Delta Flow-Salinity Modeling using Artificial Neural Networks: Overview

Workshop on Delta Flow-Salinity Modeling Using Machine Learning
January 27, 2023
Module #1

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DWR Delta Modeling Section

CALIFORNIA DEPARTMENT OF WATER RESOURCES

UCDAVIS UNIVERSITY OF CALIFORNIA

A historical perspective

Current Study

2021
Authors: Qi et al., DWR and UCD
Goal: CalSim 3.0 - DSM2 Emulator
Software: TensorFlow
Architecture: Major enhancement to the 1995 one: Multi-Task Learning (MTL)

2020
Authors: Jayasundara et al., DWR
Goal: CalSim 3.0 - DSM2 Emulator
Software: Matlab
Architecture: Same as the 1995 one

2018
Authors: Chen et al., Tetra Tech
Goal: DSM2 Emulator
Software: Matlab
Architecture: Similar to the 1995 one but with one hidden layer

2007
Authors: Seneviratne and Wu, DWR
Goal: CalSim II – DSM2 Emulator
Software: Matlab
Architecture: Same as the 1995 one

2001,2002
Authors: Wilbur and Munevar (2001); Mierzwa (2002); DWR
Goal: CalSim II – G Model Emulator
Software: Python/Vplotter
Architecture: Same as the 1995 one

1995
Authors: Sandhu and Finch, DWR
Goal: DWRSIM MDO Emulator
Software: Stuttgart Neural Network Simulator
Architecture: Artificial Neural Network (ANN)

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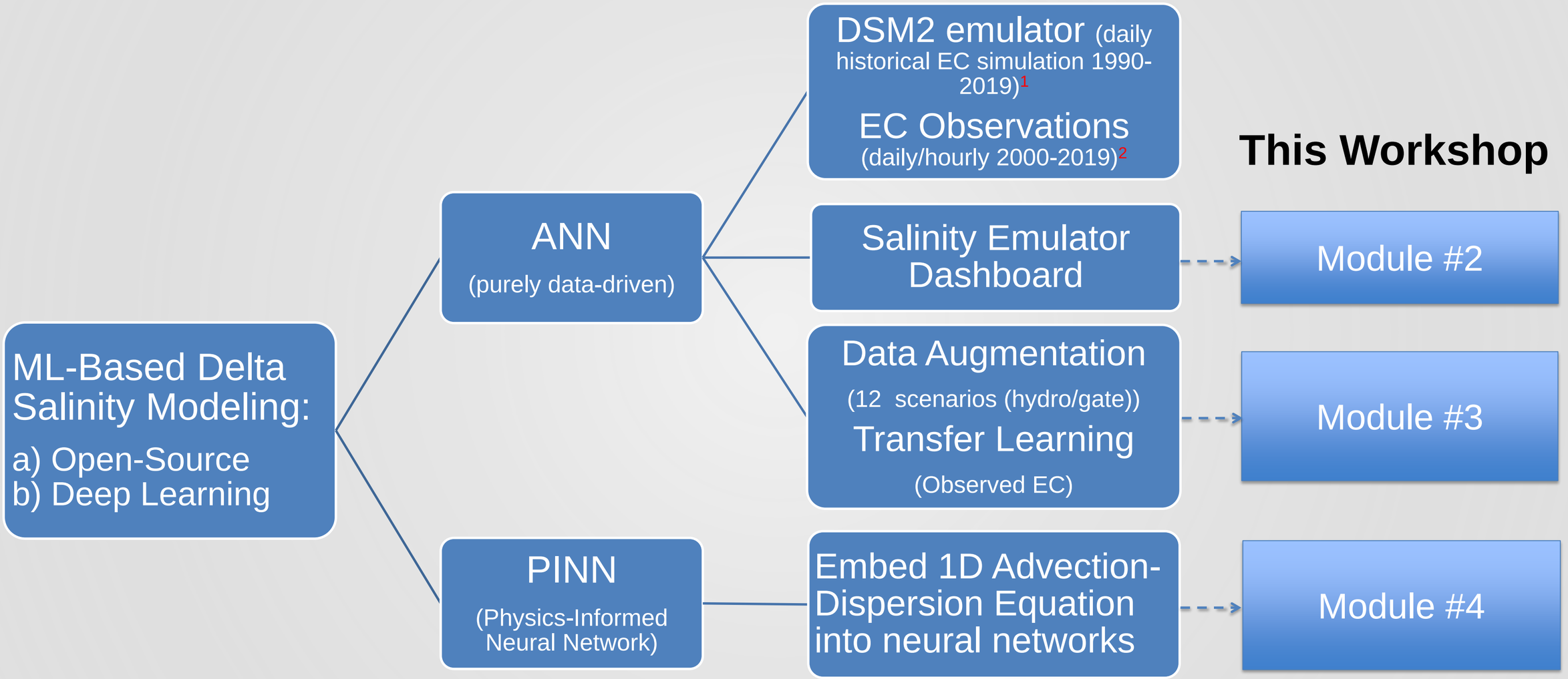
Current Study/Workshop



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[1] Multi-Location Emulation of a Process-Based Salinity Model Using Machine Learning. *Water* 2022, 14, 2030. https://doi.org/10.3390/w14132030

[2] Novel Salinity Modeling Using Deep Learning for the Sacramento–San Joaquin Delta of California. *Water* 2022, 14, 3628. https://doi.org/10.3390/w14223628

References

1. Sandhu, N.; Finch, R. Application of artificial neural networks to the Sacramento-San Joaquin Delta. In *Estuarine and Coastal Modeling*; ASCE: Reston, FL, USA, 1995; pp. 490–504..
2. Wilbur, R.; Munevar, A. Integration of CALSIM and Artificial Neural Networks Models for Sacramento-San Joaquin Delta Flow-Salinity Relationships. In *Methodology for Flow and Salinity Estimates in the Sacramento-San Joaquin Delta and Suisun Marsh: 22nd Annual Progress Report*; CDWR: Sacramento, CA, USA, 2001.
3. Mierzwa, M. CALSIM versus DSM2 ANN and G-model Comparisons. In *Methodology for Flow and Salinity Estimates in the Sacramento-San Joaquin Delta and Suisun Marsh: 23rd Annual Progress Report*; CDWR: Sacramento, CA, USA, 2002.
4. Seneviratne, S.; Wu, S. Enhanced Development of Flow-Salinity Relationships in the Delta Using Artificial Neural Networks: Incorporating Tidal Influence. In *Methodology for Flow and Salinity Estimates in the Sacramento-San Joaquin Delta and Suisun Marsh: 28th Annual Progress Report*; CDWR: Sacramento, CA, USA, 2007
5. Chen, L.; Roy, S.B.; Hutton, P.H. Emulation of a process-based estuarine hydrodynamic model. *Hydrol. Sci. J.* **2018**, *63*, 783–802.
6. Jayasundara, N.C.; Seneviratne, S.A.; Reyes, E.; Chung, F.I. Artificial neural network for Sacramento–San Joaquin Delta flow–salinity relationship for CalSim 3.0. *J. Water Resour. Plan. Manag.* **2020**, *146*, 04020015.
7. Qi, S.; Bai, Z.; Ding, Z.; Jayasundara, N.; He, M.; Sandhu, P.; Seneviratne, S.; Kadir, T. Enhanced Artificial Neural Networks for Salinity Estimation and Forecasting in the Sacramento-San Joaquin Delta of California. *J. Water Resour. Plan. Manag.* **2021**, *147*, 04021069.

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