

Max Kp and GPRA

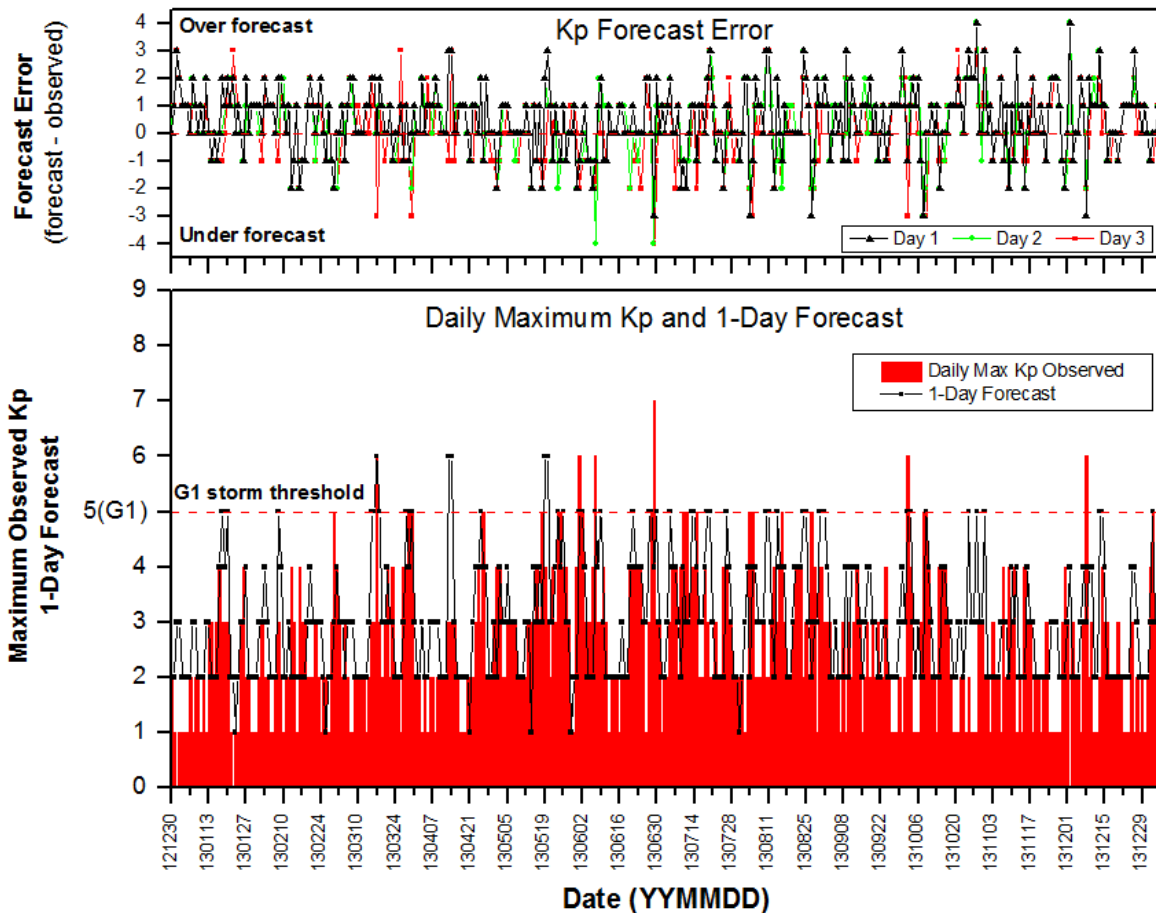
The [Government Performance and Results Act](#), or GPRA, metrics for SWPC are based on the performance of geomagnetic storm forecasts. Geomagnetic Storm Forecast Accuracy is measured as the percentage of times that the 24 hour geomagnetic storm forecast is correct for the 60 most recent geomagnetic storms. The 24 hour geomagnetic storm forecast is considered accurate if a G1 or greater storm event was predicted. This measure is based on the next-day forecast of maximum Kp, where Kp=5 (NOAA Scale G1) or greater constitutes a storm, and is verified against the NOAA Kp estimated from ground-based magnetometer observations. The specific metric of importance is the Probability of Detection (POD). Due to the nature of the approximately 11-year solar cycle and variability of geomagnetic storm occurrence, the POD is assessed over the 60 most recent geomagnetic storms to maintain statistical significance.

