APPENDIX 1

In scientific literature, Juba and Dala are explained as spring tides (when the earth, the moon, and sun are in alignment). During a new moon, the gravitational forces of the moon and the sun pull along the same direction resulting in high water level (i.e. Juba). During a full moon, the gravitational forces of the sun and the moon exert forces in opposite direction resulting in low level of water (i.e. Dala) (Gönnert and Sossidi, 2011; Park and Suh, 2012). When a high tide coincides with Juba it produces a very high level of tide (i.e. higher than average) and conversely, when low tide coincides with Dala it produces a very low level of tide (i.e. lower than average). During Cyclone Sidr, it was low tide with low spring tide (lower left Quatrain in Fig. S.1).

![Diagram of tide levels]

**Fig. S.1**: Connection between spring tides with high and low tides

**References**
