BINCASTS: BGS Index Nowcasts and Forecasts

SWENET | **British Geological Survey** — NATURAL ENVIRONMENT RESEARCH COUNCIL

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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.

User requests to BGS
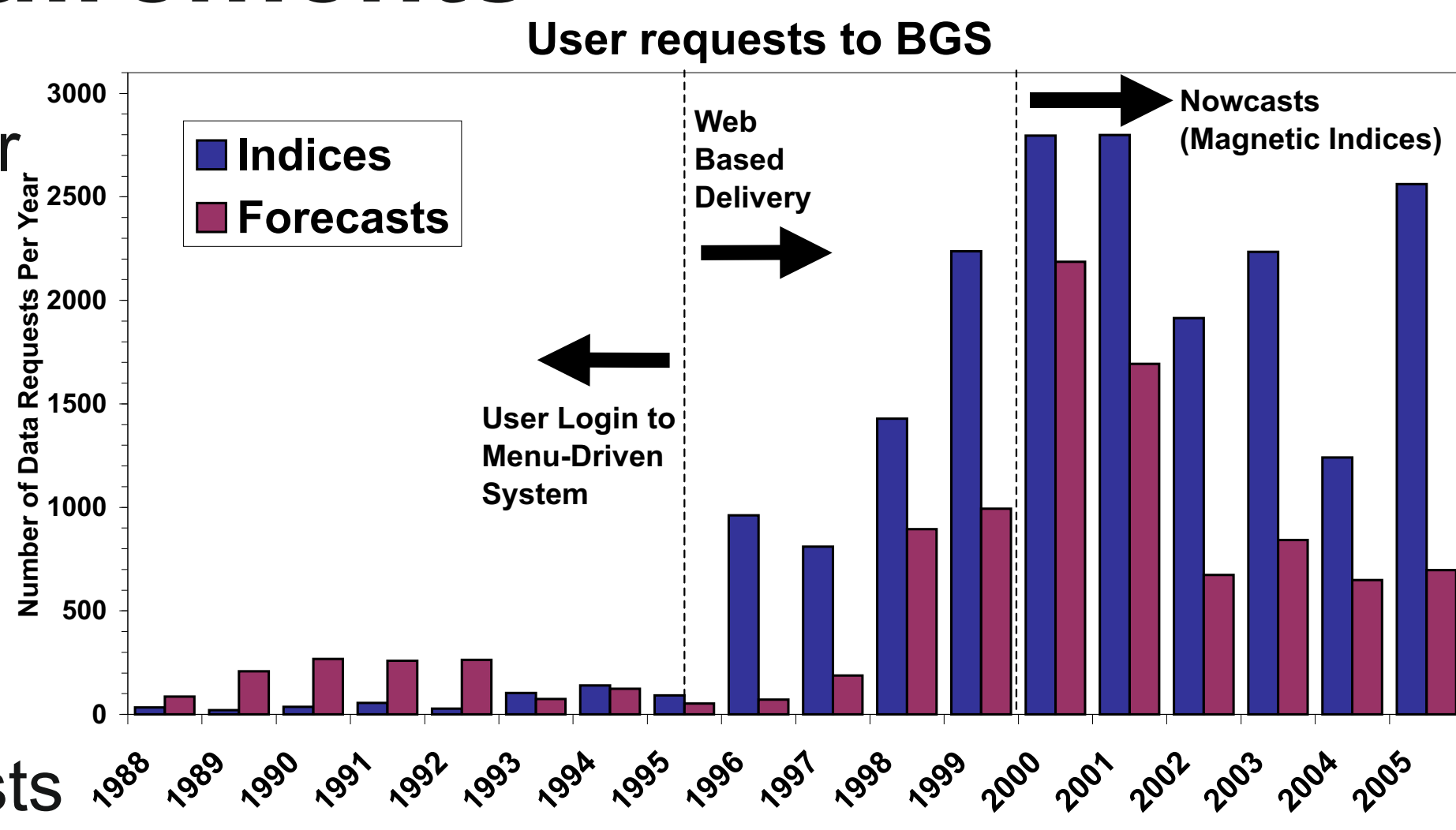
History

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.
