

APPENDIX A Supplementary Data

Machine Learning Architecture

Normalization of Data: It is a well-established fact that the learning efficiency depends on the range of values of different parameters. It is seen that if the range of values for different parameters are approximately same, then the efficiency of the ML will be maximum. Thus, we transform each quantity to dimensionless variables ranging around [-1.5, 1.5] by

$$\bar{M}_w = (M_w - 5.5) / 2 \quad \text{-----}(A1)$$

$$\bar{R} = \log_{10} (R(\text{in m}) - 4.23) \quad \text{-----}(A2)$$

$$\bar{D} = (D(\text{in km}) - 18) / 10 \quad \text{-----}(A3)$$

$$\bar{V}_{s30} = 6.3 \log_{10} (V_{s30} (\text{in m/s})) - 16.8 \quad \text{-----}(A4)$$

$$\bar{y} = \log_{10} (y (\text{m/s}^2)) \quad \text{-----}(A5)$$

These dimensionless variables are used as inputs and outputs of XGBoost ML algorithm, and the dimensionless quantities are recovered by inverse transformations.