Max Kp Statistics Summary Table

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# Prepared by the U.S. Dept. of Commerce, NOAA, Space Weather Prediction
Center.
# Please send comments and suggestions to SWPC.Webmaster@noaa.gov
#
# Annual Verification Statistics for Daily Maximum Kp Index Forecasts
#
# Lead Time: Forecast lead time
# Total Records: Total number of forecast/observation records used to
generate statistic
# Mean (f): Mean forecast
# Mean (x): Mean observation
# Median (f): Median forecast
# Median (x): Median observation
# Std Dev (f): Standard deviation of forecasts
# Std Dev (x): Standard deviation of observations
# Std Dev (f-x): Standard deviation of forecasts minus observations
# ME: Mean error
# MAE: Mean absolute error
# MSE: Mean square error
# RMSE: Root mean square error
# Linear Assoc: Linear association between forecasts and observations
# Skill: Forecast skill with respect to observed climatology (same as
prediction efficiency)
#
# Missing data: -99999
#
```

```
Forecast Type: NOAA Daily Maximum Kp Index (integer 0-9)
Year: 2013
Start: 1/1/13
End: 12/31/13
Lead Time: Day 1 Day 2 Day 3
Total Records: 365 365 365
Mean (f): 3.008 2.937 2.726
Mean (x): 2.529 2.529 2.529
Median (f): 3.000 3.000 3.000
Median (x): 2.000 2.000 2.000
Std Dev (f): 1.098 1.008 0.927
Std Dev (x): 1.235 1.235 1.235
Std Dev (f-x): 1.233 1.243 1.251
ME: 0.479 0.408 0.197
MAE: 0.989 1.011 0.975
MSE: 1.745 1.707 1.600
RMSE: 1.321 1.306 1.265
Linear Assoc: 0.447 0.400 0.357
Skill: -0.148 -0.123 -0.052
```

Daily Maximum Kp Observations and Forecasts



This figure shows the performance of SWPC forecasts of maximum Kp during 2013. The bottom panel plots the daily observed maximum Kp (solid histogram) along with the next-day (one-day lead time) maximum Kp forecast (connected points). The G1 storm threshold is indicated by the horizontal dashed line at Kp=5. The top panel plots the Kp forecast error (forecast-observed) in Kp units, indicating either over or under forecasting of the daily maximum observed Kp, for forecasts with one to three-day lead times. Next-day forecasts of maximum Kp of G1 or greater are the basis for the SWPC geomagnetic storm GPRA metric.

G1-G5 Forecasts (2012-2013) Contingency Table

