

# Estimated Ap Forecast Verification

Forecasts of Estimated [Ap index](#) are integer forecasts of the observed daily (24 hour) geomagnetic Ap index estimated by the USAF through 2011 and by NOAA from 2012 onward. Forecast lead times range from 1-day to 7-days. Verification results are provided on forecasts from July 1986 (the beginning of solar cycle 22) through December 2013. The USAF estimated Ap index is a real-time estimate of the official Göttingen Ap values using ground-based magnetometers at Meanook, Canada; Sitka, Alaska; Glenlea, Canada; Saint Johns, Canada; Ottawa, Canada; Newport, Washington; Fredericksburg, Virginia; Boulder, Colorado; and Fresno, California. A comparison of the USAF estimated Ap to the Göttingen Ap can be found in: Gehred, P.A., et al.: 1995, 'A Comparison of USAF Ap Indices to Göttingen Indices', *NOAA Technical Memorandum*, ERL SEL-88. The NOAA estimated Ap is a real-time estimated Ap currently derived from geomagnetic ground stations at Sitka, Alaska; Meanook, Canada; Ottawa, Canada; Fredericksburg, Virginia; Hartland, UK; Wingst, Germany; Niemeck, Germany; and Canberra, Australia.

# Estimated Ap Forecast Statistics Tables

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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
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# Annual Verification Statistics for Estimated Ap Index Forecasts
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# 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
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Forecast Type: Estimated Ap Index (integer)

Year: 2013  
Start: 1/1/2013  
End: 12/31/2013

Lead Time:	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Total Records:	365	365	365	365	365	365	365
Mean (f):	9.66	9.54	8.58	7.55	6.92	6.63	6.31
Mean (x):	7.6	7.6	7.6	7.6	7.6	7.6	7.6
Median (f):	8	8	8	5	5	5	5
Median (x):	6	6	6	6	6	6	6
Std Dev (f):	5.98	5.73	4.76	3.47	2.93	2.84	2.51
Std Dev (x):	6.65	6.65	6.65	6.65	6.65	6.65	6.65
Std Dev (f-x):	6.61	6.9	7.12	6.35	6.25	6.45	6.65
ME:	2.06	1.94	0.98	-0.04	-0.68	-0.97	-1.29
MAE:	4.65	4.8	4.64	3.97	3.81	3.93	3.93

MSE:	47.85	51.26	51.46	40.26	39.4	42.48	45.71
RMSE:	6.92	7.16	7.17	6.35	6.28	6.52	6.76
Linear Assoc:	0.46	0.39	0.26	0.34	0.35	0.28	0.19
Skill:	-0.09	-0.16	-0.17	0.09	0.11	0.04	-0.04

Forecast Type: Estimated Ap Index (integer)

Year:	2012						
Start:	1/1/2012						
End:	12/31/2012						
Lead Time:	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Total Records:	366	366	366	366	366	366	366
Mean (f):	9.85	9.22	8	6.99	6.53	6.33	6.06
Mean (x):	8.68	8.68	8.68	8.68	8.68	8.68	8.68
Median (f):	8	8	7	5	5	5	5
Median (x):	6	6	6	6	6	6	6
Std Dev (f):	9.25	6.69	4.03	2.98	2.74	2.54	2.42
Std Dev (x):	8.02	8.02	8.02	8.02	8.02	8.02	8.02
Std Dev (f-x):	9.62	8.14	7.38	7.84	8.07	8.01	8.01
ME:	1.17	0.54	-0.68	-1.7	-2.16	-2.35	-2.62
MAE:	4.92	4.78	4.26	4.32	4.53	4.4	4.43
MSE:	93.7	66.37	54.78	64.1	69.56	69.45	70.8
RMSE:	9.68	8.15	7.4	8.01	8.34	8.33	8.41
Linear Assoc:	0.39	0.4	0.4	0.25	0.15	0.16	0.15
Skill:	-0.46	-0.04	0.15	0	-0.09	-0.08	-0.11

Forecast Type: Estimated Ap Index (integer)

Year:	2011						
Start:	1/1/2011						
End:	12/31/2011						
Lead Time:	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Total Records:	365	365	365	365	365	365	365
Mean (f):	8.39	8.1	7.52	6.92	6.46	6.25	6.04
Mean (x):	7.6	7.6	7.6	7.6	7.6	7.6	7.6
Median (f):	7	6	5	5	5	5	5
Median (x):	5	5	5	5	5	5	5
Std Dev (f):	5.26	4.55	3.74	3.21	2.73	2.49	2.56
Std Dev (x):	7.61	7.61	7.61	7.61	7.61	7.61	7.61
Std Dev (f-x):	6.3	6.67	7.35	7.52	7.57	7.51	7.59
ME:	0.8	0.5	-0.08	-0.68	-1.13	-1.35	-1.55
MAE:	4.16	4.34	4.44	4.32	4.32	4.28	4.27
MSE:	40.24	44.62	53.92	56.87	58.35	58.12	59.85
RMSE:	6.34	6.68	7.34	7.54	7.64	7.62	7.74
Linear Assoc:	0.57	0.49	0.31	0.24	0.19	0.2	0.17

Skill: 0.3 0.23 0.07 0.01 -0.01 -0.01 -0.04

Forecast Type: Estimated Ap Index (integer)

Year: 2010

Start: 1/1/2010

End: 12/31/2010

Lead Time:	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Total Records:	365	365	365	365	365	365	365
Mean (f):	7.64	7.69	7.36	7.12	6.49	6.1	5.91
Mean (x):	6.11	6.11	6.11	6.11	6.11	6.11	6.11
Median (f):	5	5	5	5	5	5	5
Median (x):	4	4	4	4	4	4	4
Std Dev (f):	4.39	4.27	3.63	4.19	2.73	2.35	2.1
Std Dev (x):	6	6	6	6	6	6	6
Std Dev (f-x):	5.47	5.95	6.08	6.47	5.89	5.78	5.75
ME:	1.53	1.58	1.25	1.01	0.38	-0.01	-0.2
MAE:	3.75	4.01	3.98	3.83	3.52	3.35	3.28
MSE:	32.15	37.8	38.42	42.81	34.76	33.32	33
RMSE:	5.67	6.15	6.2	6.54	5.9	5.77	5.74
Linear Assoc:	0.48	0.37	0.28	0.23	0.27	0.29	0.29
Skill:	0.11	-0.05	-0.07	-0.19	0.03	0.07	0.08

Forecast Type: Estimated Ap Index (integer)

