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Analysis of the solar activity dynamics by the method of nonlinear singular forecasting

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The main goal of solar-terrestrial physics is the study of the Sun-Earth coupling and processes controlled by the latter. Forecasting of solar activity maximums (in particular all cycles up to the 19-th inclusive and 21-st cycle) cause certain difficulties in spite of ability to forecast successfully the positions of separate parts of each cycle (ascending and descending parts and maximums) in frames of a linear approach. Present work performs an attempt to give a forecast of cycle maximum magnitudes by a method, which is a nonlinear extension of the singular prognosis algorithm (an idea of original singular prognosis algorithm was proposed by Loskutov, Istomin at al. in 2001 – 2006). The main problem of nonlinear approaches is a necessity to optimize a metric of difference between etalon lag sequence [Varadi, F., Pap, J., Ulrich, R. at al., 1999] and lags from a teaching database. In case of poor database and necessity to apply significantly long lag sequences to the time series forecasting such metric defined (accordingly traditional nonlinear dynamics) on extremely multidimensional space of lag sequence coordinates, leads to prognostic algorithm instability [Shuster&Just, 2005]. In this work essentially different approach has been applied: the metric is introduced on the space of parameters characterizing the position of a lag sequence in the solar activity cycle instead of its definition in the space of these lag sequences. The initial database consists of daily Wolf numbers for the time interval 1860 – 2010. It is shown that our approach can improve the forecast quality and reveal solar cycle forming mode leading to appearance of change points in Wn-index time series.