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Seasonal prediction of Indian Summer Monsoon onset with machine learning

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The prediction of the onset date of the Indian Summer Monsoon (ISM) is crucial for effective agricultural planning and water resource management on the Indian subcontinent, with more than one billion inhabitants. Existing approaches focus on extended-range to subseasonal forecasts, i.e., provide skillful predictions of the ISM onset date at horizons of 10 to 60 days. Here we propose a method for ISM onset prediction and show that it has high forecast skill at longer, seasonal time scales. The method is based on recurrent neural networks and allows for ensemble forecasts to quantify uncertainties. Our approach outperforms state-of-the-art numerical weather prediction models at comparable or longer lead times. To our knowledge, there is no statistical forecasting approach at comparable, seasonal time scales. Our results suggest that predictability of the ISM onset emerges earlier than previously assumed.