Year: 2009

Start: 1/1/2009

End: 12/31/2009

Lead Time:	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Total Records:	365	365	365	365	365	365	365
Mean (f):	5.96	5.91	5.88	5.78	5.66	5.53	5.51
Mean (x):	4.16	4.16	4.16	4.16	4.16	4.16	4.16
Median (f):	5	5	5	5	5	5	5
Median (x):	4	4	4	4	4	4	4
Std Dev (f):	1.99	1.99	2.05	1.94	1.86	1.71	1.68
Std Dev (x):	3.1	3.1	3.1	3.1	3.1	3.1	3.1
Std Dev (f-x):	3.17	3.2	3.19	3.18	3.23	3.15	3.15
ME:	1.8	1.75	1.72	1.62	1.5	1.37	1.35
MAE:	2.8	2.79	2.77	2.74	2.67	2.57	2.56
MSE:	13.26	13.27	13.07	12.72	12.64	11.76	11.7
RMSE:	3.64	3.64	3.62	3.57	3.56	3.43	3.42
Linear Assoc:	0.29	0.27	0.29	0.27	0.23	0.25	0.24
Skill:	-0.38	-0.39	-0.36	-0.33	-0.32	-0.23	-0.22

Forecast Type: Estimated Ap Index (integer)

Year: 2008  
 Start: 1/1/2008  
 End: 12/31/2008

Lead Time:	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Total Records:	366	366	366	366	366	366	366
Mean (f):	7.93	7.76	7.69	7.55	7.41	7.42	7.36
Mean (x):	6.78	6.78	6.78	6.78	6.78	6.78	6.78
Median (f):	5	5	5	5	5	5	5
Median (x):	5	5	5	5	5	5	5
Std Dev (f):	4.37	4.18	4.19	4.12	3.99	3.97	3.99
Std Dev (x):	5.67	5.67	5.67	5.67	5.67	5.67	5.67
Std Dev (f-x):	4.66	4.79	4.92	4.93	4.9	4.83	4.71
ME:	1.15	0.98	0.91	0.77	0.63	0.64	0.58
MAE:	3.3	3.37	3.4	3.39	3.34	3.35	3.25
MSE:	22.99	23.86	24.97	24.86	24.3	23.63	22.46
RMSE:	4.79	4.89	5	4.99	4.93	4.86	4.74
Linear Assoc:	0.6	0.56	0.54	0.53	0.53	0.55	0.57
Skill:	0.28	0.26	0.22	0.23	0.24	0.26	0.3

Forecast Type: Estimated Ap Index (integer)

Year: 2007  
 Start: 1/1/2007  
 End: 12/31/2007

Lead Time:	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Total Records:	365	365	365	364	364	364	364
Mean (f):	8.91	8.78	8.73	8.41	8.31	8.27	8.21
Mean (x):	7.51	7.51	7.51	7.53	7.52	7.52	7.53
Median (f):	7	7	5	5	5	5	5
Median (x):	6	6	6	6	6	6	6
Std Dev (f):	5.09	5.07	5.24	4.81	4.78	4.74	4.83
Std Dev (x):	6.42	6.42	6.42	6.42	6.42	6.42	6.42
Std Dev (f-x):	4.91	5.18	5.47	5.38	5.47	5.66	5.76
ME:	1.4	1.27	1.22	0.89	0.79	0.75	0.68
MAE:	3.71	3.75	3.84	3.78	3.9	3.99	4.01
MSE:	25.95	28.39	31.3	29.59	30.45	32.52	33.49
RMSE:	5.09	5.33	5.59	5.44	5.52	5.7	5.79
Linear Assoc:	0.66	0.62	0.58	0.57	0.56	0.52	0.51
Skill:	0.37	0.31	0.24	0.28	0.26	0.21	0.19

Forecast Type: Estimated Ap Index (integer)

Year: 2006  
 Start: 1/1/2006  
 End: 12/31/2006

Lead Time:	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Total Records:	365	365	365	364	364	364	364
Mean (f):	10.38	9.97	9.39	8.84	8.22	8.12	7.98
Mean (x):	8.68	8.68	8.68	8.68	8.68	8.68	8.68
Median (f):	8	8	8	8	7	5	5
Median (x):	6	6	6	6	6	6	6
Std Dev (f):	9.41	8.31	5.81	5.04	4.49	4.61	4.56
Std Dev (x):	9.52	9.52	9.52	9.52	9.52	9.52	9.52
Std Dev (f-x):	8.75	8.44	9.03	8.98	9.13	9.21	9.34
ME:	1.69	1.29	0.71	0.16	-0.47	-0.56	-0.7
MAE:	5.21	5.25	5.01	4.78	4.8	4.87	4.95
MSE:	79.18	72.7	81.79	80.36	83.3	84.81	87.43
RMSE:	8.9	8.53	9.04	8.96	9.13	9.21	9.35
Linear Assoc:	0.57	0.56	0.39	0.37	0.32	0.31	0.28
Skill:	0.12	0.2	0.1	0.11	0.08	0.06	0.03

Forecast Type: Estimated Ap Index (integer)

Year: 2005

Start: 1/1/2005

End: 12/31/2005

Lead Time:	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Total Records:	365	365	365	364	364	364	364
Mean (f):	14.68	13.68	12.18	11.03	10.38	9.97	9.82
Mean (x):	13.72	13.72	13.72	13.75	13.75	13.73	13.72
Median (f):	12	12	10	10	10	10	10
Median (x):	9	9	9	9	9	9	9
Std Dev (f):	11.22	9.36	5.87	5.1	4.98	4.75	4.46
Std Dev (x):	14.5	14.5	14.5	14.5	14.5	14.5	14.5
Std Dev (f-x):	11.7	11.96	13.97	14.48	14.5	14.46	14.5
ME:	0.96	-0.03	-1.53	-2.71	-3.36	-3.76	-3.89
MAE:	7.32	7.48	7.93	8.18	8.15	8.11	8.04
MSE:	137.55	142.56	196.93	216.31	221.07	222.64	224.71
RMSE:	11.73	11.94	14.03	14.71	14.87	14.92	14.99
Linear Assoc:	0.61	0.57	0.29	0.18	0.17	0.17	0.15
Skill:	0.34	0.32	0.06	-0.03	-0.06	-0.06	-0.07

Forecast Type: Estimated Ap Index (integer)

Year: 2004

Start: 1/1/2004

End: 12/31/2004

Lead Time:	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Total Records:	366	366	366	366	366	366	366
Mean (f):	14.33	13.66	12.99	11.8	11.16	11.01	10.84

