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Transport of marked pebbles in short periods of time on a coarse clastic beach (Marina di Pisa, Italy)

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Transport of coarse sediments on coarse clastic beaches still presents aspects that are not fully understood. For instance, there is a generally perceived notion that during fair-weather periods coarse grains hardly move, if not at all. The aim of this experiment is to prove that sediments such as pebbles are subject to significant shift in very short lapses of time and under low energy waves. An artificial coarse clastic beach at Marina di Pisa (Tuscany, Italy) was chosen as study site: Barbarossa beach is 110 m long and is bounded by two groynes. The mean grain size is about 40-to-50 mm. About 80 pebbles were marked by means of the RFID technology, which enables to univocally identify the tracers. The marked pebbles were released along cross-shore transects (one pebble each on the fair-weather berm, on the beachface and on the step crest) on the morning of September 15th, and two recovery campaigns were carried out after 6 and 24 hours from the injection. No particular wave activity was recorded during the time frame of the experiment. After the first recovery campaign, which was performed 6 hours later than the injection, about 94% of the pebbles were detected. After the second recovery campaign, 24 hours later, the recovery rate decreased to 89%. Considering that the technique provides for detection of tracers within 50 cm, the resulting loss of pebbles after so brief spans of time is remarkable. The lack of detection of few tracers implies that the transport rate that they experienced is not negligible. The highest rate of losses was recorded on the beachface, the zone that is subjected the most to waves even under calm conditions. Pebble movement is also confirmed by the fact that tracers detected after the first recovery campaign were not detected once again after the second recovery campaign, and vice versa. The results of the experiment are useful to better define the transport of coarse sediments, verifying that pebbles have to be expected be moving even in short periods of time.