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Downstream migrating antidunes or in-phase waves?

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Late back in the beginning of the 20th century, Gilbert observed bedforms that migrated in opposite direction to flow. Since this feature was remarkable and inverse to the behavior of dunes (most often observed in rivers and flumes), he called the new species antidunes. Subsequent researchers identified other characteristic attributes of the new species, and it was later commonly accepted that a defining characteristic of antidunes was that undulations of bed and water profiles were roughly in-phase. Due to its generality, such definition has given place to some ambiguities, particularly when dealing with bedforms close to the critical-supercritical transition, as occurs with bedforms with bed and water profiles roughly in-phase but migrating downstream. Such bedforms are described by different researchers, but they are not always classified as antidunes. Some sedimentologists argue that given the depositional pattern of such streamwise migrating forms is different to that of upstream-migrating antidunes, the more generic term “in-phase waves” should be applied to consider them as a different class. The lack of a stability field for 2D downstream-migrating antidunes in the classical theoretical study of Kennedy in the early sixties, has also contributed to some confusion. According to such theoretical diagram, downstream-migrating antidunes could only exist being 3D, but empirical evidences -even from Kennedy- contradict this outcome. In this work, such results and other morphodynamic features of downstream-migrating antidunes will be discussed, in light of experimental data and a simple hydraulic analysis of the direction of movement of antidunes. An open question will be left to debate about the appropriateness of classifying downstream-migrating in-phase waves as antidunes, and it will be emphasized that finding consensus between different disciplines involved with the study of bedforms will be advantageous.