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Estimate of uncertain cohesive suspended sediment deposition rate from uncertain floc size in Meghna estuary, Bangladesh

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Supplementary Information for

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Velocity output from the Delft3D model

At Location 1 (West Shahbazpur channel, northwest of Char Gazaria, Meghna estuary), the river flow slows down as it interacts with the tide. Fig. S1 depicts two-hourly depth averaged velocity vector and magnitude fields at this location. Fig. S1(a) represents the high water condition (at elapsed time $t_e = 0$ h), when the flow velocity is almost zero and some reverse circulation can be discerned. Two hours later (at elapsed time $t_e = 2$ h), in Fig. S1(b), the channel flow has begun to speed up, and the southward direction of the all arrows indicates that the bulk of the flow is now directed downstream in the vicinity of Location1. From Fig. S1(c) at $t_e = 4$ h as the tidal low water condition is reached, it is evident that the deeper channels contain high-velocity flow. Later at $t_e = 6$ h and 8 h, (Fig. S1(d) and Fig. S1(e)), the velocity in the channels further intensifies. As would be expected, such locations where the water speed is high are particularly erosion-prone (Fig. 6, main text). From Fig. S1(f), it can be seen that at $t_e = 10$ h, the high-water tide level is returning, and the flow velocity has already reduced in shallow areas surrounding Location 1. At $t_e = 12$ h, the flow velocity is even lower everywhere, including deep channels (Fig. S1(g)).

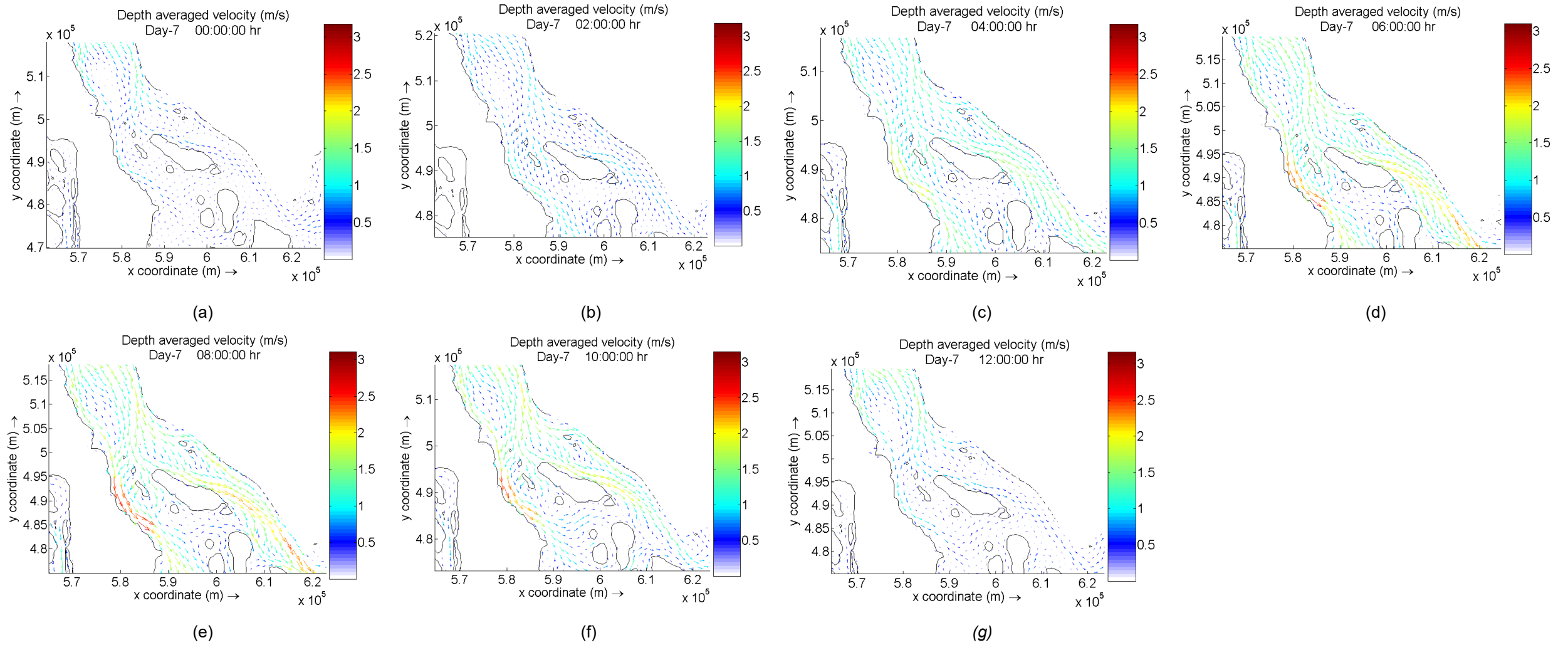


Fig. S1. Depth-averaged velocity fields at two hourly intervals in the vicinity of Location 1, West Shahbazpur channel, northwest of Char Gazaria, Meghna estuary.

