Geophysical Research Abstracts
Vol. 19, EGU2017-254, 2017
EGU General Assembly 2017

Storm surge and tidal range energy

Matthew Lewis (1), Athanasios Angeloudis (2), Peter Robins (1), Paul Evans (2), and Simon Neill (1)

(1) Center of Applied Marine Sciences, School of Ocean Sciences, Bangor University, UK (m.j.lewis@bangor.ac.uk), (2) School of Engineering, Cardiff University

The need to reduce carbon-based energy sources whilst increasing renewable energy forms has led to concerns of intermittency within a national electricity supply strategy. The regular rise and fall of the tide makes prediction almost entirely deterministic compared to other stochastic renewable energy forms; therefore, tidal range energy is often stated as a predictable and firm renewable energy source. Storm surge is the term used for the non-astronomical forcing of tidal elevation, and is synonymous with coastal flooding because positive storm surges can elevate water-levels above the height of coastal flood defences. We hypothesis storm surges will affect the reliability of the tidal range energy resource; with negative surge events reducing the tidal range, and conversely, positive surge events increasing the available resource. Moreover, tide-surge interaction, which results in positive storm surges more likely to occur on a flooding tide, will reduce the annual tidal range energy resource estimate. Water-level data (2000-2012) at nine UK tide gauges, where the mean tidal amplitude is above 2.5m and thus suitable for tidal-range energy development (e.g. Bristol Channel), were used to predict tidal range power with a 0D modelling approach. Storm surge affected the annual resource estimate by between -5% to +3%, due to inter-annual variability. Instantaneous power output were significantly affected (Normalised Root Mean Squared Error: 3%-8%, Scatter Index: 15%-41%) with spatial variability and variability due to operational strategy. We therefore find a storm surge affects the theoretical reliability of tidal range power, such that a prediction system may be required for any future electricity generation scenario that includes large amounts of tidal-range energy; however, annual resource estimation from astronomical tides alone appears sufficient for resource estimation. Future work should investigate water-level uncertainties on the reliability and predictability of tidal range energy with 2D hydrodynamic models.