

# **X-class Flare Forecast Verification**

X Flare forecasts are daily probabilistic forecasts, ranging from 1% (0.01) to 99% (0.99), of the likelihood of an X class X-ray flare occurring within the specified 24-hour day. The X1 X-ray flare threshold is  $10^{-4}$  Watts / m<sup>2</sup> [X-ray flux](#) in the 0.1 to 0.8 nm passband as measured by the NOAA GOES spacecraft. Forecast lead times range from one to three days. Verification results are provided on forecasts from July 1986 (the beginning of solar cycle 22) through December 2013.

# X-class Flare Forecast Statistics 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 X Flare Probability Forecasts
#
# Lead Time:          Forecast lead time
# Total Records:     Total number of daily forecast/observation records used to
generate statistic
# Event Days:       Total number of days in the sample on which at least one X
class flare occurred
# Mean (f):         Mean forecast
# Mean (x):         Mean observation
# Median (f):       Median forecast
# Std Dev (f):      Standard deviation of forecasts
# Std Dev (x):      Standard deviation of observations
# Std Dev (f-x):    Standard deviation of forecasts minus observations
# Mean (f|x=1):     Mean forecast given the occurrence of an event
# Mean (f|x=0):     Mean forecast given the non-occurrence of an event
# Median (f|x=1):   Median forecast given the occurrence of an event
# Median (f|x=0):   Median forecast given the non-occurrence of an event
# Std Dev (f|x=1): Standard deviation of forecasts given the occurrence of an
event
# Std Dev (f|x=0): Standard deviation of forecasts given the non-occurrence
of an event
# Discrimination:   The difference between [Mean (f|x=1)] and [Mean (f|x=0)]
# ME:              Mean error
# MAE:             Mean absolute error
# MSE:             Mean square error
# RMSE:           Root mean square error
# Linear Assoc:    Linear correlation 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: Likelihood (probability) of the occurrence of an X class flare

Year:	2013		
Start:	1/1/13		
End:	12/31/13		
Lead Time:	Day 1	Day 2	Day 3
Total Records:	365	365	365
Events:	10	10	10
Mean (f):	0.051	0.050	0.048
Mean (x):	0.027	0.027	0.027
Median (f):	0.010	0.010	0.010
Std Dev (f):	0.085	0.084	0.084
Std Dev (x):	0.163	0.163	0.163
Std Dev (f-x):	0.152	0.156	0.164
Mean (f x=1):	0.250	0.220	0.170
Mean (f x=0):	0.046	0.045	0.044

Median (f x=1):	0.250	0.250	0.200
Median (f x=0):	0.010	0.010	0.010
Std Dev (f x=1):	0.151	0.130	0.106
Std Dev (f x=0):	0.075	0.077	0.081
Discrimination:	0.204	0.175	0.126
ME:	0.024	0.022	0.020
MAE:	0.065	0.065	0.066
MSE:	0.024	0.025	0.027
RMSE:	0.153	0.158	0.165
Linear Assoc:	0.393	0.341	0.246
Skill:	0.118	0.067	-0.026

Forecast Type: Likelihood (probability) of the occurrence of an X class flare

Year:	2012		
Start:	1/1/12		
End:	12/31/12		
Lead Time:	Day 1	Day 2	Day 3
Total Records:	366	366	366
Event Days:	6	6	6
Mean (f):	0.040	0.039	0.039
Mean (x):	0.016	0.016	0.016
Median (f):	0.010	0.010	0.010
Std Dev (f):	0.070	0.070	0.069
Std Dev (x):	0.127	0.127	0.127
Std Dev (f-x):	0.129	0.134	0.135
Mean (f x=1):	0.177	0.135	0.125
Mean (f x=0):	0.037	0.037	0.037
Median (f x=1):	0.200	0.150	0.100
Median (f x=0):	0.010	0.010	0.010
Std Dev (f x=1):	0.100	0.119	0.069
Std Dev (f x=0):	0.067	0.068	0.068
Discrimination:	0.139	0.098	0.088
ME:	0.023	0.023	0.022
MAE:	0.050	0.051	0.051
MSE:	0.017	0.018	0.019
RMSE:	0.131	0.135	0.136
Linear Assoc:	0.253	0.178	0.161
Skill:	-0.058	-0.136	-0.152