| | | G1-G5 Observed | |
|-----------------------|-----|------------------------------|-----------------------------------------|
| | | YES | NO |
| G1-G5 Forecast Issued | YES | HIT 14 | FALSE ALARM 44 |
| | NO | MISS 19 | Correct Null 448 |

| | Statistic | Value |
|----|--------------------------|-------|
| 1 | Hits | 14 |
| 2 | Misses | 19 |
| 3 | False Alarms | 44 |
| 4 | Bias | 1.76 |
| 5 | Critical Success Index | 0.18 |
| 6 | Probability of Detection | 0.42 |
| 7 | False Alarm Ratio | 0.76 |
| 8 | | |
| 9 | | |
| 10 | | |
| 11 | | |
| 12 | | |
| 13 | | |

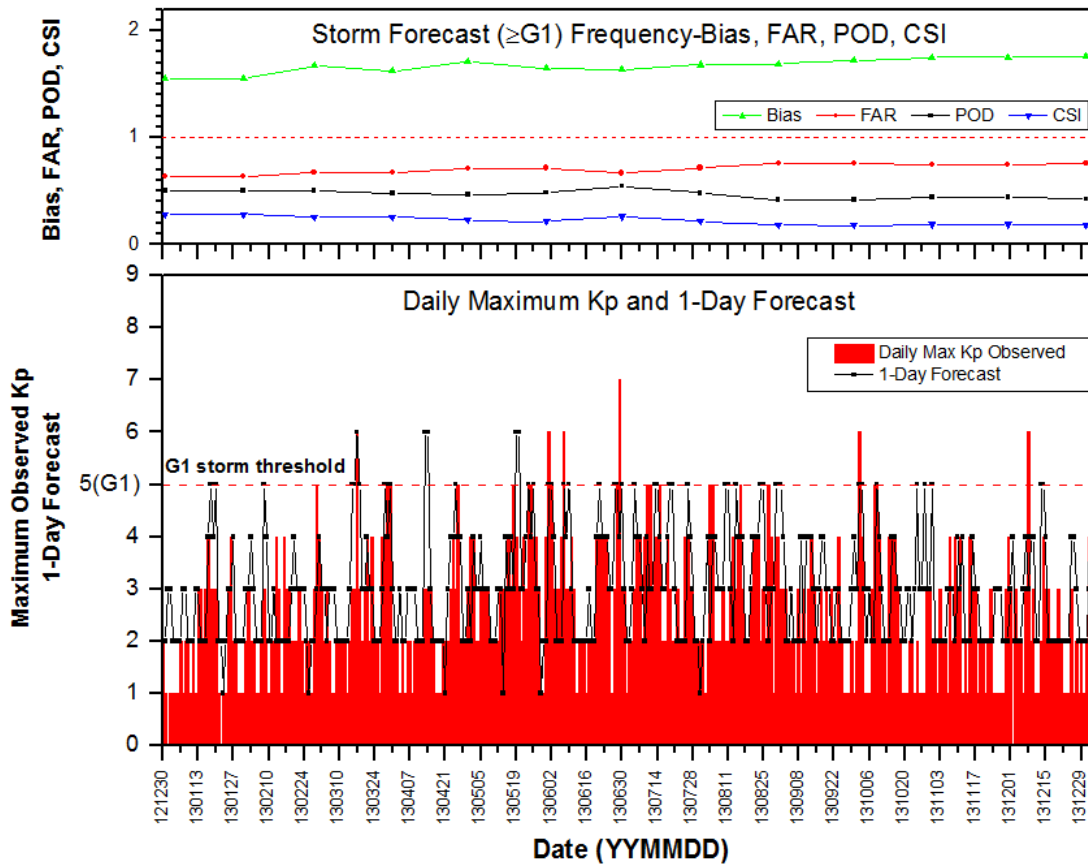
Note: Please see verification glossary for statistics definitions



2014, NOAA Space Environment Center, Boulder, CO, USA

This 2x2 contingency table summarizes the joint distribution of SWPC next-day G1 or greater storm forecasts from 7/25/2012 to 12/31/2013. The "Correct Null" value in the table represents the number of days in the period for which no warning was issued and no G1 or greater activity occurred. The summary statistics derived from the contingency table include the frequency Bias (values greater than 1 indicate more warnings were issued than events observed), Critical Success Index (also called the Threat Score), Probability of Detection (POD), and the False Alarm Ratio (FAR). The POD is currently the SWPC GPRA metric. Detailed definitions of these metrics are in the Verification Glossary.

Daily Maximum Kp Storm Forecast Metrics



This figure shows the performance of SWPC next-day G1 or greater storm forecasts during 2013. The bottom panel plots the daily observed maximum Kp (solid histogram) along with the next-day (one-day lead time) maximum Kp forecast (connected points). The G1 storm threshold is indicated by the horizontal dashed line at Kp=5. The top panel plots various performance metrics of the G1 or greater forecasts, including the frequency Bias (values greater than 1 indicate more warnings were issued than events observed), Critical Success Index (also called the Threat Score), Probability of Detection (POD), and the False Alarm Ratio (FAR). The POD is currently the SWPC GPRA metric. Detailed definitions of these metrics are in the Verification Glossary.