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Oral Presentation:

Data Assimilation and Uncertainties in Early Solar Cycle Predictions

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Stochastic nature of solar activity variations together with our limited knowledge of the dynamo mechanism and subsurface dynamics causes uncertainty in predictions of the solar cycle. For improving the physics-based predictions we can take advantage of the mathematical data assimilation approach that allows us to take into account both, observational errors and model uncertainties, and provide estimates of the next solar cycle along with prediction uncertainties. In this study we use the Parker's migratory dynamo model together with the equation of magnetic helicity balance, which reproduces main properties of the sunspot cycles and allow us to minimize discrepancies between the observed global activity variations and the model solution. The test simulation runs show that a reliable prediction can be obtained for two phases of preceding solar cycle: 1) if the polar field reversals shortly after the solar maxima (strong toroidal field and weak poloidal field), and 2) during the solar minima (strongest poloidal and weak toroidal fields). The early estimate of Cycle 25 obtained by this method shows that this cycle will start in 2019 – 2020, reach the maximum in 2023 – 2024, and that the mean sunspot number at the maximum will be about 90 (for the v2.0 sunspot number series).