Forecast Type: Likelihood (probability) of the occurrence of an X class flare

Year:	2011		
Start:	1/1/11		
End:	12/31/11		
Lead Time:	Day 1	Day 2	Day 3
Total Records:	365	365	365
Event Days:	8	8	8
Mean (f):	0.036	0.034	0.032
Mean (x):	0.022	0.022	0.022
Median (f):	0.010	0.010	0.010
Std Dev (f):	0.060	0.056	0.054
Std Dev (x):	0.147	0.147	0.147
Std Dev (f-x):	0.151	0.153	0.156
Mean (f x=1):	0.089	0.060	0.031
Mean (f x=0):	0.035	0.033	0.032
Median (f x=1):	0.100	0.050	0.010

Median (f x=0):	0.010	0.010	0.010
Std Dev (f x=1):	0.056	0.064	0.033
Std Dev (f x=0):	0.060	0.055	0.054
Discrimination:	0.054	0.027	-0.001
ME:	0.014	0.012	0.010
MAE:	0.054	0.053	0.052
MSE:	0.023	0.023	0.024
RMSE:	0.151	0.153	0.156
Linear Assoc:	0.133	0.071	-0.002
Skill:	-0.068	-0.096	-0.141

Forecast Type: Likelihood (probability) of the occurrence of an X class flare

Year:	2010		
Start:	1/1/10		
End:	12/31/10		
Lead Time:	Day 1	Day 2	Day 3
Total Records:	365	365	365
Event Days:	0	0	0
Mean (f):	0.014	0.014	0.014
Mean (x):	0.000	0.000	0.000
Median (f):	0.010	0.010	0.010
Std Dev (f):	0.023	0.023	0.023
Std Dev (x):	0.000	0.000	0.000
Std Dev (f-x):	0.023	0.023	0.023
Mean (f x=1):	-99999	-99999	-99999
Mean (f x=0):	0.014	0.014	0.014
Median (f x=1):	-99999	-99999	-99999
Median (f x=0):	0.010	0.010	0.010
Std Dev (f x=1):	-99999	-99999	-99999
Std Dev (f x=0):	0.023	0.023	0.023
Discrimination:	-99999	-99999	-99999
ME:	0.014	0.014	0.014
MAE:	0.014	0.014	0.014
MSE:	0.001	0.001	0.001
RMSE:	0.027	0.027	0.027
Linear Assoc:	-99999	-99999	-99999
Skill:	-99999	-99999	-99999

Forecast Type: Likelihood (probability) of the occurrence of an X class flare

Year:	2009		
Start:	1/1/09		
End:	12/31/09		
Lead Time:	Day 1	Day 2	Day 3
Total Records:	365	365	365
Event Days:	0	0	0
Mean (f):	0.010	0.010	0.010
Mean (x):	0.000	0.000	0.000
Median (f):	0.010	0.010	0.010
Std Dev (f):	0.000	0.000	0.000
Std Dev (x):	0.000	0.000	0.000
Std Dev (f-x):	0.000	0.000	0.000
Mean (f x=1):	-99999	-99999	-99999
Mean (f x=0):	0.010	0.010	0.010
Median (f x=1):	-99999	-99999	-99999
Median (f x=0):	0.010	0.010	0.010

Std Dev (f x=1):	-99999	-99999	-99999
Std Dev (f x=0):	0.000	0.000	0.000
Discrimination:	-99999	-99999	-99999
ME:	0.010	0.010	0.010
MAE:	0.010	0.010	0.010
MSE:	0.000	0.000	0.000
RMSE:	0.010	0.010	0.010
Linear Assoc:	-99999	-99999	-99999
Skill:	-99999	-99999	-99999

Forecast Type: Likelihood (probability) of the occurrence of an X class flare

Year:	2008		
Start:	1/1/08		
End:	12/31/08		
Lead Time:	Day 1	Day 2	Day 3
Total Records:	366	366	366
Event Days:	0	0	0
Mean (f):	0.011	0.011	0.011
Mean (x):	0.000	0.000	0.000
Median (f):	0.010	0.010	0.010
Std Dev (f):	0.005	0.005	0.005
Std Dev (x):	0.000	0.000	0.000
Std Dev (f-x):	0.005	0.005	0.005
Mean (f x=1):	-99999	-99999	-99999
Mean (f x=0):	0.011	0.011	0.011
Median (f x=1):	-99999	-99999	-99999
Median (f x=0):	0.010	0.010	0.010
Std Dev (f x=1):	-99999	-99999	-99999
Std Dev (f x=0):	0.005	0.005	0.005
Discrimination:	-99999	-99999	-99999
ME:	0.011	0.011	0.011
MAE:	0.011	0.011	0.011
MSE:	0.000	0.000	0.000
RMSE:	0.012	0.012	0.012
Linear Assoc:	-99999	-99999	-99999
Skill:	-99999	-99999	-99999

