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Short-term evolution of the Capbreton submarine canyon: from morphobathymetry and current data to processes

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The Capbreton canyon stands out by its deep incision through continental shelf and slope and its present turbidity activity. The head of the canyon is disconnected from the Adour River since 1310 AD but is located close enough to the coast to allow a direct supply by longshore drifting. Gravity processes in the canyon body are well understand, but many questions remain for the head and the upper part of the Capbreton submarine canyon such as: Which kind of gravity processes provide sediment transfer from the head to the canyon? How these processes interact with the canyon floor morphology: floor shaping and feedback?
Our study is based on the analysis and comparison of eight multibeam bathymetric surveys acquired between 1998 and 2018 from a depth of 10 to 320 m below sea level. This data set covers the same area of the upper part of the canyon and allows the comparison and morphologic follow-up of this outstanding dynamic area. This proximal dataset is completed by two distal bathymetric surveys on a meander at 1500m water depth acquired in the canyon in 2013 and 2016. The morphological evolutions in these sites over the last 20 years especially affect the canyon floor and the canyon head. Time of flat floor talweg is observed, succeeded by a period of talweg incision (low lateral terraces and axial narrow talweg). The entrenchment of the narrow talweg is induced by retrogressive erosion and is evidenced by upstream-migrating-knickpoints suggesting a return to the equilibrium profile. The construction process of the low terraces observed here appears to be an analog of the fluvial terraces construction, where axial channel entrenchment follow the sediment filling of the valley.
Time of flat shaped talweg (1998) suggests a partial filling of the canyon talweg related to a substantial emptying of the canyon head and significant mass transfer to the proximal part of the canyon. Such flat floor talweg has not been observed again so far (since 2010), suggesting a possible quieter working mode of the canyon. In fact, in the light of currentmeter data (ADCP) recorded during winters 2015 and 2016 (at 555, 900 and 1500m water depth in the canyon), periods of talweg entrenchment (2010 to present day) are subject to gravity flows weaker than 40 cm.s-1. However, first accurate volume quantification on the canyon floor has been undertaken. This underlines an alternation of filling and erosive periods in the canyon axis and an unexpected continuous sediment deposition in the canyon head during the last 20 years. At the present time, the canyon head is filling up and we may fear an important head emptying including costal risks during the upcoming violent event.