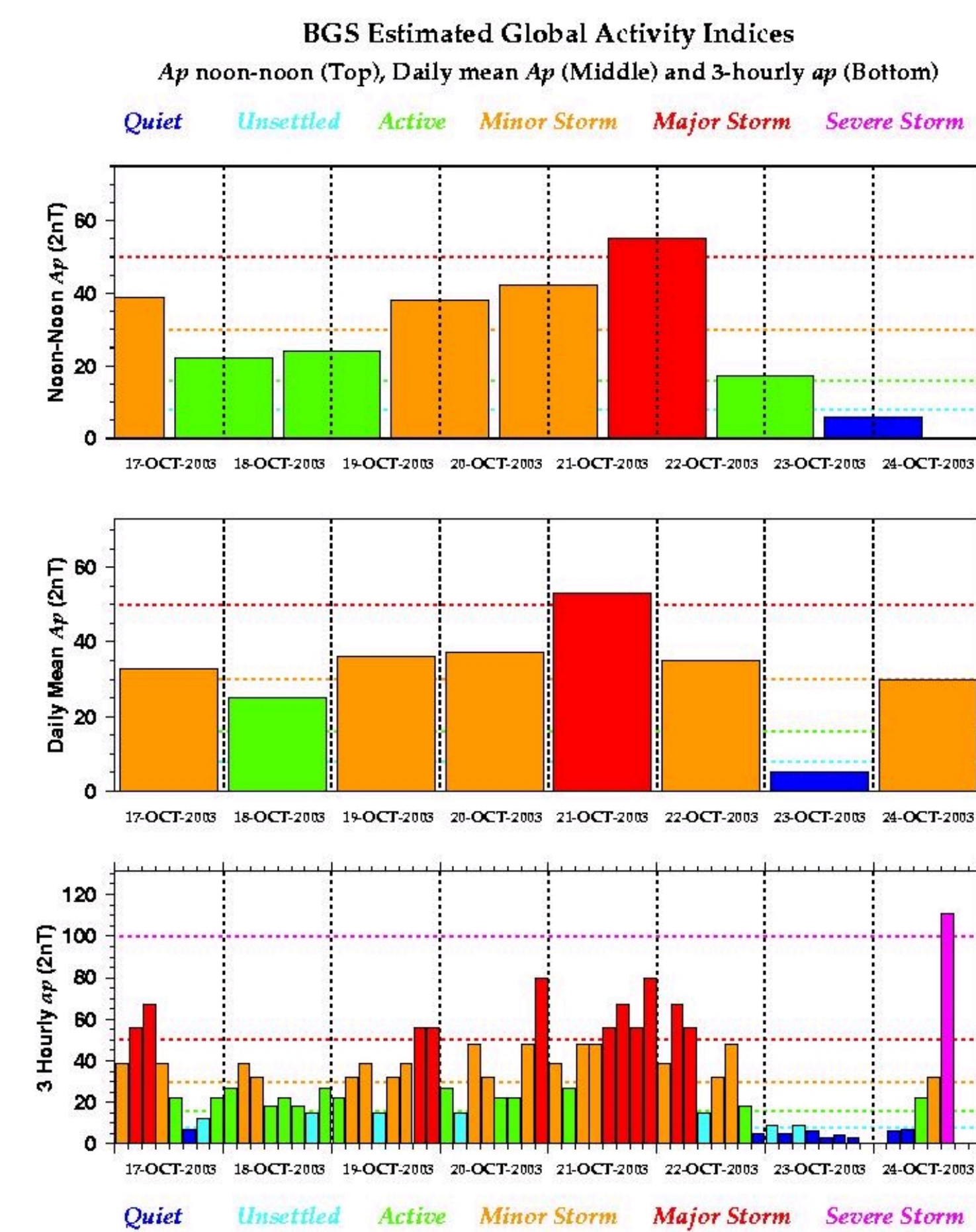
Acknowledgments

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.