Forecast Type: Likelihood (probability) of the occurrence of an X class flare

Year:	2007		
Start:	1/1/07		
End:	12/31/07		
Lead Time:	Day 1	Day 2	Day 3
Total Records:	365	365	365
Event Days:	0	0	0
Mean (f):	0.014	0.014	0.014
Mean (x):	0.000	0.000	0.000
Median (f):	0.010	0.010	0.010
Std Dev (f):	0.020	0.021	0.021
Std Dev (x):	0.000	0.000	0.000
Std Dev (f-x):	0.020	0.021	0.021
Mean (f x=1):	-99999	-99999	-99999
Mean (f x=0):	0.014	0.014	0.014
Median (f x=1):	-99999	-99999	-99999
Median (f x=0):	0.010	0.010	0.010
Std Dev (f x=1):	-99999	-99999	-99999

Std Dev (f x=0):	0.020	0.021	0.021
Discrimination:	-99999	-99999	-99999
ME:	0.014	0.014	0.014
MAE:	0.014	0.014	0.014
MSE:	0.001	0.001	0.001
RMSE:	0.024	0.025	0.026
Linear Assoc:	-99999	-99999	-99999
Skill:	-99999	-99999	-99999

Forecast Type: Likelihood (probability) of the occurrence of an X class flare

Year:	2006		
Start:	1/1/06		
End:	12/31/06		
Lead Time:	Day 1	Day 2	Day 3
Total Records:	365	365	365
Event Days:	4	4	4
Mean (f):	0.019	0.019	0.018
Mean (x):	0.011	0.011	0.011
Median (f):	0.010	0.010	0.010
Std Dev (f):	0.050	0.048	0.048
Std Dev (x):	0.104	0.104	0.104
Std Dev (f-x):	0.098	0.111	0.113
Mean (f x=1):	0.190	0.055	0.043
Mean (f x=0):	0.017	0.018	0.018
Median (f x=1):	0.300	0.100	0.050
Median (f x=0):	0.010	0.010	0.010
Std Dev (f x=1):	0.161	0.052	0.043
Std Dev (f x=0):	0.044	0.048	0.048
Discrimination:	0.173	0.037	0.024
ME:	0.008	0.008	0.007
MAE:	0.026	0.028	0.028
MSE:	0.010	0.012	0.013
RMSE:	0.098	0.111	0.113
Linear Assoc:	0.362	0.080	0.053
Skill:	0.112	-0.147	-0.171

Forecast Type: Likelihood (probability) of the occurrence of an X class flare

Year:	2005		
Start:	1/1/05		
End:	12/31/05		
Lead Time:	Day 1	Day 2	Day 3
Total Records:	365	365	365
Event Days:	13	13	13
Mean (f):	0.049	0.046	0.043
Mean (x):	0.036	0.036	0.036
Median (f):	0.010	0.010	0.010
Std Dev (f):	0.105	0.097	0.092
Std Dev (x):	0.186	0.186	0.186
Std Dev (f-x):	0.161	0.171	0.173
Mean (f x=1):	0.323	0.250	0.223
Mean (f x=0):	0.039	0.038	0.037
Median (f x=1):	0.300	0.200	0.100
Median (f x=0):	0.010	0.010	0.010
Std Dev (f x=1):	0.211	0.190	0.196
Std Dev (f x=0):	0.084	0.083	0.078

Discrimination:	0.284	0.212	0.186
ME:	0.014	0.010	0.008
MAE:	0.062	0.064	0.063
MSE:	0.026	0.029	0.030
RMSE:	0.161	0.171	0.173
Linear Assoc:	0.502	0.405	0.377
Skill:	0.242	0.147	0.127

Forecast Type: Likelihood (probability) of the occurrence of an X class flare

Year:	2004		
Start:	1/1/04		
End:	12/31/04		
Lead Time:	Day 1	Day 2	Day 3
Total Records:	366	366	366
Event Days:	9	9	9
Mean (f):	0.048	0.046	0.043
Mean (x):	0.025	0.025	0.025
Median (f):	0.010	0.010	0.010
Std Dev (f):	0.068	0.067	0.065
Std Dev (x):	0.155	0.155	0.155
Std Dev (f-x):	0.149	0.154	0.157
Mean (f x=1):	0.179	0.146	0.113
Mean (f x=0):	0.045	0.043	0.041
Median (f x=1):	0.200	0.150	0.100
Median (f x=0):	0.010	0.010	0.010
Std Dev (f x=1):	0.110	0.090	0.079
Std Dev (f x=0):	0.064	0.065	0.064
Discrimination:	0.134	0.102	0.072
ME:	0.023	0.021	0.018
MAE:	0.064	0.063	0.062
MSE:	0.023	0.024	0.025
RMSE:	0.151	0.155	0.158
Linear Assoc:	0.305	0.237	0.173
Skill:	0.052	-0.001	-0.044