Mean (x):	13.53	13.53	13.53	13.51	13.52	13.52	13.53
Median (f):	12	12	12	10	10	10	10
Median (x):	10	10	10	10	10	10	10
Std Dev (f):	10.62	7.14	6.24	5.11	4.91	4.82	4.47
Std Dev (x):	18.62	18.62	18.62	18.62	18.62	18.62	18.62
Std Dev (f-x):	17.32	16.78	17.63	18.18	18.19	18.18	18.17
ME:	0.8	0.13	-0.54	-1.71	-2.36	-2.51	-2.69
MAE:	7.18	6.98	6.97	6.7	6.77	6.81	6.89
MSE:	299.84	280.93	310.41	332.67	335.55	336.01	336.44
RMSE:	17.32	16.76	17.62	18.24	18.32	18.33	18.34
Linear Assoc:	0.4	0.44	0.32	0.22	0.22	0.22	0.22
Skill:	0.13	0.19	0.1	0.04	0.03	0.03	0.03

Forecast Type:	Estimated Ap	Index ( integer)					
Year:	2003						
Start:	1/1/2003						
End:	12/31/2003						
Lead Time:	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Total Records:	365	365	365	365	365	365	365
Mean (f):	20.13	19.01	17.43	16.38	15.8	15.81	15.55
Mean (x):	20.99	20.99	20.99	20.99	20.99	20.99	20.99
Median (f):	15	15	15	15	15	15	15
Median (x):	17	17	17	17	17	17	17
Std Dev (f):	12.74	12.14	7.05	6.19	6.32	6.49	6.46
Std Dev (x):	17.63	17.63	17.63	17.63	17.63	17.63	17.63
Std Dev (f-x):	14.13	16.6	17.48	17.44	17.52	17.49	17.63
ME:	-0.85	-1.98	-3.56	-4.61	-5.18	-5.17	-5.43
MAE:	8.17	8.85	9.21	8.94	8.96	8.95	9.34
MSE:	199.99	278.94	317.5	324.81	333.24	331.87	339.79
RMSE:	14.14	16.7	17.81	18.02	18.25	18.21	18.43
Linear Assoc:	0.6	0.42	0.22	0.2	0.19	0.2	0.18
Skill:	0.35	0.1	-0.02	-0.04	-0.07	-0.07	-0.09

Forecast Type:	Estimated Ap	Index (integer)					
Year:	2002						
Start:	1/1/2002						
End:	12/31/2002						
Lead Time:	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Total Records:	365	365	365	364	364	364	364
Mean (f):	13.16	12.56	11.61	10.32	9.59	9.22	8.98
Mean (x):	13.57	13.57	13.57	13.59	13.57	13.54	13.57
Median (f):	12	10	10	10	8	8	8
Median (x):	11	11	11	11	11	11	11

Std Dev (f):	6.6	6.48	4.81	4.11	3.5	2.63	2.29
Std Dev (x):	9.59	9.59	9.59	9.59	9.59	9.59	9.59
Std Dev (f-x):	9.35	9.65	9.43	9.65	9.56	9.42	9.49
ME:	-0.41	-1	-1.96	-3.26	-3.98	-4.32	-4.6
MAE:	5.83	5.98	6.01	6.05	6.03	5.93	6.03
MSE:	87.36	93.87	92.6	103.56	106.93	107.08	110.96
RMSE:	9.35	9.69	9.62	10.18	10.34	10.35	10.53
Linear Assoc:	0.38	0.33	0.28	0.2	0.19	0.2	0.16
Skill:	0.05	-0.03	-0.01	-0.13	-0.17	-0.17	-0.21

Forecast Type: Estimated Ap Index (integer)

Year: 2001  
Start: 1/1/2001  
End: 12/31/2001

Lead Time:	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Total Records:	365	365	365	365	365	365	365
Mean (f):	14	13.92	12.41	10.56	9.49	9.1	8.92
Mean (x):	12.54	12.54	12.54	12.54	12.54	12.54	12.54
Median (f):	10	10	10	10	10	10	10
Median (x):	9	9	9	9	9	9	9
Std Dev (f):	10.97	10.29	6.25	4.08	3.12	2.75	2.63
Std Dev (x):	13.91	13.91	13.91	13.91	13.91	13.91	13.91
Std Dev (f-x):	13.32	13.42	13.62	14.32	14.27	14.07	13.94
ME:	1.46	1.38	-0.13	-1.99	-3.06	-3.45	-3.62
MAE:	7.33	7.58	7.12	6.96	6.66	6.46	6.51
MSE:	178.96	181.41	185.07	208.33	212.49	209.4	206.87
RMSE:	13.38	13.47	13.6	14.43	14.58	14.47	14.38
Linear Assoc:	0.45	0.42	0.27	0.05	0	0.04	0.08
Skill:	0.07	0.06	0.04	-0.08	-0.1	-0.09	-0.07

Forecast Type: Estimated Ap Index (integer)

Year: 2000  
Start: 1/1/2000  
End: 12/31/2000

Lead Time:	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Total Records:	366	366	366	360	360	360	360
Mean (f):	15.85	15.41	13.71	11.71	10.79	10.25	10.08
Mean (x):	14.49	14.49	14.49	14.56	14.38	14.48	14.48
Median (f):	12	12	10	10	10	10	10
Median (x):	11	11	11	11	11	11	11
Std Dev (f):	11.57	11.15	8.26	4.6	3.66	2.92	2.62
Std Dev (x):	14.42	14.42	14.42	14.42	14.42	14.42	14.42
Std Dev (f-x):	14.4	16.41	15.19	14.35	14.22	14.33	14.39



ME:	1.36	0.92	-0.78	-2.85	-3.59	-4.23	-4.4
MAE:	8.3	8.99	8.31	7.83	7.51	7.66	7.68
MSE:	208.76	269.28	230.82	213.5	214.59	222.59	225.82
RMSE:	14.45	16.41	15.19	14.61	14.65	14.92	15.03
Linear Assoc:	0.4	0.19	0.18	0.18	0.15	0.13	0.1
Skill:	-0.02	-0.32	-0.13	-0.03	-0.05	-0.07	-0.09

Forecast Type: Estimated Ap Index (integer)

