BINCASTS: BGS Index Nowcasts and Forecasts

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We describe high quality real time ("nowcast") geomagnetic indices that are produced by BGS, using geomagnetic data provided by observatories and institutes contributing to official IAGA indices. The data are currently available on the BGS web site. However both nowcast and forecast data will soon be available through SWENET for academic purposes. Near real time geomagnetic index data estimates are given for Ap, ap, Aa and aa. Short-term (1-27 day) forecasts of Ap, DRX (the daily range in the north component of the field in the UK), and solar $F_{10.7}$ are made. Long-term (1-60 smoothed monthly) forecasts of $F_{10.7}$, sunspot number, Ap and Aa are also provided. These data will be supported and developed by BGS in response to user needs.

Background
Near real time estimates and forecasts of geomagnetic indices are used in a wide variety of space weather applications, for example, to estimate atmospheric drag on satellites and geomagnetically induced currents in power grids. This SDA is therefore designed to make available existing BGS forecasts and nowcasts of geomagnetic and solar indices for academic and other communities, and to make use of BGS real time capabilities to provide data of the highest accuracy.

User Requirements
No specific prior survey of the user community was done. However given that there are similar data providers around the world, this suggests that a definite need exists in the space science community. The BGS data were requested by ESA, to integrate with SWENET.

History
In the early 1990s ESA/ESOC commissioned 1-27 day forecasts of Ap and $F_{10.7}$. These data are used in MSIS density models to determine drag on low-altitude satellites. Autoregressive and neural network models were designed and implemented. ESOC also commissioned a solar cycle forecast model for smoothed monthly Sunspot number, $F_{10.7}$, Ap and Aa. A modified ‘McNish-Lincoln’ model of activity was adopted for this purpose, similar to models in use in the US.

Nowcasts
Daily Aa$_{est}$, 3-hourly Aa$_{est}$, daily Ap$_{est}$, 3-hourly Ap$_{est}$. Data are updated every hour, using all available observatories at that time. ‘EST’ is used to indicate that these are proxy indices for IAGA endorsed indices.

Forecasts
Daily solar radio flux $F_{10.7}$, geomagnetic Ap$_{est}$ and DRX indices (the daily average of the hourly range in the north component of the field in the UK), all for 1-27 days ahead. Solar cycle forecasts of monthly $F_{10.7}$, Ap$_{est}$, Aa$_{est}$ and Sunspot number.

The Future?
The user community is welcome to suggest new ideas. We will continue to improve our proxy indices to make them as close as possible to the official IAGA versions. We would welcome collaboration with other ‘index institutes’ for the benefit of the space weather community.

BGS is committed to near real time operations, e.g.
- we are a World Data Centre for geomagnetism
- we have good relationships with and data access to observatories contributing to IAGA indices
- we are actively involved in INTERMAGNET and its development of near real time data communications.

Our forecast and nowcast data will be maintained for the foreseeable future. We would encourage advertising of these data and any feedback.

Acknowledgments
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Data from BINCASTS
BGS index data are produced in these formats and some can be found on our website: www.geomag.bgs.ac.uk. The layout of these plots may therefore change, depending on the implementation adopted for SWENET.

Nowcast Data

Forecast Data

Left: Seven days of estimated Ap (both midnight-ninthday and noon-noon), based on as many Ap observations as available nearby data. Right: Web page display (via address above) for Aa$_{est}$ using definitive or estimated (‘Est’). $K$ indices from Hartland and Canberra. Example from 11:30UT, 9th November.

Below Left: A recent solar cycle forecast (blue/green line) and last 3 cycles (black) of 13-month smoothed monthly solar and geomagnetic data. Red denotes last 6 months unsmoothed data. Below: 1-27 day predictions (yellow zone) and last 6 actual months (blue zone) of data. One and three sigma forecast uncertainties are given.