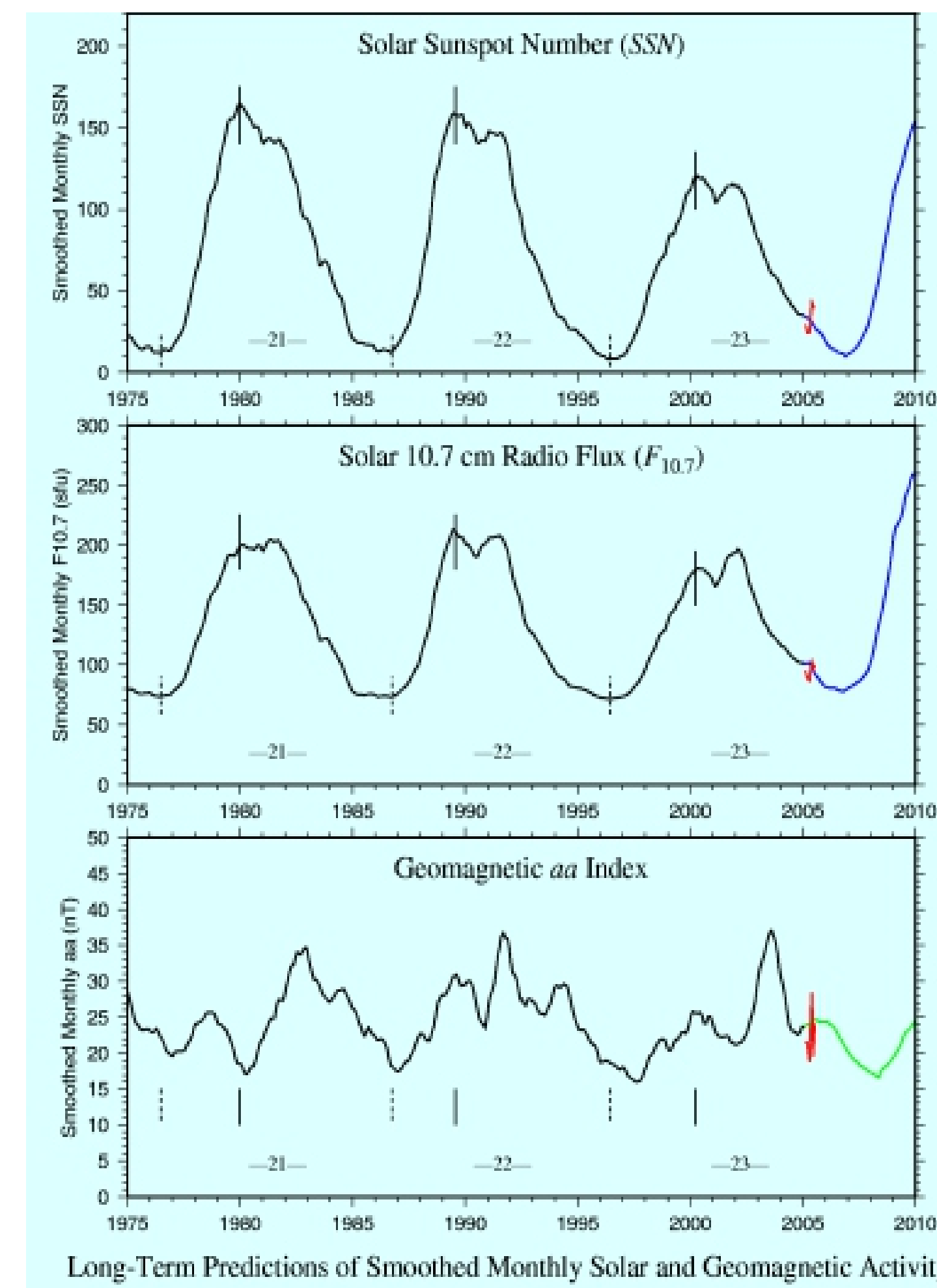
Nowcast Data

Left: Seven days of estimated Ap (both midnight-nidnight and noon-noon), based on as many Ap observatories as are available in near real time on each hourly update.
