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The role of meteorological forcing to Evros delta, NE Greece, flood events

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The present contribution aims to investigate the role of meteorology and hydrology and the subsequent meteorological tide to the inundation of the lower Evros delta (188 km^2). Evros delta is characterised by a rather smooth relief with the half of it being cultivated and hosting a number of lagoons and water bodies. Evros river exhibits high inter-annual flow fluctuation supporting the development of frequent flood events [1], during which water discharge can exceed 2,500 m^3/s [2].

For the present analysis, we investigate: (i) the interannual wind speed and wind direction changes for the period 1979-2018, based on the ECMWF ERA-Interim reanalysis dataset [3] on a 0.125˚x0.125˚ grid for the broader delta area; (ii) the correlation between wind direction and sea level set up (meteorological tide) (HNHS data, [4]) for the examined flood event periods; and (iii) the relationship between meteorological tide and spatial occurrence of flood events in the lower part of Evros delta based on satellite imagery from Landsat 5 and Landsat 8.

The long-term wind analysis indicates that there is a statistically significant increase in the southerly winds frequencies for the cold period (November to March). In addition, the relationship between tide heights and wind force reveals that tide is significantly higher for S and SW wind directions, while it maximizes for southerly winds. Additionally, the linear-circular correlation between wind direction and tide height on 3-hourly lag basis becomes important for wind directions for up to 3 days before the tide measurement and maximizes for zero lag, indicating that previous meteorological conditions can trigger the piling up of the water.

These findings are in agreement to the occurrence of extended flood events in the lower part of the Evros deltaic plain. On the contrary, it is found that during winds of other (not southerly) directions, either flood events was not observed or they were not restricted to the lower part of deltaic plain but covered a much wider area along river route.

[1] Tzortziou, M. et al., 2015: Limnology and Oceanography, 60(4),1222–1240 [2] Angelidis, P., Kotsikas, M., Kotsovinos, N., 2010: Water Resour. Manag. 24, 2467–2484. [3] Dee D.P. et al., 2011: Quart. J. Roy. Meteorol. Soc, 137, 553–597. [4] HNHS, 2005: Tidal data from Greek Ports. Hydrographic Service, Hellenic Army Navy, Athens, 94 p.