Location 2 (West Shahbazpur channel, west of Manpura island, Meghna estuary) comprises a tidal flat where the local bathymetry is extremely irregular, varying from 5 to 12 m below mean sea level. The deepest channels are located to the northeast and southeast of Bholā island, and just to the north of Hatia island. Fig. S2 shows the velocity field at two-hourly intervals, covering a representative tidal cycle, at Location 2. At tidal high water, when $t_e = 0$ h, the river flow passing through West Shahbazpur channel bifurcates, and slackens losing intensity. Further downstream, the flow velocity speeds up again, as it enters the deeper channel. During low water at elapsed times $t_e = 2$ h, 4 h, 6 h, and 10 h, the flow in the whole estuary is directed southwards towards the Bay (see Fig. S2(b-e)). During high water, considerable residual circulation occurs in the shallow areas (Fig. S2(f-g)). Some of these shallow areas, including Location 2, even dry out at low water (Fig. S2(a)).

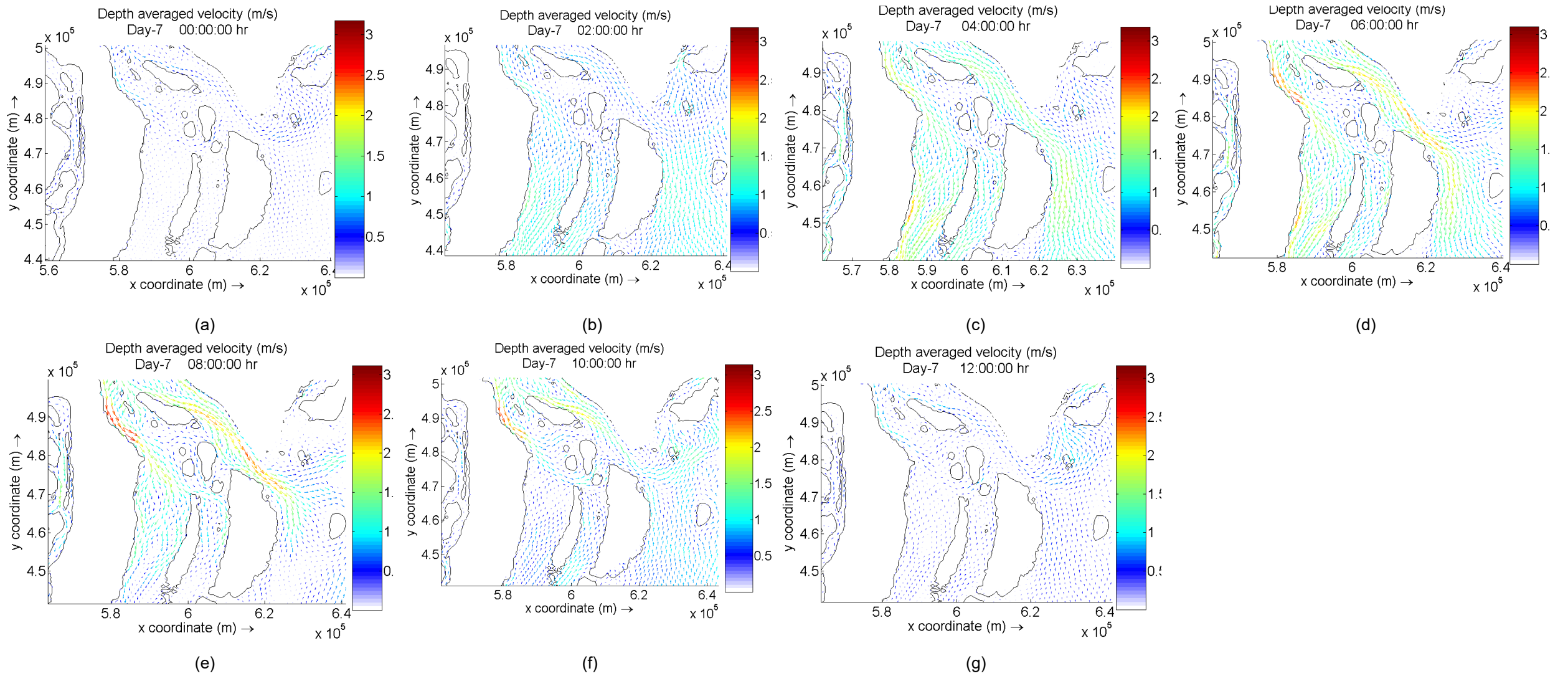


Fig. S2. Depth-averaged velocity fields at two hourly intervals in the vicinity of Location 2, West Shahbazpur channel, west of Manpura island, Meghna estuary.