Year: 1999

Start: 1/1/1999

End: 12/31/1999

Lead Time:	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Total Records:	365	365	365	196	195	194	193
Mean (f):	12.75	12.24	11.63	11.38	10.62	10.15	9.74
Mean (x):	12.01	12.01	12.01	13.13	13.28	13.05	13.34
Median (f):	12	10	10	10	10	10	8
Median (x):	9	9	9	10	10	10	10
Std Dev (f):	6.07	5.42	5.19	5.51	4.88	4.43	3.89
Std Dev (x):	10.11	10.11	10.11	10.11	10.11	10.11	10.11
Std Dev (f-x):	8.79	9.46	9.18	9.81	9.98	9.72	9.62
ME:	0.74	0.23	-0.38	-1.75	-2.66	-2.9	-3.6
MAE:	6.1	6.33	6.06	6.29	6.39	6.31	6.47
MSE:	77.52	89.2	84.16	98.73	106.13	102.34	105.07
RMSE:	8.8	9.45	9.17	9.94	10.3	10.12	10.25
Linear Assoc:	0.4	0.25	0.29	0.33	0.28	0.29	0.31
Skill:	0.09	-0.05	0.01	0.03	-0.03	-0.03	-0.03

Forecast Type: Estimated Ap Index (integer)

Year: 1998

Start: 1/1/1998

End: 12/31/1998

Lead Time:	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Total Records:	365	365	365	266	266	267	267
Mean (f):	12.25	11.69	10.88	9.31	8.56	8.26	8.26
Mean (x):	12.03	12.03	12.03	12.1	12.17	12.06	11.75
Median (f):	10	10	10	8	8	8	8
Median (x):	8	8	8	8	9	8	8
Std Dev (f):	7.81	6.91	5.34	3.98	3.63	3.34	3.5
Std Dev (x):	12.37	12.37	12.37	12.37	12.37	12.37	12.37
Std Dev (f-x):	10.95	11.34	12.7	13.13	12.99	13.27	12.12
ME:	0.22	-0.34	-1.15	-2.79	-3.61	-3.8	-3.49
MAE:	6.15	6.45	6.63	6.37	6.12	6.17	5.99
MSE:	119.63	128.44	162.06	179.49	181.14	189.96	158.65

RMSE:	10.94	11.33	12.73	13.4	13.46	13.78	12.6
Linear Assoc:	0.59	0.55	0.35	0.31	0.36	0.25	0.21
Skill:	0.34	0.3	0.11	0.06	0.05	-0.01	-0.04

Forecast Type: Estimated Ap Index (integer)

Year: 1997

Start: 1/1/1997

End: 12/31/1997

Lead Time:	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Total Records:	365	365	365	343	342	341	340
Mean (f):	9.87	9.79	9.45	8.83	8.06	7.9	7.61
Mean (x):	8.36	8.36	8.36	8.41	8.42	8.44	8.39
Median (f):	8	8	8	8	8	8	8
Median (x):	6	6	6	6	6	6	6
Std Dev (f):	5.93	5.92	5.84	4.48	3.45	3.4	3.26
Std Dev (x):	7.48	7.48	7.48	7.48	7.48	7.48	7.48
Std Dev (f-x):	7.58	8.02	7.89	7.78	7.59	7.64	7.57
ME:	1.52	1.43	1.09	0.42	-0.36	-0.54	-0.78
MAE:	5.02	5.41	5.24	5.11	4.97	5.06	4.82
MSE:	59.57	66.23	63.24	60.49	57.61	58.49	57.74
RMSE:	7.72	8.14	7.95	7.78	7.59	7.65	7.6
Linear Assoc:	0.37	0.29	0.31	0.22	0.19	0.18	0.19
Skill:	-0.09	-0.21	-0.16	-0.1	-0.04	-0.05	-0.04

Forecast Type: Estimated Ap Index (integer)

Year: 1996

Start: 1/1/1996

End: 12/31/1996

Lead Time:	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Total Records:	366	366	366	357	356	355	354
Mean (f):	8.93	8.87	8.82	8.54	8.35	8.31	8.01
Mean (x):	8.74	8.74	8.74	8.8	8.83	8.86	8.86
Median (f):	8	8	8	8	8	8	8
Median (x):	7	7	7	7	7	7	7
Std Dev (f):	4.79	4.78	4.58	4.25	4.01	3.95	3.74
Std Dev (x):	6.34	6.34	6.34	6.34	6.34	6.34	6.34
Std Dev (f-x):	6.04	6.64	6.55	6.55	6.32	6.47	6.47
ME:	0.19	0.13	0.08	-0.26	-0.48	-0.55	-0.86
MAE:	4.09	4.46	4.47	4.49	4.39	4.47	4.35
MSE:	36.35	43.93	42.74	42.86	40.01	42.01	42.45
RMSE:	6.03	6.63	6.54	6.55	6.33	6.48	6.52
Linear Assoc:	0.43	0.31	0.31	0.29	0.32	0.28	0.26
Skill:	0.08	-0.11	-0.08	-0.07	0	-0.05	-0.06

Forecast Type: Estimated Ap Index (integer)

Year: 1995

Start: 1/1/1995

End: 12/31/1995

Lead Time:	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Total Records:	365	365	365	365	365	365	365
Mean (f):	13.17	13.07	13.04	12.55	12.2	11.86	11.75
Mean (x):	11.59	11.59	11.59	11.59	11.59	11.59	11.59
Median (f):	10	10	10	10	10	10	10
Median (x):	8	8	8	8	8	8	8
Std Dev (f):	7.11	7.04	6.85	6.16	5.94	5.81	5.82
Std Dev (x):	9.36	9.36	9.36	9.36	9.36	9.36	9.36
Std Dev (f-x):	8.81	9.51	9.24	8.9	8.8	9.02	9.07
ME:	1.59	1.49	1.46	0.96	0.61	0.27	0.16
MAE:	6.29	6.77	6.57	6.47	6.28	6.36	6.29
MSE:	79.87	92.42	87.19	79.92	77.52	81.15	82.13
RMSE:	8.94	9.61	9.34	8.94	8.8	9.01	9.06
Linear Assoc:	0.46	0.35	0.38	0.4	0.41	0.37	0.36
Skill:	0.09	-0.06	0	0.08	0.11	0.07	0.06

Forecast Type: Estimated Ap Index (integer)

