deltas and estuaries revealed that variations in the elevation of water and tidal properties are primarily governed by alterations in the landward, seaward and geometric boundaries (Vellinga et al., 2014; Hoitink and Jay, 2016). The water level in estuaries is affected by coastal processes, astronomical tides, river flow, and other external forces, and their relative importance changes along the estuary (Jay et al., 2015, 2016). Water level variations also play an important role in the estuarine environment. For example, the impacts of subtidal water level variations, particularly fortnightly oscillations, on wetland inundation and navigation are not negligible (Buschman et al., 2009; Hoitink and Jay, 2016; Sassi and Hoitink, 2013; Jay et al., 2015). In this study, subtidal variations refer to water level fluctuations over periods significantly longer than one day (Hoitink and Jay, 2016). Jay et al. (2015) suggested that subtidal oscillations should be considered when defining the seaward boundary of the tidal rivers. Upstream of the boundary the lowest low water levels occur during neap tides instead of spring tides, which is regarded as the reversal of the lowest low waters (RLLW). Variations in the lowest low water levels affect tidal freshwater wetlands (Bunn and Arthington, 2002; Wolanski, 2007) and navigation channels (Jay et al., 2011). Therefore, it is essential and practically important to better understand the RLLW and its corresponding hydrological processes.

Previous studies have shown that subtidal nonlinear oscillations larger than the daily tidal variations are responsible for the RLLW (Hoitink and Jay, 2016; Jay et al., 2011, 2016). Subtidal surface variations could reach the point where the diurnal and semidiurnal tides are extinct (Godin and Martinez, 1994), thus, they even greatly influence the inland water levels. The fortnightly tide Msf, one of the key constituents of subtidal tides, is forced in shallow water by river-tide interactions in analytical one-dimensional models (LeBlond, 1979; Kukulka and Jay, 2003). Buschman et al. (2009) demonstrated that river-tide interactions are the main factor inducing fortnightly subtidal

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Impacts of tidal species on water level variations in Pearl River Delta channel networks

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ABSTRACT

Variations in the water level of tide-influenced deltas are strongly related to the evolution of tides as the tidal waves propagate upriver. However, the impacts of tidal species on these water level variations are not well understood, particularly in delta channel networks. Therefore, a one-dimensional hydrodynamics model of the Pearl River Delta channel networks was established to investigate the impacts of different tidal species on the distribution of the water level. Spatial distributions of the amplitude of four main tidal species (the diurnal (D_1), semidiurnal (D_2), quarterdiurnal (D_4), and fortnightly ($D_{1/14}$) tidal species) were extracted using the continuous wavelet transform method. The results reveal that the diurnal and semidiurnal tidal species dominate the fluctuation in the water level near the river outlets, but are significantly attenuated in the upstream direction. The quarterdiurnal tidal species strengthens in shallow waters and then decays farther upriver. However, the fortnightly tidal species grows upriver. There is a strong resemblance between the distribution patterns of the water level and that of the amplitude of the fortnightly tidal species in the Pearl River Delta channel networks. Moreover, in the upstream channels, dominant fortnightly tides lead to the occurrence of lowest low water levels on neap tides rather than the expected spring tides. The results of this study have significant implications for the investigation of hydrodynamic processes and the management of navigation safety in delta channel networks.

1. Introduction

Deltas are landforms that deliver nutrients, water, and sediments from upstream rivers to coastal oceans via channel pathways; they are co-influenced by river flows, tides, and waves (Canestrelli et al., 2010; Tejedor et al., 2014). Among these factors, tides play an important role in the variation of the water level in tide-influenced deltas (Gallo and Vinzon, 2005; Buschman et al., 2009). However, tides in delta channel networks do not respond simply to astronomical forcing, and they are influenced by nonlinear interactions between the seawater and the river flow, channel geometry, and bottom friction (LeBlond, 1978, 1979; Aubrey and Speer, 1985; Godin, 1985; Parker, 1991; Jay, 1991; Wong et al., 2009). As a consequence, the variability of tides is intrinsically complex and contributes to modulation of the water level.

2015; Cai et al., 2018). When tidal waves propagate into estuaries, nonlinear interactions between the tide and the river discharge cause shallow water tides (e.g., M_4, MS_4, MSf) whose frequencies are differences and sums of the tides directly induced by astronomical forcing. Studies have indicated that the distortion and damping of tides can best be represented by modulation of the timing and amplitudes of tidal constituents at specific frequencies (Godin and Martinez, 1994; Sassi and Hoitink, 2013; Zhang et al., 2018). A group of tidal constituents with similar frequencies is denoted as a tidal species (Buschman et al., 2009; Hoitink et al., 2003; Hoitink and Jay, 2016; Jay, 1991; Jay and Flinchem, 1997; Sassi et al., 2012) (Table 1). Multiple tidal species exist in coastal regions and play a significant role in variations in the water level (Hoitink and Jay, 2016).

Numerous researchers have considered the impact of tidal

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