Forecast Type: Likelihood (probability) of the occurrence of an X class flare

Year:	2003		
Start:	1/1/03		
End:	12/31/03		
Lead Time:	Day 1	Day 2	Day 3
Total Records:	365	365	365
Event Days:	17	17	17
Mean (f):	0.065	0.061	0.056
Mean (x):	0.047	0.047	0.047
Median (f):	0.050	0.050	0.050
Std Dev (f):	0.104	0.100	0.090
Std Dev (x):	0.211	0.211	0.211
Std Dev (f-x):	0.188	0.200	0.203
Mean (f x=1):	0.281	0.215	0.180
Mean (f x=0):	0.055	0.053	0.050
Median (f x=1):	0.250	0.150	0.100
Median (f x=0):	0.050	0.050	0.010
Std Dev (f x=1):	0.244	0.225	0.192
Std Dev (f x=0):	0.079	0.083	0.077

Discrimination:	0.226	0.161	0.130
ME:	0.019	0.014	0.010
MAE:	0.086	0.087	0.086
MSE:	0.036	0.040	0.041
RMSE:	0.188	0.201	0.203
Linear Assoc:	0.458	0.340	0.304
Skill:	0.200	0.093	0.076

Forecast Type: Likelihood (probability) of the occurrence of an X class flare

Year:	2002		
Start:	1/1/02		
End:	12/31/02		
Lead Time:	Day 1	Day 2	Day 3
Total Records:	365	365	365
Event Days:	12	12	12
Mean (f):	0.073	0.070	0.066
Mean (x):	0.033	0.033	0.033
Median (f):	0.050	0.050	0.050
Std Dev (f):	0.062	0.061	0.060
Std Dev (x):	0.179	0.179	0.179
Std Dev (f-x):	0.177	0.179	0.178
Mean (f x=1):	0.138	0.123	0.123
Mean (f x=0):	0.070	0.068	0.064
Median (f x=1):	0.200	0.150	0.150
Median (f x=0):	0.050	0.050	0.050
Std Dev (f x=1):	0.071	0.075	0.072
Std Dev (f x=0):	0.061	0.060	0.059
Discrimination:	0.067	0.055	0.058
ME:	0.040	0.037	0.033
MAE:	0.096	0.094	0.091
MSE:	0.033	0.033	0.033
RMSE:	0.182	0.183	0.181
Linear Assoc:	0.193	0.160	0.172
Skill:	-0.037	-0.050	-0.033

Forecast Type: Likelihood (probability) of the occurrence of an X class flare

Year:	2001		
Start:	1/1/01		
End:	12/31/01		
Lead Time:	Day 1	Day 2	Day 3
Total Records:	365	365	365
Event Days:	18	18	18
Mean (f):	0.100	0.095	0.092
Mean (x):	0.049	0.049	0.049
Median (f):	0.050	0.050	0.050
Std Dev (f):	0.099	0.095	0.092
Std Dev (x):	0.217	0.217	0.217
Std Dev (f-x):	0.218	0.216	0.213
Mean (f x=1):	0.194	0.192	0.192
Mean (f x=0):	0.095	0.090	0.086
Median (f x=1):	0.200	0.200	0.200
Median (f x=0):	0.050	0.050	0.050
Std Dev (f x=1):	0.089	0.099	0.094
Std Dev (f x=0):	0.097	0.092	0.089
Discrimination:	0.100	0.101	0.105



ME:	0.050	0.046	0.042
MAE:	0.130	0.126	0.122
MSE:	0.050	0.048	0.047
RMSE:	0.223	0.220	0.217
Linear Assoc:	0.219	0.232	0.249
Skill:	-0.061	-0.034	-0.006

Forecast Type: Likelihood (probability) of the occurrence of an X class flare

Year:	2000		
Start:	1/1/00		
End:	12/31/00		
Lead Time:	Day 1	Day 2	Day 3
Total Records:	366	366	366
Event Days:	14	14	14
Mean (f):	0.080	0.078	0.075
Mean (x):	0.038	0.038	0.038
Median (f):	0.050	0.050	0.050
Std Dev (f):	0.092	0.087	0.082
Std Dev (x):	0.192	0.192	0.192
Std Dev (f-x):	0.192	0.196	0.203
Mean (f x=1):	0.189	0.154	0.108
Mean (f x=0):	0.076	0.075	0.074
Median (f x=1):	0.150	0.100	0.100
Median (f x=0):	0.050	0.050	0.050
Std Dev (f x=1):	0.139	0.134	0.072
Std Dev (f x=0):	0.088	0.083	0.082
Discrimination:	0.113	0.080	0.034
ME:	0.042	0.039	0.037
MAE:	0.104	0.104	0.105
MSE:	0.039	0.040	0.042
RMSE:	0.197	0.200	0.206
Linear Assoc:	0.236	0.176	0.080
Skill:	-0.052	-0.088	-0.151

