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First direct monitoring and time-lapse mapping starts to reveal how a large submarine fan works

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Turbidity currents form many of the largest sediment accumulations, longest channels, and deepest canyons on our planet. These seabed sediment avalanches can be very (> 10 m/s) fast, runout for hundreds of kilometres, and break seabed cables that now form the backbone of the internet and global data transfer. It was once thought that detailed monitoring of turbidity currents in action was impractical, ensuring these flows were relatively poorly understood. However, a series of recent projects have used new approaches and technology to show how these flows can be measured in shallow water (< 2 km) settings, such as Monterey Canyon and Canadian fjords, where flows ran out for < ~50 km and had speeds of up to 8 m/s. Here we present initial results from an ambitious project to measure active flows that runout for >1,000 km to form a major submarine fan in the deep ocean. The project studies the Congo submarine canyon-channel system that extends for ~1,100 km from the mouth of the Congo River, offshore West Africa. Monitoring in 2010 at a single site in the upper Congo Canyon had previously shown that flows are active for ~30% of the time, and reach speeds of up to 3 m/s. In this new project, direct flow monitoring at 11 sites are being combined with detailed time-lapse mapping and coring of flow deposits, through a series of 4 or 5 major research cruises from 2019 to 2023. Here we present initial results from the first of these cruises (JC187) in August-to-October 2019, which placed 11 moorings with sensors at water depths of 1.6 to 5.5 km. The presentation will initially focus on the geomorphology of the channel system, and how it varies down-slope and through time. For example, it is apparent that a landslide partly blocked one location in the upper canyon in the last 20 years, causing meander bend cut-off and sediment ponding. The talk will then discuss models for how submarine channel bends evolve, and the implications for channel

deposits. Recent work in sandy submarine channels suggests that they can be dominated by very fast-moving knickpoints (waterfall like features). However, the much muddier Congo channel displays well-developed meander bend bars for which cores are available. We therefore start to show how muddy deep-sea channels may differ in significant ways from their sandier cousins in shallow water.