Location 3 is at the Northwest of Bholia island in Tetulia channel, Meghna estuary. Fig. S3 shows the velocity field (at two hourly intervals through a representative tidal cycle in the vicinity of Location 3. The mean depth is about 3-5 m. Historically, the whole Tetulia channel has been deposition-prone. During high water, the shallow area near Location 3 experiences very low flow velocity. It can be seen from Fig. S3 that part of the river flow from the large Meghna river diverts to the Tetulia channel. The tidal reach extends northwards, a little beyond the mouth of the Tetulia channel in Meghna river. Fig. S3(a) and Fig. S3(b) present the velocity condition at high tidal water, when $t_e = 0$ h. River water coming from the upper Meghna river mixes with saline water on entry to the estuary. During low water, the river flow is sufficiently strong to push the sea water southwards towards the Bay of Bengal, and the flow velocity intensifies in both the Meghna river and Tetulia channel (Fig. S3(c-f)). In Fig. S3(g), high water conditions have again returned, with the flow speed decreasing throughout the whole Tetulia channel, including Location 3. Seawater has entered the Meghna estuary, but has yet to reach the mouth of the Tetulia channel.

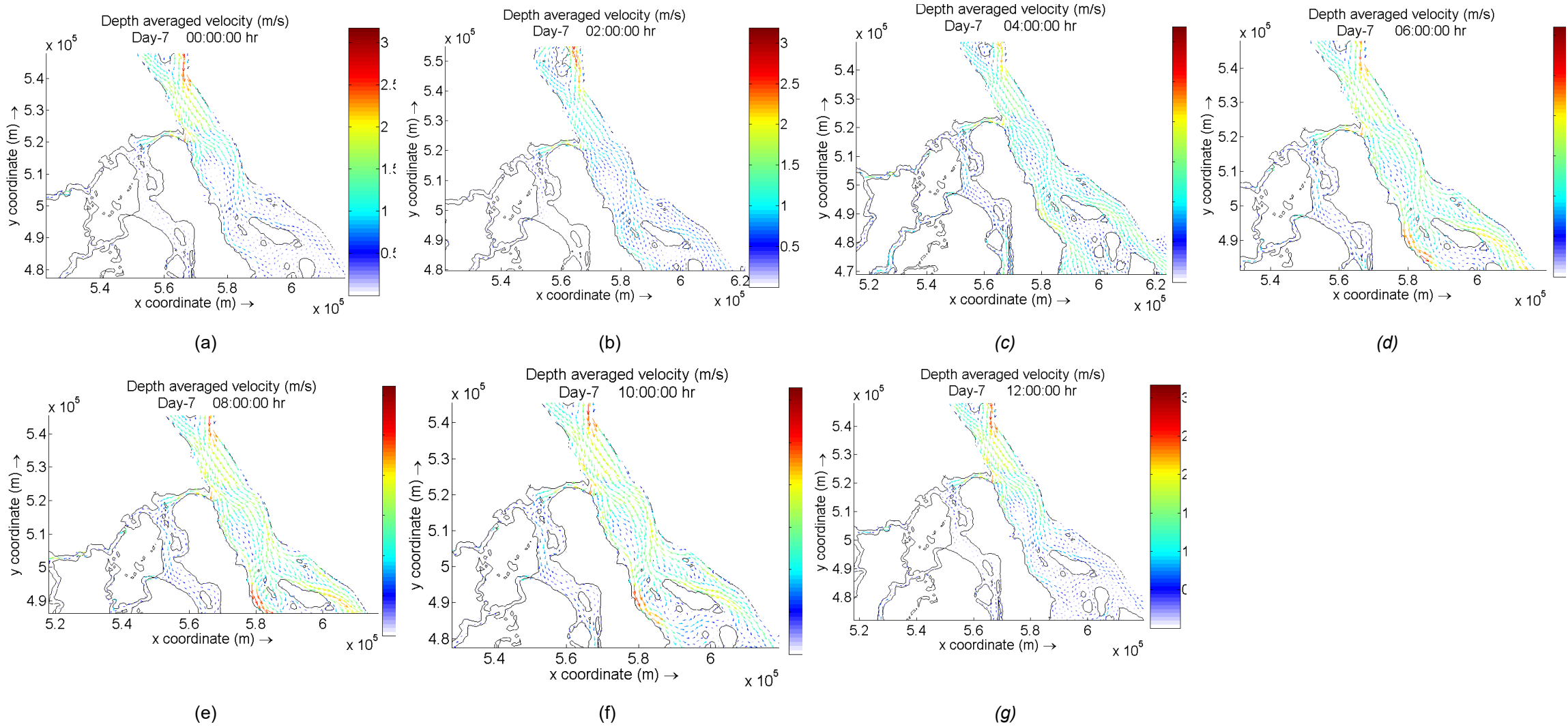


Fig. S3. Depth-averaged velocity fields at two hourly intervals in the vicinity of Location 3, north of Bhola Kheyaghat in Tetulia channel, Meghna estuary.

