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ENSO detection and use to inform the operation of large scale water systems

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El Nino Southern Oscillation (ENSO) is a large-scale, coupled ocean-atmosphere phenomenon occurring in the tropical Pacific Ocean, and is considered one of the most significant factors causing hydro-climatic anomalies throughout the world. Water systems operations could benefit from a better understanding of this global phenomenon, which has the potential for enhancing the accuracy and lead-time of long-range streamflow predictions. In turn, these are key to design interannual water transfers in large scale water systems to contrast increasingly frequent extremes induced by changing climate. Despite the ENSO teleconnection is well defined in some locations such as Western USA and Australia, there is no consensus on how it can be detected and used in other river basins, particularly in Europe, Africa, and Asia. In this work, we contribute a general framework relying on Input Variable Selection techniques for detecting ENSO teleconnection and using this information for improving water reservoir operations. Core of our procedure is the Iterative Input variable Selection (IIS) algorithm, which is employed to find the most relevant determinants of streamflow variability for deriving predictive models based on the selected inputs as well as to find the most valuable information for conditioning operating decisions. Our framework is applied to the multipurpose operations of the Hoa Binh reservoir in the Red River basin (Vietnam), taking into account hydropower production, water supply for irrigation, and flood mitigation during the monsoon season. Numerical results show that our framework is able to quantify the relationship between the ENSO fluctuations and the Red River basin hydrology. Moreover, we demonstrate that such ENSO teleconnection represents valuable information for improving the operations of Hoa Binh reservoir.