Forecast Type: Likelihood (probability) of the occurrence of an X class flare

Year:	1999		
Start:	1/1/99		
End:	12/31/99		
Lead Time:	Day 1	Day 2	Day 3
Total Records:	365	365	365
Event Days:	4	4	4
Mean (f):	0.065	0.063	0.061
Mean (x):	0.011	0.011	0.011
Median (f):	0.050	0.050	0.050
Std Dev (f):	0.075	0.075	0.075
Std Dev (x):	0.104	0.104	0.104
Std Dev (f-x):	0.119	0.126	0.126
Mean (f x=1):	0.175	0.087	0.087
Mean (f x=0):	0.064	0.063	0.061
Median (f x=1):	0.150	0.100	0.100
Median (f x=0):	0.050	0.050	0.050
Std Dev (f x=1):	0.155	0.048	0.048
Std Dev (f x=0):	0.074	0.075	0.075
Discrimination:	0.111	0.025	0.027
ME:	0.054	0.052	0.050

MAE:	0.072	0.072	0.070
MSE:	0.017	0.019	0.018
RMSE:	0.130	0.136	0.136
Linear Assoc:	0.154	0.035	0.037
Skill:	-0.567	-0.717	-0.696

Forecast Type: Likelihood (probability) of the occurrence of an X class flare

Year:	1998		
Start:	1/1/98		
End:	12/31/98		
Lead Time:	Day 1	Day 2	Day 3
Total Records:	365	365	365
Event Days:	12	12	12
Mean (f):	0.052	0.049	0.045
Mean (x):	0.033	0.033	0.033
Median (f):	0.010	0.010	0.010
Std Dev (f):	0.079	0.076	0.071
Std Dev (x):	0.179	0.179	0.179
Std Dev (f-x):	0.181	0.187	0.185
Mean (f x=1):	0.131	0.090	0.083
Mean (f x=0):	0.049	0.048	0.044
Median (f x=1):	0.100	0.050	0.050
Median (f x=0):	0.010	0.010	0.010
Std Dev (f x=1):	0.103	0.093	0.091
Std Dev (f x=0):	0.077	0.075	0.070
Discrimination:	0.082	0.042	0.039
ME:	0.019	0.016	0.012
MAE:	0.076	0.076	0.072
MSE:	0.033	0.035	0.034
RMSE:	0.182	0.188	0.186
Linear Assoc:	0.184	0.099	0.098
Skill:	-0.044	-0.106	-0.083

Forecast Type: Likelihood (probability) of the occurrence of an X class flare

Year:	1997		
Start:	1/1/97		
End:	12/31/97		
Lead Time:	Day 1	Day 2	Day 3
Total Records:	365	365	365
Event Days:	3	3	3
Mean (f):	0.016	0.016	0.017
Mean (x):	0.008	0.008	0.008
Median (f):	0.010	0.010	0.010
Std Dev (f):	0.027	0.027	0.027
Std Dev (x):	0.090	0.090	0.090
Std Dev (f-x):	0.082	0.087	0.083
Mean (f x=1):	0.150	0.093	0.137
Mean (f x=0):	0.015	0.016	0.016
Median (f x=1):	0.100	0.020	0.100
Median (f x=0):	0.010	0.010	0.010
Std Dev (f x=1):	0.132	0.136	0.148
Std Dev (f x=0):	0.022	0.024	0.022
Discrimination:	0.135	0.078	0.121
ME:	0.008	0.008	0.008
MAE:	0.022	0.023	0.023

MSE:	0.007	0.008	0.007
RMSE:	0.082	0.088	0.084
Linear Assoc:	0.454	0.262	0.405
Skill:	0.174	0.059	0.144