Year: 1994

Start: 1/1/1994

End: 12/31/1994

Lead Time:	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Total Records:	365	365	365	365	365	365	365
Mean (f):	17.3	17.19	16.65	15.8	15.07	14.92	14.83
Mean (x):	16.11	16.11	16.11	16.11	16.11	16.11	16.11
Median (f):	15	15	15	15	12	12	10
Median (x):	11	11	11	11	11	11	11
Std Dev (f):	9.52	9.08	8.62	8.18	7.97	8.1	8.41
Std Dev (x):	13.85	13.85	13.85	13.85	13.85	13.85	13.85
Std Dev (f-x):	10.76	11.76	11.56	12.46	12.41	12.69	12.98
ME:	1.19	1.07	0.54	-0.32	-1.04	-1.19	-1.29
MAE:	6.91	7.53	7.74	7.67	7.57	7.78	8.03
MSE:	116.89	139.15	133.58	154.84	154.62	162.05	169.63
RMSE:	10.81	11.8	11.56	12.44	12.43	12.73	13.02
Linear Assoc:	0.63	0.54	0.56	0.46	0.46	0.43	0.4
Skill:	0.39	0.27	0.3	0.19	0.19	0.15	0.11

Forecast Type: Estimated Ap Index (integer)

Year: 1993

Start:	1/1/1993						
End:	12/31/1993						
Lead Time:	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Total Records:	365	365	365	365	365	365	365
Mean (f):	15.76	15.62	15.17	14.47	13.9	13.73	13.33
Mean (x):	13.67	13.67	13.67	13.67	13.67	13.67	13.67
Median (f):	15	15	15	10	10	10	10
Median (x):	10	10	10	10	10	10	10
Std Dev (f):	7.61	7.89	7.62	7.19	7.33	7.51	5.89
Std Dev (x):	12.26	12.26	12.26	12.26	12.26	12.26	12.26
Std Dev (f-x):	11.43	11.9	12.09	12.26	12.57	12.27	12.01
ME:	2.1	1.95	1.5	0.81	0.23	0.07	-0.34
MAE:	7.72	7.8	7.79	7.7	7.74	7.5	7.31
MSE:	134.72	145.12	147.96	150.45	157.52	150.15	143.94
RMSE:	11.61	12.05	12.16	12.27	12.55	12.25	12
Linear Assoc:	0.42	0.37	0.33	0.29	0.26	0.31	0.28
Skill:	0.1	0.03	0.01	0	-0.05	0	0.04

Forecast Type: Estimated Ap Index (integer)

Year:	1992						
Start:	1/1/1992						
End:	12/31/1992						
Lead Time:	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Total Records:	366	366	366	366	366	366	366
Mean (f):	16.68	16.23	15.04	13.65	13.01	12.62	12.46
Mean (x):	14.79	14.79	14.79	14.79	14.79	14.79	14.79
Median (f):	15	15	15	10	10	10	10
Median (x):	11	11	11	11	11	11	11
Std Dev (f):	10.83	9.48	7.31	5.36	4.88	4.71	4.33
Std Dev (x):	13.55	13.55	13.55	13.55	13.55	13.55	13.55
Std Dev (f-x):	14.54	14.72	14.11	14.19	13.99	13.93	14.01
ME:	1.89	1.45	0.25	-1.14	-1.78	-2.17	-2.32
MAE:	8.42	8.8	8.38	8.11	7.96	7.91	7.91
MSE:	214.35	218.28	198.63	202.17	198.33	198.22	201.07
RMSE:	14.64	14.77	14.09	14.22	14.08	14.08	14.18
Linear Assoc:	0.31	0.22	0.19	0.08	0.09	0.09	0.05
Skill:	-0.17	-0.19	-0.08	-0.1	-0.08	-0.08	-0.1

Forecast Type: Estimated Ap Index (integer)

Year:	1991						
Start:	1/1/1991						
End:	12/31/1991						
Lead Time:	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7



Median (f):	18	18	18	15	15	15	15
Median (x):	14	14	14	14	14	14	14
Std Dev (f):	14.19	11.3	8.17	5.84	4.82	4.86	4.5
Std Dev (x):	16.96	16.96	16.96	16.96	16.96	16.96	16.96
Std Dev (f-x):	16.47	17.2	17.33	17.08	16.9	17.18	17.08
ME:	3.18	2.72	0.46	-1.66	-2.69	-3.14	-3.56
MAE:	10.64	10.81	10.48	9.81	9.8	10.11	10.08
MSE:	280.35	302.23	299.5	293.4	291.86	304.17	303.47
RMSE:	16.74	17.39	17.31	17.13	17.08	17.44	17.42
Linear Assoc:	0.45	0.31	0.2	0.15	0.16	0.1	0.11
Skill:	0.02	-0.05	-0.04	-0.02	-0.02	-0.06	-0.06

Forecast Type: Estimated Ap Index (integer)

Year:	1988						
Start:	1/1/1988						
End:	12/31/1988						
Lead Time:	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Total Records:	366	366	366	-99999	-99999	-99999	-99999
Mean (f):	22.74	21.99	20.22	-99999	-99999	-99999	-99999
Mean (x):	20.3	20.3	20.3	-99999	-99999	-99999	-99999
Median (f):	20	20	20	-99999	-99999	-99999	-99999
Median (x):	16	16	16	-99999	-99999	-99999	-99999
Std Dev (f):	10.03	10.84	8.27	-99999	-99999	-99999	-99999
Std Dev (x):	15.59	15.59	15.59	-99999	-99999	-99999	-99999
Std Dev (f-x):	16.02	17.79	17.06	-99999	-99999	-99999	-99999
ME:	2.44	1.69	-0.08	-99999	-99999	-99999	-99999
MAE:	10.38	11.03	10.58	-99999	-99999	-99999	-99999
MSE:	261.78	318.39	290.11	-99999	-99999	-99999	-99999
RMSE:	16.18	17.84	17.03	-99999	-99999	-99999	-99999
Linear Assoc:	0.28	0.13	0.08	-99999	-99999	-99999	-99999
Skill:	-0.08	-0.31	-0.2	-99999	-99999	-99999	-99999

Forecast Type: USAF Estimated Ap Index (integer)

