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Seeding metrics for image velocimetry performances in rivers

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Optical sensors coupled with image velocimetry techniques are becoming popular for river monitoring applications. In this context, new opportunities and challenges are growing for the research community aimed to: i) define standardized practices and methodologies; and ii) overcome some recognized uncertainty at the field scale. At this regard, the accuracy of image velocimetry techniques strongly depends on the occurrence and distribution of visible features on the water surface in consecutive frames. In a natural environment, the amount, spatial distribution and visibility of natural features on river surface are continuously challenging because of environmental factors and hydraulic conditions. The dimensionless seeding distribution index (SDI), recently introduced by Pizarro et al., 2020a,b and Dal Sasso et al., 2020, represents a metric based on seeding density and spatial distribution of tracers for identifying the best frame window (FW) during video footage. In this work, a methodology based on the SDI index was applied to different study cases with the Large Scale Particle Image Velocimetry (LSPIV) technique. Videos adopted are taken from the repository recently created by the COST Action Harmonious, which includes 13 case study across Europe and beyond for image velocimetry applications (Perks et al., 2020). The optimal frame window selection is based on two criteria: i) the maximization of the number of frames and ii) the minimization of SDI index. This methodology allowed an error reduction between 20 and 39% respect to the entire video configuration. This novel idea appears suitable for performing image velocimetry in natural settings where environmental and hydraulic conditions are extremely challenging and particularly useful for real-time observations from fixed river-gauged stations where an extended number of frames are usually recorded and analyzed.

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