Forecast Type: Likelihood (probability) of the occurrence of an X class flare

Year:	1996		
Start:	1/1/96		
End:	12/31/96		
Lead Time:	Day 1	Day 2	Day 3
Total Records:	366	366	366
Event Days:	1	1	1
Mean (f):	0.011	0.011	0.011
Mean (x):	0.003	0.003	0.003
Median (f):	0.010	0.010	0.010
Std Dev (f):	0.010	0.007	0.005
Std Dev (x):	0.052	0.052	0.052
Std Dev (f-x):	0.053	0.053	0.053
Mean (f x=1):	0.010	0.010	0.010
Mean (f x=0):	0.011	0.011	0.011
Median (f x=1):	-99999	-99999	-99999
Median (f x=0):	0.010	0.010	0.010
Std Dev (f x=1):	-99999	-99999	-99999
Std Dev (f x=0):	0.010	0.007	0.005
Discrimination:	-0.001	-0.001	-0.001
ME:	0.009	0.008	0.008
MAE:	0.014	0.014	0.013
MSE:	0.003	0.003	0.003
RMSE:	0.054	0.053	0.053
Linear Assoc:	-0.007	-0.008	-0.007
Skill:	-0.069	-0.049	-0.036

Forecast Type: Likelihood (probability) of the occurrence of an X class flare

Year:	1995		
Start:	1/1/95		
End:	12/31/95		
Lead Time:	Day 1	Day 2	Day 3
Total Records:	365	365	365
Event Days:	0	0	0
Mean (f):	0.010	0.010	0.010
Mean (x):	0.000	0.000	0.000
Median (f):	0.010	0.010	0.010
Std Dev (f):	0.005	0.002	0.000
Std Dev (x):	0.000	0.000	0.000
Std Dev (f-x):	0.005	0.002	0.000
Mean (f x=1):	-99999	-99999	-99999
Mean (f x=0):	0.010	0.010	0.010
Median (f x=1):	-99999	-99999	-99999
Median (f x=0):	0.010	0.010	0.010
Std Dev (f x=1):	-99999	-99999	-99999
Std Dev (f x=0):	0.005	0.002	0.000
Discrimination:	-99999	-99999	-99999
ME:	0.010	0.010	0.010
MAE:	0.010	0.010	0.010
MSE:	0.000	0.000	0.000

RMSE:	0.012	0.010	0.010
Linear Assoc:	-99999	-99999	-99999
Skill:	-99999	-99999	-99999

Forecast Type: Likelihood (probability) of the occurrence of an X class flare

Year:	1994		
Start:	1/1/94		
End:	12/31/94		
Lead Time:	Day 1	Day 2	Day 3
Total Records:	365	365	365
Event Days:	0	0	0
Mean (f):	0.013	0.013	0.013
Mean (x):	0.000	0.000	0.000
Median (f):	0.010	0.010	0.010
Std Dev (f):	0.013	0.013	0.013
Std Dev (x):	0.000	0.000	0.000
Std Dev (f-x):	0.013	0.013	0.013
Mean (f x=1):	-99999	-99999	-99999
Mean (f x=0):	0.013	0.013	0.013
Median (f x=1):	-99999	-99999	-99999
Median (f x=0):	0.010	0.010	0.010
Std Dev (f x=1):	-99999	-99999	-99999
Std Dev (f x=0):	0.013	0.013	0.013
Discrimination:	-99999	-99999	-99999
ME:	0.013	0.013	0.013
MAE:	0.013	0.013	0.013
MSE:	0.000	0.000	0.000
RMSE:	0.018	0.018	0.019
Linear Assoc:	-99999	-99999	-99999
Skill:	-99999	-99999	-99999

Forecast Type: Likelihood (probability) of the occurrence of an X class flare

Year:	1993		
Start:	1/1/93		
End:	12/31/93		
Lead Time:	Day 1	Day 2	Day 3
Total Records:	365	365	365
Event Days:	0	0	0
Mean (f):	0.030	0.030	0.028
Mean (x):	0.000	0.000	0.000
Median (f):	0.010	0.010	0.010
Std Dev (f):	0.042	0.041	0.040
Std Dev (x):	0.000	0.000	0.000
Std Dev (f-x):	0.042	0.041	0.040
Mean (f x=1):	-99999	-99999	-99999
Mean (f x=0):	0.030	0.030	0.028
Median (f x=1):	-99999	-99999	-99999
Median (f x=0):	0.010	0.010	0.010
Std Dev (f x=1):	-99999	-99999	-99999
Std Dev (f x=0):	0.042	0.041	0.040
Discrimination:	-99999	-99999	-99999
ME:	0.030	0.030	0.028
MAE:	0.030	0.030	0.028
MSE:	0.003	0.003	0.002
RMSE:	0.051	0.051	0.048

Linear Assoc:           -99999       -99999       -99999  
Skill:                   -99999       -99999       -99999