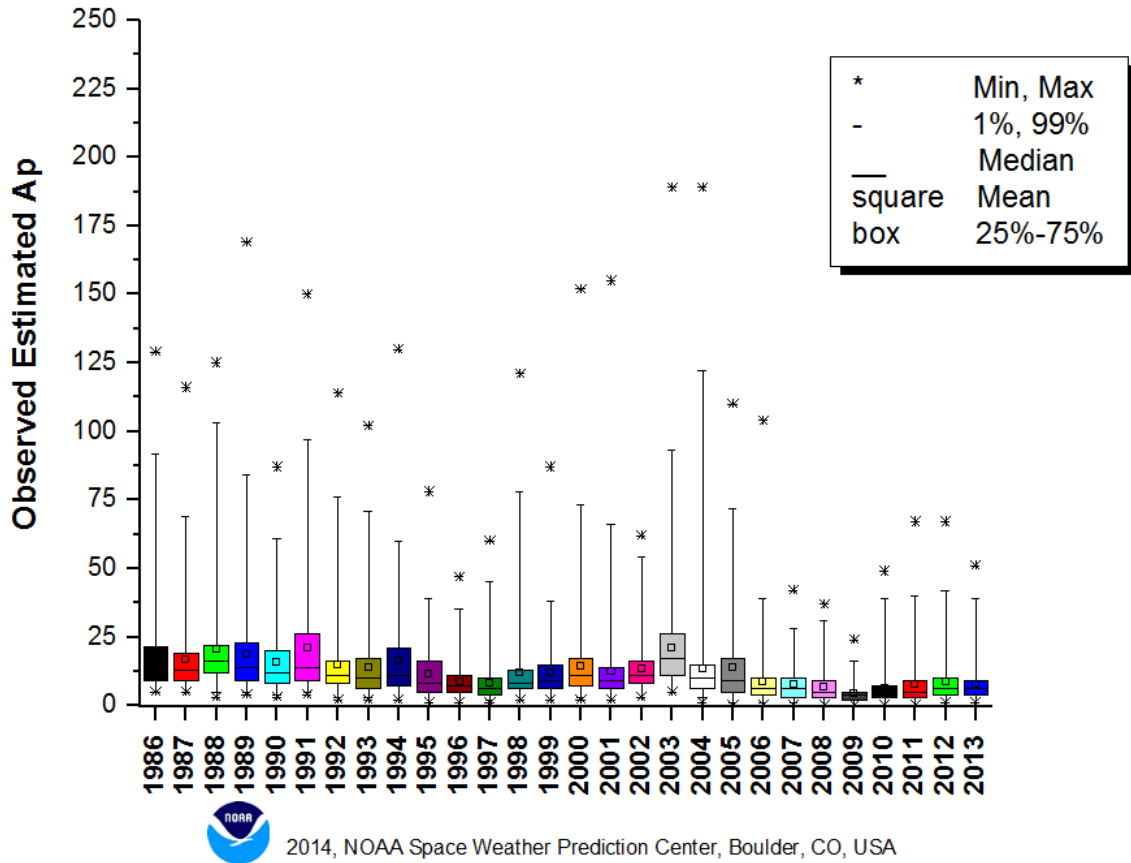
Year:	1987						
Start:	1/1/1987						
End:	12/31/1987						
Lead Time:	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Total Records:	365	365	365	-99999	-99999	-99999	-99999
Mean (f):	17.39	16.79	16.15	-99999	-99999	-99999	-99999
Mean (x):	16.58	16.58	16.58	-99999	-99999	-99999	-99999
Median (f):	15	15	15	-99999	-99999	-99999	-99999
Median (x):	13	13	13	-99999	-99999	-99999	-99999
Std Dev (f):	7.24	7.05	6.86	-99999	-99999	-99999	-99999

Std Dev (x):	13.26	13.26	13.26	-99999	-99999	-99999	-99999
Std Dev (f-x):	12.57	13.52	13.64	-99999	-99999	-99999	-99999
ME:	0.81	0.21	-0.43	-99999	-99999	-99999	-99999
MAE:	8.19	8.56	8.55	-99999	-99999	-99999	-99999
MSE:	158.2	182.42	185.63	-99999	-99999	-99999	-99999
RMSE:	12.58	13.51	13.63	-99999	-99999	-99999	-99999
Linear Assoc:	0.37	0.23	0.2	-99999	-99999	-99999	-99999
Skill:	0.1	-0.04	-0.06	-99999	-99999	-99999	-99999

Forecast Type: Estimated Ap Index (integer)

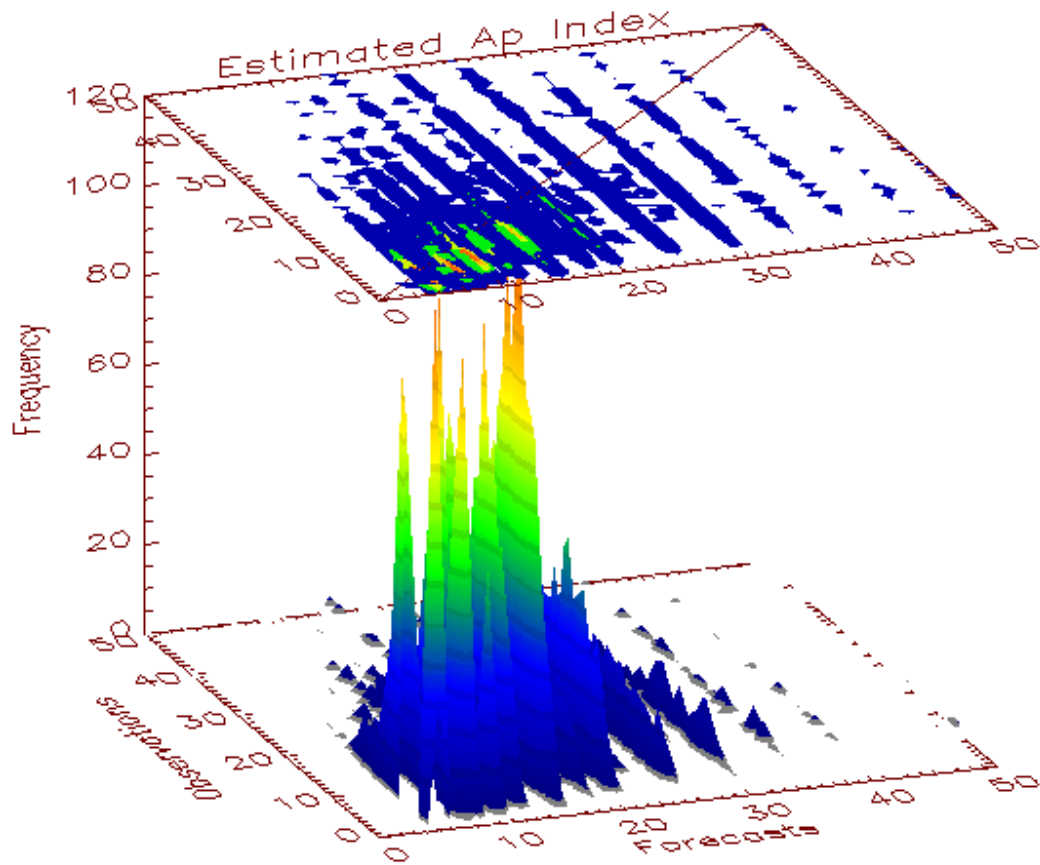
Year:	1986						
Start:	7/1/1986						
End:	12/31/1986						
Lead Time:	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Total Records:	184	184	184	-99999	-99999	-99999	-99999
Mean (f):	16.91	16.45	16.29	-99999	-99999	-99999	-99999
Mean (x):	17.94	17.94	17.94	-99999	-99999	-99999	-99999
Median (f):	15	15	15	-99999	-99999	-99999	-99999
Median (x):	13	13	13	-99999	-99999	-99999	-99999
Std Dev (f):	6.72	6.12	6.56	-99999	-99999	-99999	-99999
Std Dev (x):	15.53	15.53	15.53	-99999	-99999	-99999	-99999
Std Dev (f-x):	14.61	16	15.94	-99999	-99999	-99999	-99999
ME:	-1.02	-1.49	-1.65	-99999	-99999	-99999	-99999
MAE:	8.4	9.12	9.31	-99999	-99999	-99999	-99999
MSE:	213.33	256.65	255.31	-99999	-99999	-99999	-99999
RMSE:	14.61	16.02	15.98	-99999	-99999	-99999	-99999
Linear Assoc:	0.35	0.12	0.15	-99999	-99999	-99999	-99999
Skill:	0.11	-0.07	-0.06	-99999	-99999	-99999	-99999