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.
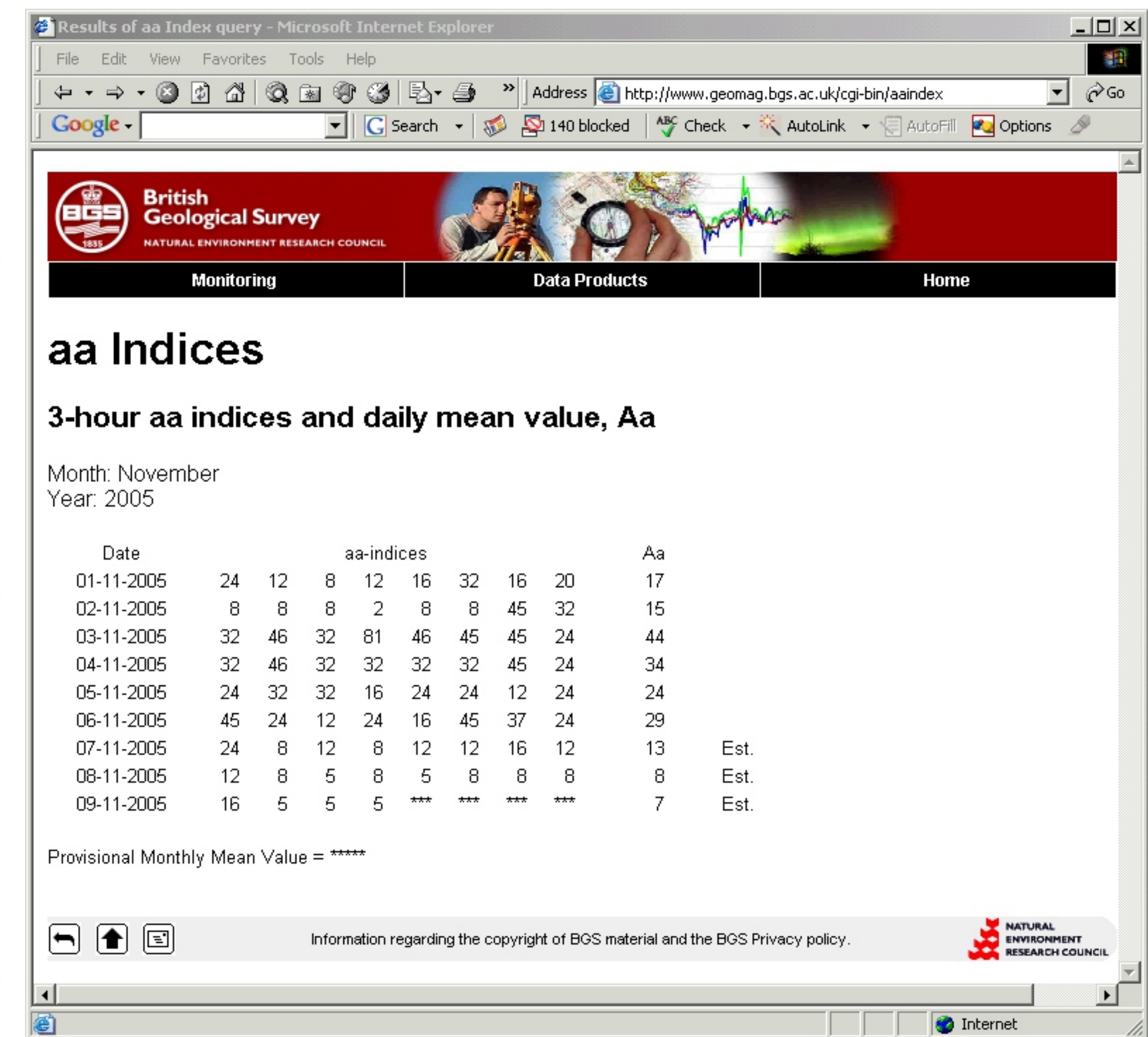
Forecast Data

Long-Term Predictions of Smoothed Monthly Solar and Geomagnetic Activity

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.
