The short-term prediction of LOD introducing atmospheric angular momentum by 1D-Convolutional Neural Networks (1D-CNN)

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Abstract
Knowledge of the Earth orientation parameters (EOP) is essential for numerous practical and scientific applications including, positioning and navigating in space and on Earth. The LOD (length of day), which represents the variation in the Earth's rotation rate, is the most difficult to forecast since it is primarily affected by the torques associated with changes in atmospheric circulation. Therefore, accurate LOD predictions are an ongoing challenge and are the focus of this work. Consequently, there is a compelling need to identify next-generation time series prediction algorithms to be integrated into an operational processing chain. Of specific interest is the emergence of deep learning methods. These methods tend to behave as highly adaptive and versatile fitting algorithms and can thus replace conventional fitting functions for enabling more accurate predictions.

In this study, the 1D-Convolutional Neural Networks (1D-CNN) is introduced to model and to predict the LOD using the IERS EOP 14 C04 and the axial Z component of the atmospheric angular momentum (AAM) taken from the German Research Centre for Geosciences (GFZ), since it is strongly correlated with the LOD changes. The prediction procedure operates as follows: First, we detrend the LOD and Z-component series by using the LS method, then, we obtain the residuals series of each one to be used in the 1D-CNN prediction algorithm. Finally, we analyzed the results before and after introducing the AAM function. These results prove the potential of the proposed method as an optimal algorithm to successfully reconstruct and predict LOD for up to 7 days.

Keywords
1D-Convolutional Neural Networks (1D-CNN); Length of the day; atmospheric angular momentum(AAM) function; prediction