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## The Polar Precursor Method for Solar Cycle Prediction: Comparison of Predictors and Their Temporal Range

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The polar precursor method is widely considered to be the most robust physically motivated method to predict the strengths of an upcoming solar cycle. It uses in form of indicators, the magnetic field concentrated near the poles around sunspot minimum. Here, we present an extensive performance analysis of various such predictors, based on observational data like (WSO magnetograms, MWO polar faculae counts and Pulkovo A(t) index) and outputs (global dipole moment) of various existing flux transport dynamo models. We have calculated Pearson correlation coefficients ( $r$ ) of the predictors with the next cycle amplitude as a function of time measured from solar cycle maximum and polar field reversal. Setting  $r = 0.8$  as a lower limit for acceptable predictions, we find that observations and models alike indicate that the earliest time when the polar predictor can be safely used is 4 years after polar field reversal. This is typically 2 to 3 years before the solar minimum and about 7 years before the predicted maximum. Re-evaluating the predictors another 3 years later, at the time of solar minimum, further increases the correlation level to  $r > 0.9$ . As an illustration of the result, we determine the predicted amplitude of Cycle 25 based on the value of the WSO polar field at the official minimum date of December 2019 as  $126 \pm 3$ . A forecast based on the value in early 2017, 4 years after polar reversal would have only differed from this final prediction by  $\sim 3.1\%$ .

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**Primary authors:** Mr KUMAR, Pawan (Department of Physics, Indian Institute of Technology (Banaras Hindu University), Varanasi, India); Ms NAGY, Melinda (Eötvös Loránd University, Department of Astronomy, Budapest, Hungary); Mr LEMERLE, Alexandre (Collège de Bois-de-Boulogne, Montréal, QC, Canada); Mr KARAK, Bidya Binay (Department of Physics, Indian Institute of Technology (Banaras Hindu University), Varanasi, India); Mr PETROVAY, Kristof (Eötvös Loránd University, Department of Astronomy, Budapest, Hungary)

**Presenter:** Mr KUMAR, Pawan (Department of Physics, Indian Institute of Technology (Banaras Hindu University), Varanasi, India)

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