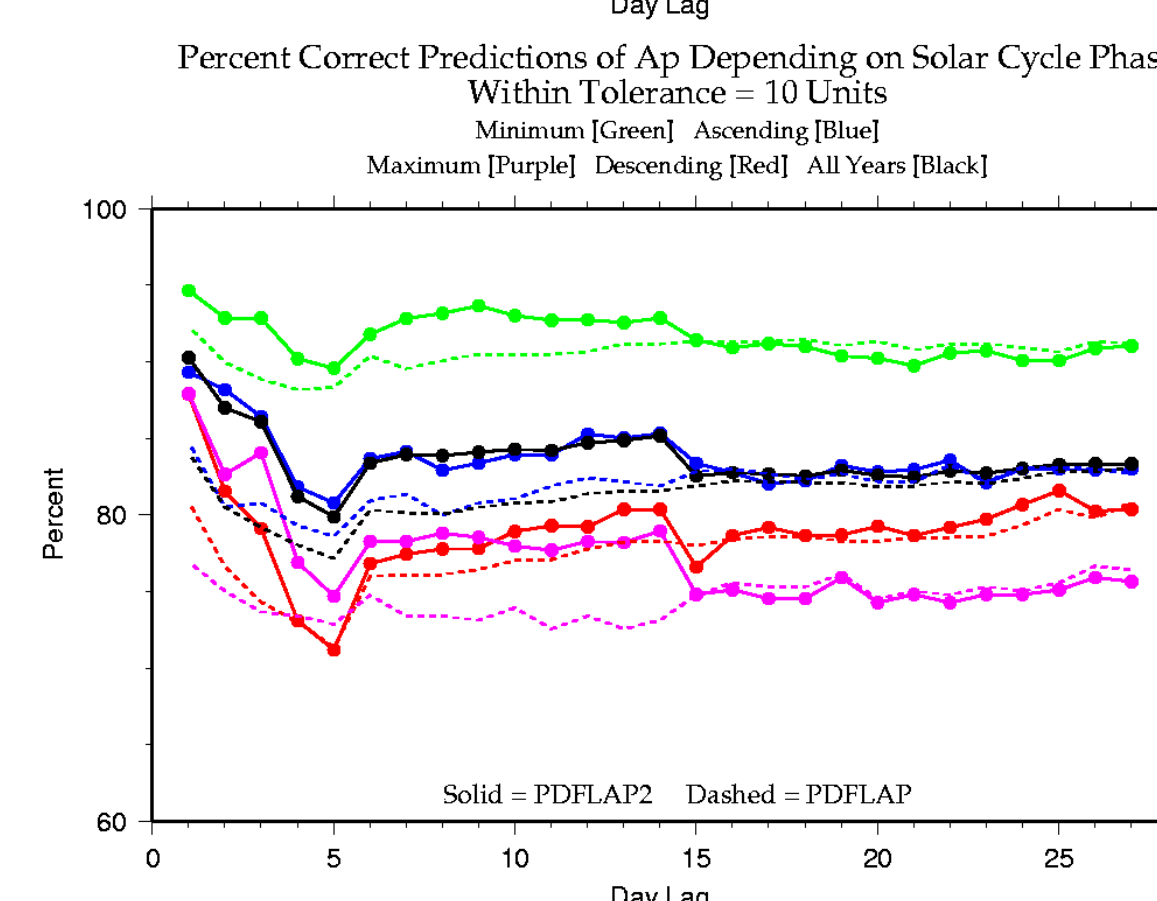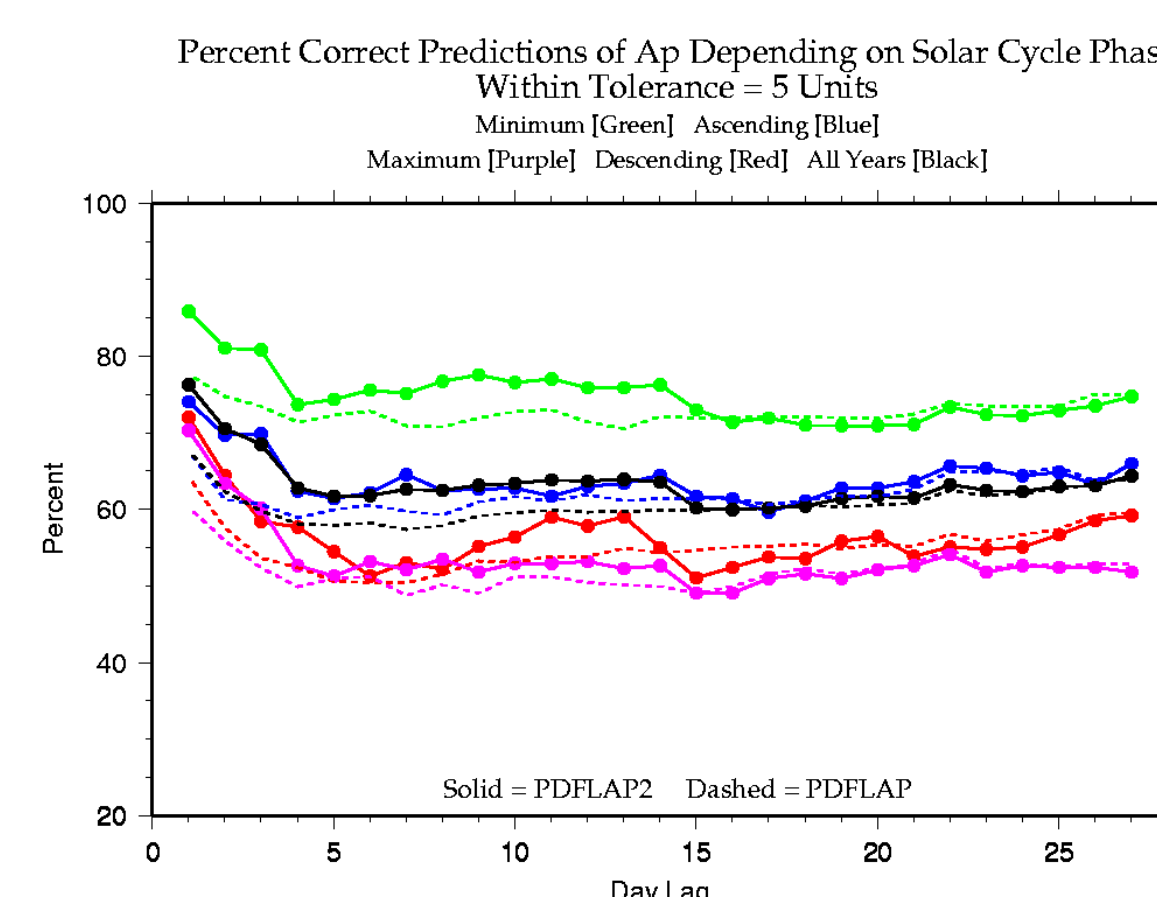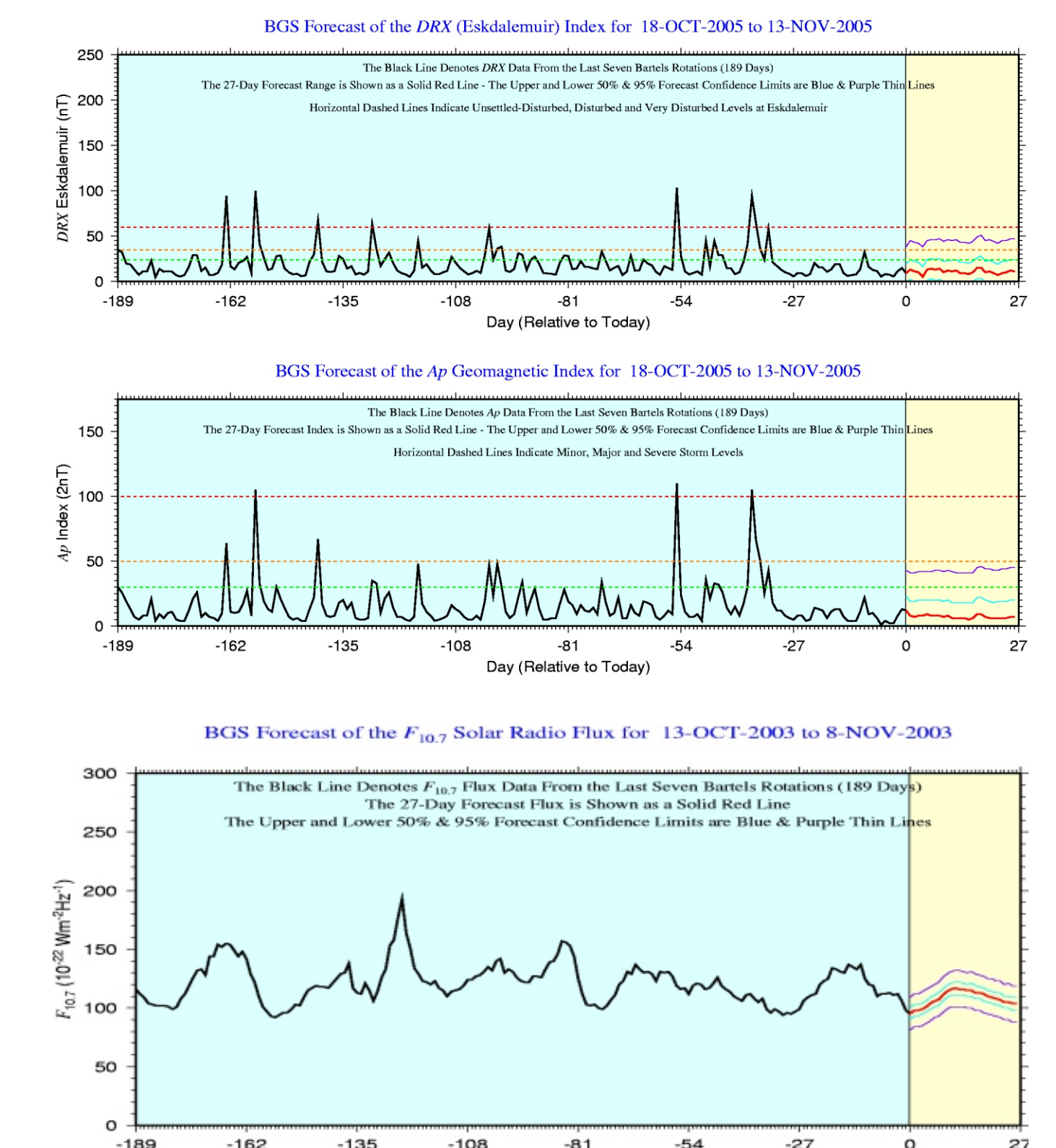
Left: Percent accuracy within $Ap\pm N$ units (N=5, 10), for 1-27 days ahead, for the 'neural network improved' model (PDFLAP2), compared to the previous version (PDFLAP) and for different solar cycle phases. The desired level of accuracy was stated to be N=10.

Right: Percent accuracy of $F_{10.7}$ model at two tolerance levels (N=10, 20). The engineering tolerance requested was N=20.