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Bedform dynamics around shipwrecks emplaced on sand and gravel seabeds

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We currently lack a thorough understanding of the baseline natural seabed dynamics around objects emplaced on complex substrates. These substrates exist in northern latitudes where glaciers have left mixtures of sand and gravel on the seabed, for which we find a much increased mobility of the coarser sediments. We also find that objects emplaced on a seafloor cause currents to deviate, enhancing the forces acting on the bed by a factor of four, accelerating the flow and causing variations in forces on the bed for many kilometres in the far-field. These processes drastically alter sediment composition, bed morphology and bedform dynamics on various temporal and spatial scales. Using real-world monitoring of bedform dynamics around shipwrecks, and the latest Computational Fluid Dynamics modelling tools, we will quantify how the increased flow intensity around an object and increased mobility of the coarser sediments in mixed substrates influence sedimentary bedform formation and subsequent dynamics. From 6 high-resolution seabed morphological datasets of the SS Apapa shipwreck site, preliminary results show that 100 years after wreck emplacement on an otherwise immobile and mixed bed, there is still active erosion in the wreck's scour marks, causing large and mobile sediment waves to form in their wake. This has significant consequences for shelf sea management. As seabed infrastructure becomes denser and more variable in design, flows above the bed will inevitably alter and further efforts from academia and industry are needed for proposing mitigation strategies and ensuring seabeds can sustainably serve society.