Forecast Type:   Likelihood (probability) of the occurrence of an X class flare

Year:                   1992  
Start:                  1/1/92  
End:                    12/31/92  
Lead Time:             Day 1           Day 2           Day 3  
Total Records:         366           366           366  
Event Days:            9             9             9  
Mean (f):              0.048       0.046       0.041  
Mean (x):              0.025       0.025       0.025  
Median (f):            0.010       0.010       0.010  
Std Dev (f):           0.061       0.057       0.050  
Std Dev (x):           0.155       0.155       0.155  
Std Dev (f-x):         0.162       0.164       0.162  
Mean (f|x=1):         0.079       0.054       0.050  
Mean (f|x=0):         0.047       0.045       0.041  
Median (f|x=1):        0.050       0.050       0.010  
Median (f|x=0):        0.010       0.010       0.010  
Std Dev (f|x=1):      0.055       0.062       0.064  
Std Dev (f|x=0):      0.061       0.057       0.050  
Discrimination:        0.032       0.009       0.009  
ME:                    0.024       0.021       0.016  
MAE:                   0.069       0.067       0.063  
MSE:                   0.027       0.027       0.026  
RMSE:                  0.163       0.165       0.162  
Linear Assoc:          0.081       0.025       0.029  
Skill:                  -0.113      -0.136      -0.098

Forecast Type:   Likelihood (probability) of the occurrence of an X class flare

Year:                   1991  
Start:                  1/1/91  
End:                    12/31/91  
Lead Time:             Day 1           Day 2           Day 3  
Total Records:         365           365           365  
Event Days:            48           48           48  
Mean (f):              0.154       0.144       0.135  
Mean (x):              0.132       0.132       0.132  
Median (f):            0.100       0.100       0.050  
Std Dev (f):           0.157       0.154       0.154  
Std Dev (x):           0.338       0.338       0.338  
Std Dev (f-x):         0.331       0.333       0.339  
Mean (f|x=1):         0.266       0.248       0.223  
Mean (f|x=0):         0.137       0.128       0.122  
Median (f|x=1):        0.300       0.250       0.150  
Median (f|x=0):        0.100       0.100       0.050  
Std Dev (f|x=1):      0.176       0.196       0.211  
Std Dev (f|x=0):      0.147       0.140       0.139  
Discrimination:        0.129       0.120       0.101  
ME:                    0.022       0.012       0.004  
MAE:                   0.215       0.210       0.208  
MSE:                   0.110       0.111       0.115  
RMSE:                  0.331       0.333       0.339  
Linear Assoc:          0.278       0.264       0.222

Skill: 0.038 0.032 -0.005

Forecast Type: Likelihood (probability) of the occurrence of an X class flare

Year: 1990

Start: 1/1/90

End: 12/31/90

Lead Time:	Day 1	Day 2	Day 3
Total Records:	365	365	365
Event Days:	15	15	15
Mean (f):	0.087	0.083	0.078
Mean (x):	0.041	0.041	0.041
Median (f):	0.050	0.050	0.050
Std Dev (f):	0.099	0.097	0.093
Std Dev (x):	0.199	0.199	0.199
Std Dev (f-x):	0.195	0.207	0.211
Mean (f x=1):	0.225	0.157	0.125
Mean (f x=0):	0.081	0.080	0.076
Median (f x=1):	0.200	0.100	0.100
Median (f x=0):	0.050	0.050	0.050
Std Dev (f x=1):	0.169	0.144	0.143
Std Dev (f x=0):	0.090	0.093	0.090
Discrimination:	0.144	0.078	0.049
ME:	0.046	0.042	0.037
MAE:	0.110	0.111	0.109
MSE:	0.040	0.044	0.046
RMSE:	0.200	0.211	0.214
Linear Assoc:	0.290	0.159	0.105
Skill:	-0.013	-0.127	-0.157

Forecast Type: Likelihood (probability) of the occurrence of an X class flare

Year: 1989

Start: 1/1/89

End: 12/31/89

Lead Time:	Day 1	Day 2	Day 3
Total Records:	365	365	365
Event Days:	54	54	54
Mean (f):	0.193	0.189	0.179
Mean (x):	0.148	0.148	0.148
Median (f):	0.100	0.100	0.100
Std Dev (f):	0.187	0.185	0.178
Std Dev (x):	0.356	0.356	0.356
Std Dev (f-x):	0.333	0.339	0.342
Mean (f x=1):	0.363	0.342	0.318
Mean (f x=0):	0.164	0.162	0.155
Median (f x=1):	0.300	0.300	0.300
Median (f x=0):	0.100	0.100	0.100
Std Dev (f x=1):	0.204	0.207	0.206
Std Dev (f x=0):	0.167	0.168	0.161
Discrimination:	0.199	0.180	0.163
ME:	0.046	0.041	0.031
MAE:	0.234	0.235	0.233
MSE:	0.113	0.117	0.118
RMSE:	0.336	0.341	0.343
Linear Assoc:	0.379	0.345	0.326
Skill:	0.106	0.075	0.068

