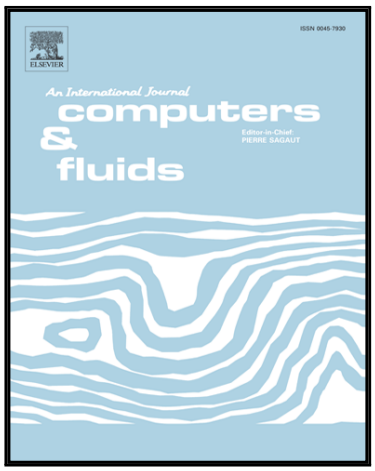

Uncertainty Quantification in littoral erosion

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UNCERTAINTY QUANTIFICATION IN LITTORAL EROSION

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Abstract. We aim at quantifying the impact of flow state uncertainties in littoral erosion to provide confidence bounds on deterministic predictions of bottom morphodynamics. Two constructions of the bathymetry standard deviation are discussed. The first construction involves directional quantile-based extreme scenarios using what is known on the flow state Probability Density Function (PDF) from on site observations. We compare this construction to a second cumulative one using the gradient by adjoint of a functional involving the energy of the system. These ingredients are illustrated for two models for the interaction between a soft bed and a flow in a shallow domain. Our aim is to keep the computational complexity comparable to the deterministic simulations taking advantage of what already available in our simulation toolbox.

1. Introduction

Littoral transformations represent obviously major societal concerns as more than two third of sand beaches worldwide face erosion or accretion with growing trends due to expected rises in the sea levels. Tremendous efforts are dedicated to the understanding of these mechanisms to help their prediction and possibly to develop protection or attenuation devices.

The literature on coastal morphodynamics is huge [12, 11, 37, 13, 49] and concerns, for instance, dunes morphodynamics, sediment transports using fluid-induced shear in the sediment modelling, sea bed friction and the feedback of bed shapes on the

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