## Estimated Ap Index

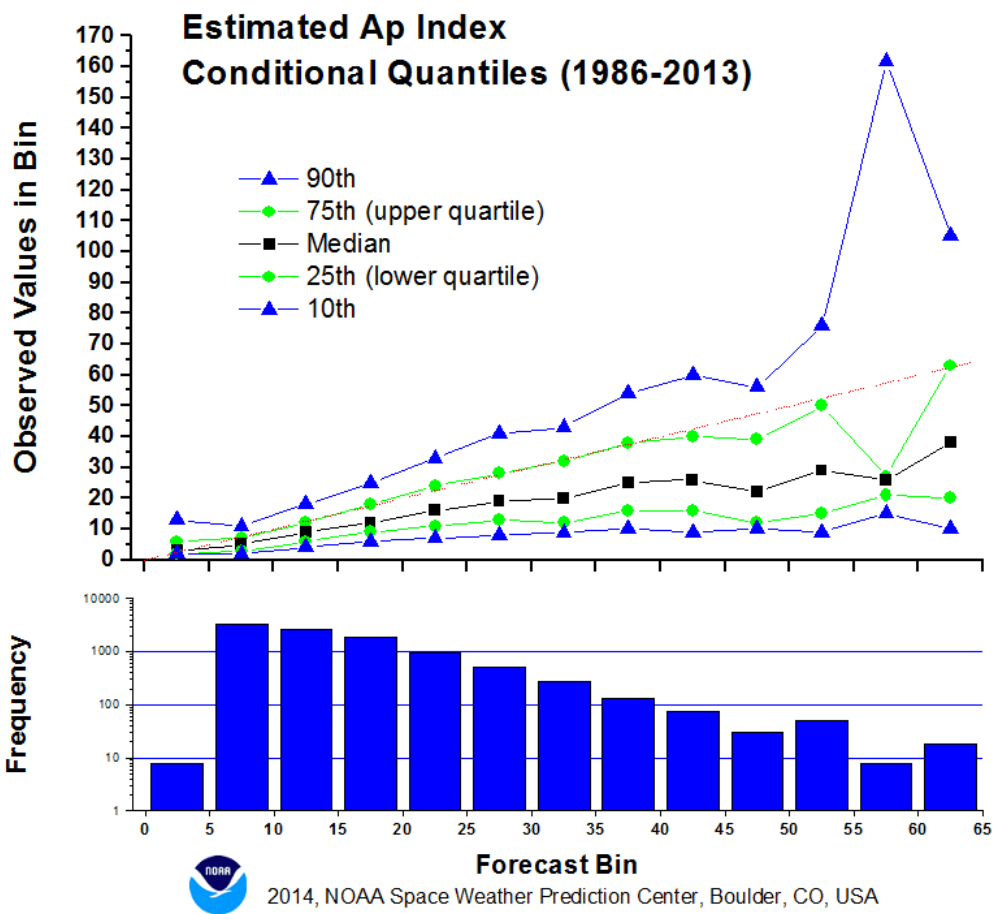


Box plots of the annual distribution of daily geomagnetic estimated Ap index from 1986 through 2013. Stars indicate the minimum and maximum values observed in the year, the small square indicates the mean observed value, and the horizontal line within the box indicates the median. The box contains the observed values from the lower quartile (25%) to the upper quartile (75%) of the distribution and includes 50% of the observed values. The box “whiskers” encompass 98% of the observed values (1% to 99% of the distribution).

