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Statistical and correlation properties of the secular variation forecast

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In this work, statistical and correlation properties of SV, the SV forecast and the SV forecast error were compared. Spatial structure of SV components was calculated from the IGRF11 coefficients. Forecast was reconstructed from IGRF3-10 coefficients. We excluded periods 1965-1975 because IGRF coefficients between these years were subsequently revised and heavily modified. Statistical and correlation characteristics were calculated both for globe and for five separate areas. Three of these areas were selected at the high latitudes, two others include near-equatorial region. Furthermore one of them includes so-called Brazilian Geomagnetic Anomaly region.

Our calculations have shown that the mean value of the SV forecast error for Brazilian anomaly is several times less than the mean value of SV. For the rest areas these average values are comparable or higher then mean value of SV. A similar result was obtained for the SV forecast dispersions. It should be noted, that although the SV forecast error dispersion much less than SV dispersion for Brazilian anomaly region, it doesn't differ by an order of magnitude from the values obtained for other areas. The extremum values of the SV forecast error exceed the SV v dispersion for all areas without an exception.For the magnetic declination (D) the minimum average value as well as the minimum dispersion value of the SV forecast error were obtained for the area, includes the South Magnetic Pole and the adjoined near-equatorial region. Maximum values of the SV forecast error were obtained for the northern high latitudes.

The correlation coefficient for the spatial distribution of SV and the SV forecast has calculated for the different years pairs . Firstly, the correlation coefficient of SVi and SVi-1 for two consequent periods was calculated; next - the correlation coefficient of SVi and the SVi forecast for the same period; and finally - the correlation coefficient of the SVi forecast and SVi-1 for the previous period. As a result the maximum correlation coefficient obtained for the last variant.

The SV forecast and SV for the same period correlate well only when high correlation between SVi and SVi-1 is observed. The existence of large and long-term anomaly provides high correlation of sequential periods, and correlation coefficient between the SV forecast and SV for the same period is greater than 0.9. Minimal correlation was obtained for northern Eurasia and the near-equatorial region of the eastern hemisphere. It is caused by the presence of small changeable anomalies. The spatial structure of the SV forecast error in Brazilian anomaly region indicates its composite character. Several added anomalies are changing independently.

The obtained results show that the contemporary methods of SV forecast do not provide high accuracy. The accuracy of the SV forecast can be improved by identify the reasons for changes of single anomalies of the different scales. This parameter determines the secular variation.