GPS in Bangladesh: Delta Subsidence, Monsoonal Loading and Continental Collision

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Bangladesh lies across the margin of the Indian craton near the junction of two plate-convergence boundaries: the Himalaya and the Burma arcs (Figure 1). These arcs are convex toward the Indian plate and override it from the north and from the east, respectively. The sediments carried from the two mountain belts have built the Ganges-Brahmaputra Delta (GBD), prograding the Indian continental margin over 300 km since the Eocene (35 Ma). The GBD is estimated to contain a thickness of 20 or more km of sediments overlying oceanic crust. Ahead of the Himalayan front, a sliver of Indian basement, the Shillong Plateau, is overthrust onto the GBD. This overthrust causes the rapid subsidence of the Sylhet basin in the NE of Bangladesh. On the eastern side of Bangladesh, the Burma Arc is actively subducting the GBD sediments forming a huge accretionary prism and foldbelt. In addition, 1/3 to 2/3 of Bangladesh is flooded every summer by the huge discharge of the Ganges and Brahmaputra River, intense local rainfall, and cyclones. In 2003, we installed six continuous GPS receivers across Bangladesh. In 2007, this array will be augmented by another 12 stations. The GPS data reveal dextral shear in the eastern part of the country affected by the oblique collision with the Burma Arc. Rapid subsidence in the delta reaches 15 mm/y in the Sylhet basin where flexural loading augments the subsidence. In addition, we see a cyclic vertical signal of 2 to 5 cm due to elastic loading by the water impounded in the country. The water loading correlates well with river discharge (Figure 2).

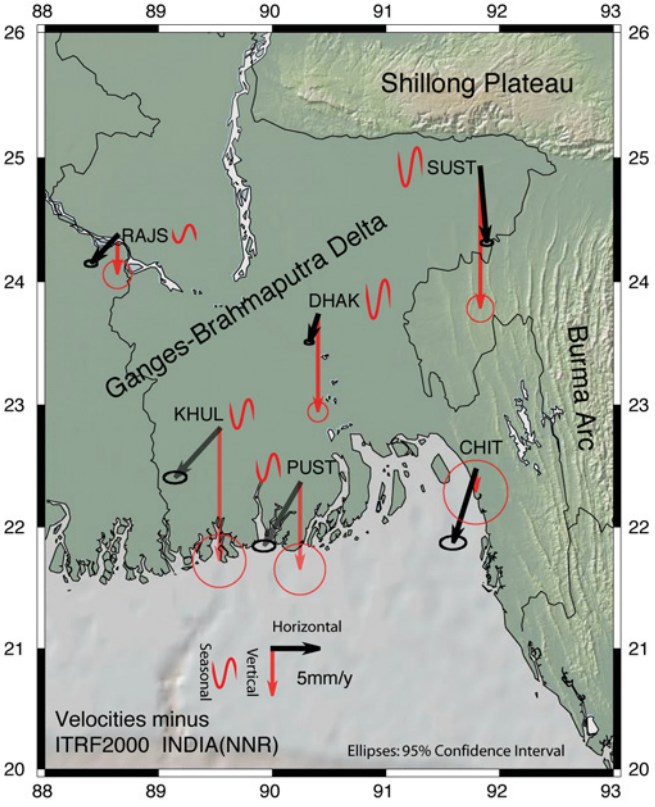
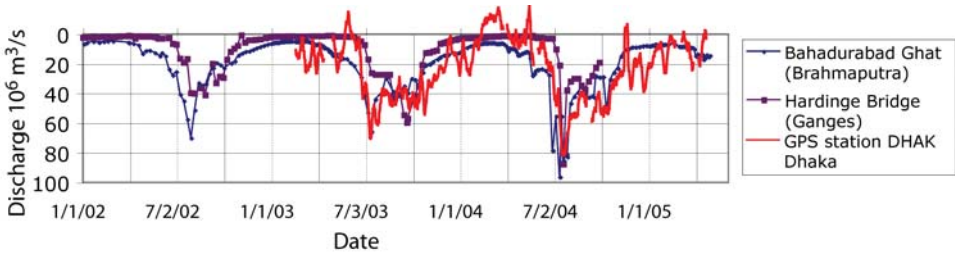


Figure 1. Relief map of Bangladesh showing GPS results. Lighter shading on KHUL and PUST indicate that they have < 3 y of processed data and are less reliable. Black arrows represent the horizontal, which shows 3 to 6 mm/y of dextral shear. Red arrows indicate vertical subsidence, which increases from the thin sediments at RAJS to the thick basin at DHAK and rapidly subsiding SUST. The curved red lines show the amplitude of the seasonal signal at the same scale.

Figure 2. Inverted discharge of Ganges and Brahmaputra Rivers compared to detrended weekly vertical position at Dhaka (r2 = 0.7). Tails on GPS persists longer because water takes time to drain after discharge decreases.



References

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