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Last decade relationship between longshore drift and the head of the canyon of Capbreton (SW France) : descriptive and numerical approaches.

Mazières Alaïs (1), Gillet Hervé (1), Castelle Bruno (1), Guyot Corentin (1), and Mallet Cyril (2)
(1) UMR EPOC, University of Bordeaux 1, Talence, France, (2) BRGM Aquitaine, Pessac, France

Problematic
The canyon of Capbreton stands out among others by its deep incision of the continental shelf (right up to the coastline, Cirac et al., 2001) and its modern turbiditic activity (Gaudin et al ., 2006, Mulder et al. 2001).These singularities led to a debate concerning the relationship between the southward longshore drift estimated at around 700 000 m3/year, and the head of the canyon: (1) The presence of slide scars within the canyon's head suggest that this structure stores the sand supplied by the littoral drift and that the regular destabilization of this stock feeds the turbiditic activity of the canyon (Gaudin et al. 2006). (2) Hydrodynamic arguments (wave refraction) and in-situ measurements (radioactive tracer) suggest that the canyon's head rather plays the role of an hydrodynamic barrier preventing the littoral drift to feed the canyon (Abe, 1984; Duplantier, 1976; Froidefond, 1982).

Data and methods :
This debate is addressed in this contribution combining descriptive approach based on detailed bathymetric surveys from 1998 to 2010 and detailed numerical modelling (Castelle et al., 2006) of wave-driven circulation in the Capbreton region.
The analysis of data from missions ITSAS1 (1998), ITSAS5 (2001), GOUFHEAD (2009), SEDYMAQ2 (2010) and SEDYMAQ 3 (2012) together with the numerical exercise led to the following results:

Results and outlooks :
(1) Morphology analysis of the head of the canyon confirms the presence of multi-decametric slip scars in relation with slipped sand masses. The proximal ramp of the head of the canyon is marked by two very steep semi-circular depressions at the edges (slope> 20°), which connect morphologically the head of the canyon to sedimentary coastlines channel.
(2) The analysis of recent sediment samplings shows a clear correlation between the canyon head's sediments and beach sediments (fine to medium sands). In addition, some sampling attest the sporadic presence of mud mixed with organic matter in the head of the canyon.
(3) The hydrodynamic modelling shows that for low- to moderate-energy wave conditions wave-driven circulations cannot transport beach sediment towards the canyon's head as a northward current is observed due to offshore wave refraction across the canyon. When wave energy exceeds a threshold, the rotational nature of surf zone circulations changes of sign and wave-induced currents have the potential to transport massive quantities of beach sands in the canyon's head.
(4) The morphological evolution between 1998 and 2012 is significant. The bottom of the head of the canyon has been substantially reworked by numerous sediment destabilizations and the south rim was strongly eroded. Conversely, the proximal ramp, closer to the coast, appears to be relatively stable over the past 14 years.
In this highly dynamic environment, the littoral drift sediment supply appears as a potential stabilizer of disturbing retrogressive erosion that is going on in the head of the canyon.
To explain the presence of more muddy sediments in the canyon head, we must consider in further study the contribution of the Ardour river muddy plume.