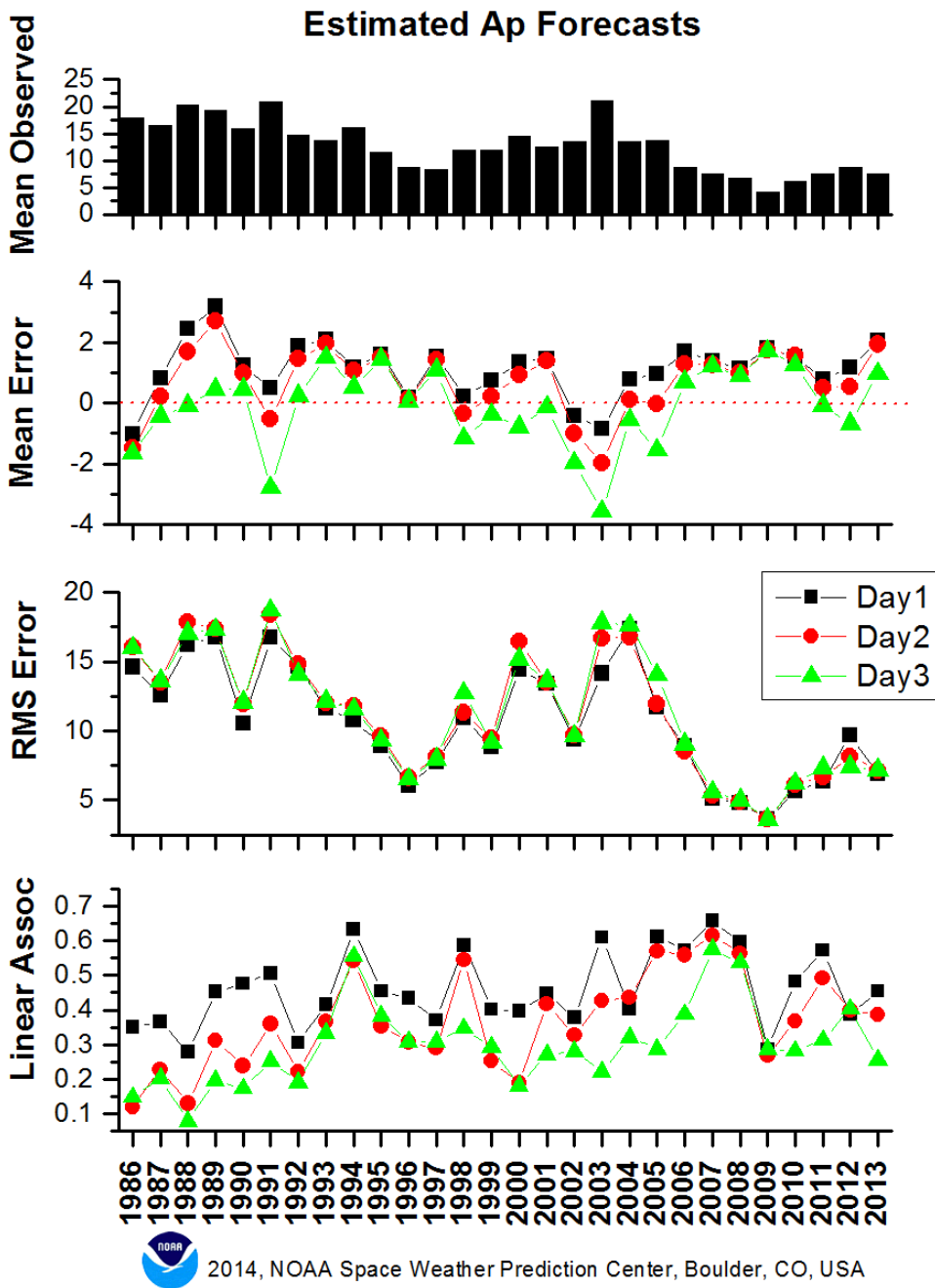




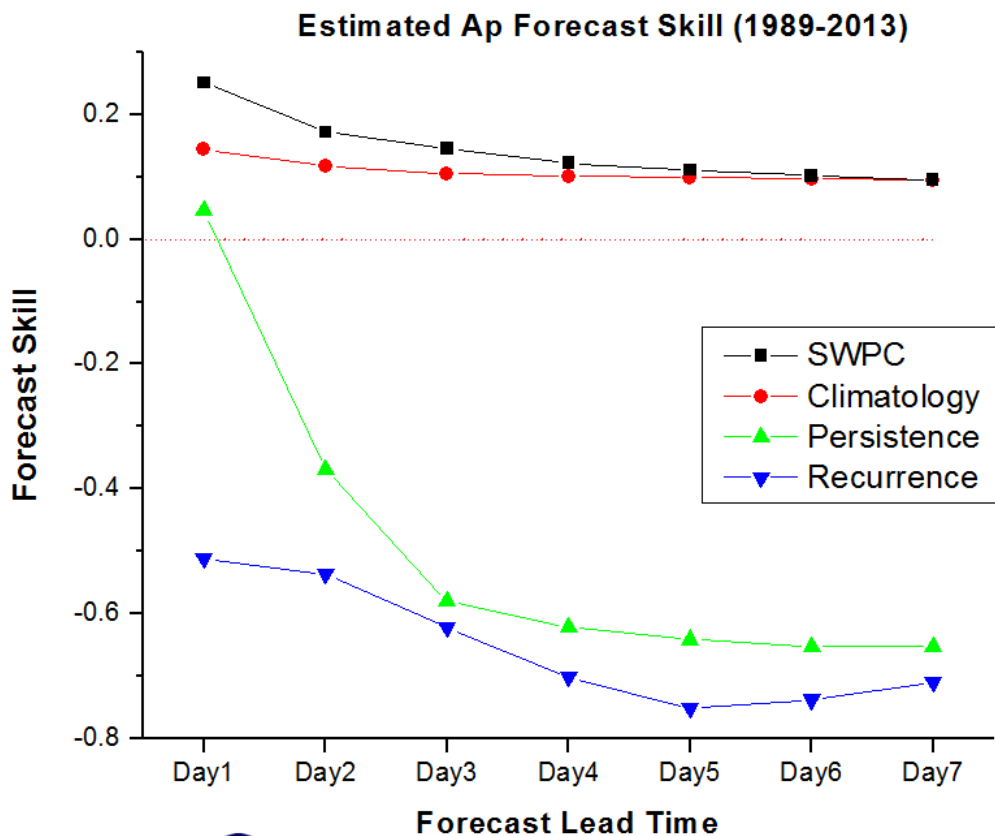
The joint distribution of next-day estimated Ap index forecasts and their corresponding observations from 1986 through 2013. Forecasts are plotted on the X-axis against observations on the Y-axis. The frequency of occurrence of a particular forecast/observation pair is plotted vertically on the Z-axis. Contours of equal frequency are projected onto a 2-dimensional plane above the joint distribution.



This conditional quantile plot shows the distribution of observed estimated Ap index values associated with forecasts grouped in 5-unit bins. The period covered is from 1986 to 2013. Distributions of the observed values are plotted on the Y-axis against 5-unit forecast bins along the X-axis. The observed distribution quantiles include the 10th, 25th (lower quartile), median, 75th (upper quartile), and 90th. A second graph directly below the quantile plot shows the number of forecasts in each bin. Note that the Y-axis of this lower graph is logarithmic.



These plots show the annual trend, from 1986 to 2013, of various verification metrics for forecasts of estimated Ap index with lead times of one to three days. The top panel plots the mean of the observed value during the year, the second panel plots the mean error (or bias) of the forecasts, the third panel shows the root mean square error of the forecasts, and the bottom panel displays the linear association (correlation) between the forecasts and observations.



2014, NOAA Space Weather Prediction Center, Boulder, CO, USA

This plot shows forecast skill as a function of lead-time for forecasts of estimated Ap index during the period 1989 to 2013. The skill of forecasts issued by SWPC is compared to that of forecasts produced by short-term (30-day) climatology, 1-day persistence, and 27-day recurrence. This skill metric is based on the relative error of the forecasts with respect to constant forecasts of sample climatology (the mean observation during the period) and is sometimes called the "prediction efficiency." The upper bound for this metric is "one" and there is no lower bound. Negative values indicate no skill above constant forecasts of sample climatology.