Forecast Type: Likelihood (probability) of the occurrence of an X class flare

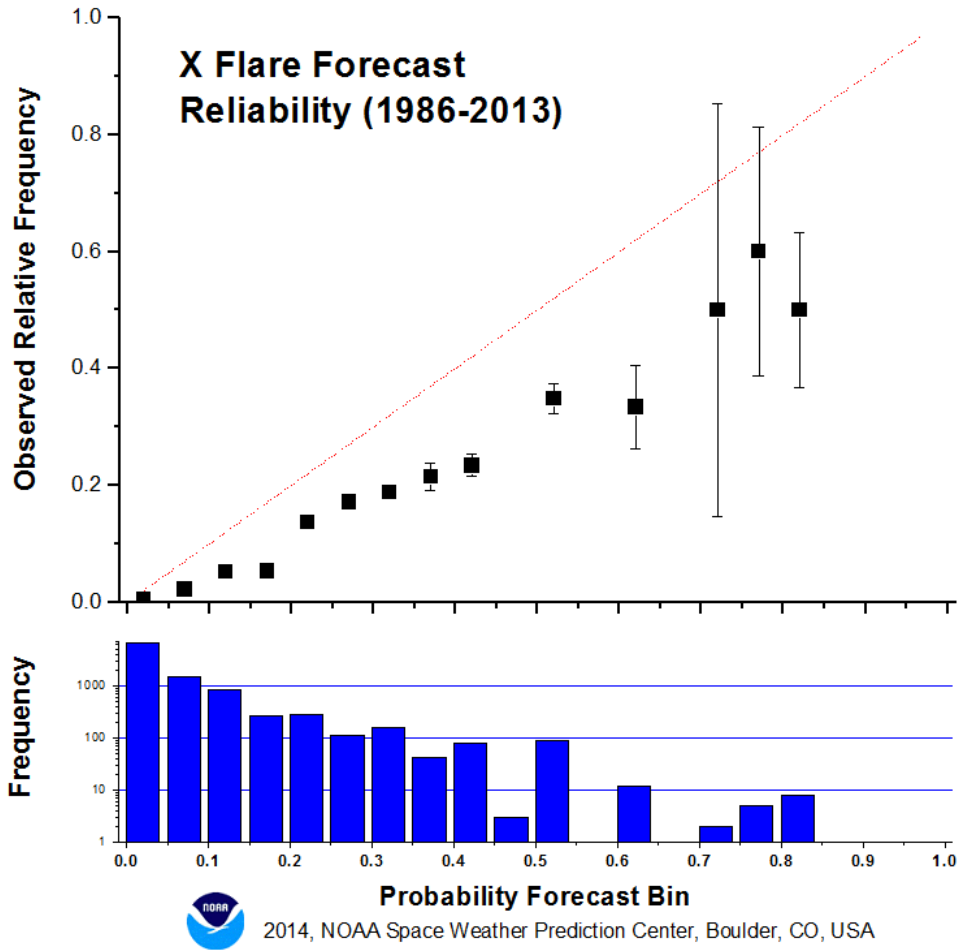
Year:	1988		
Start:	1/1/88		
End:	12/31/88		
Lead Time:	Day 1	Day 2	Day 3
Total Records:	366	366	366
Event Days:	10	10	10
Mean (f):	0.074	0.071	0.068
Mean (x):	0.027	0.027	0.027
Median (f):	0.050	0.050	0.050
Std Dev (f):	0.095	0.094	0.093
Std Dev (x):	0.163	0.163	0.163
Std Dev (f-x):	0.181	0.185	0.187
Mean (f x=1):	0.131	0.094	0.072
Mean (f x=0):	0.073	0.070	0.067
Median (f x=1):	0.100	0.050	0.050
Median (f x=0):	0.050	0.050	0.050
Std Dev (f x=1):	0.121	0.095	0.068
Std Dev (f x=0):	0.094	0.094	0.094
Discrimination:	0.058	0.024	0.005
ME:	0.047	0.043	0.040
MAE:	0.095	0.093	0.091
MSE:	0.035	0.036	0.037
RMSE:	0.187	0.190	0.191
Linear Assoc:	0.099	0.042	0.008
Skill:	-0.309	-0.355	-0.380

Forecast Type: Likelihood (probability) of the occurrence of an X class flare

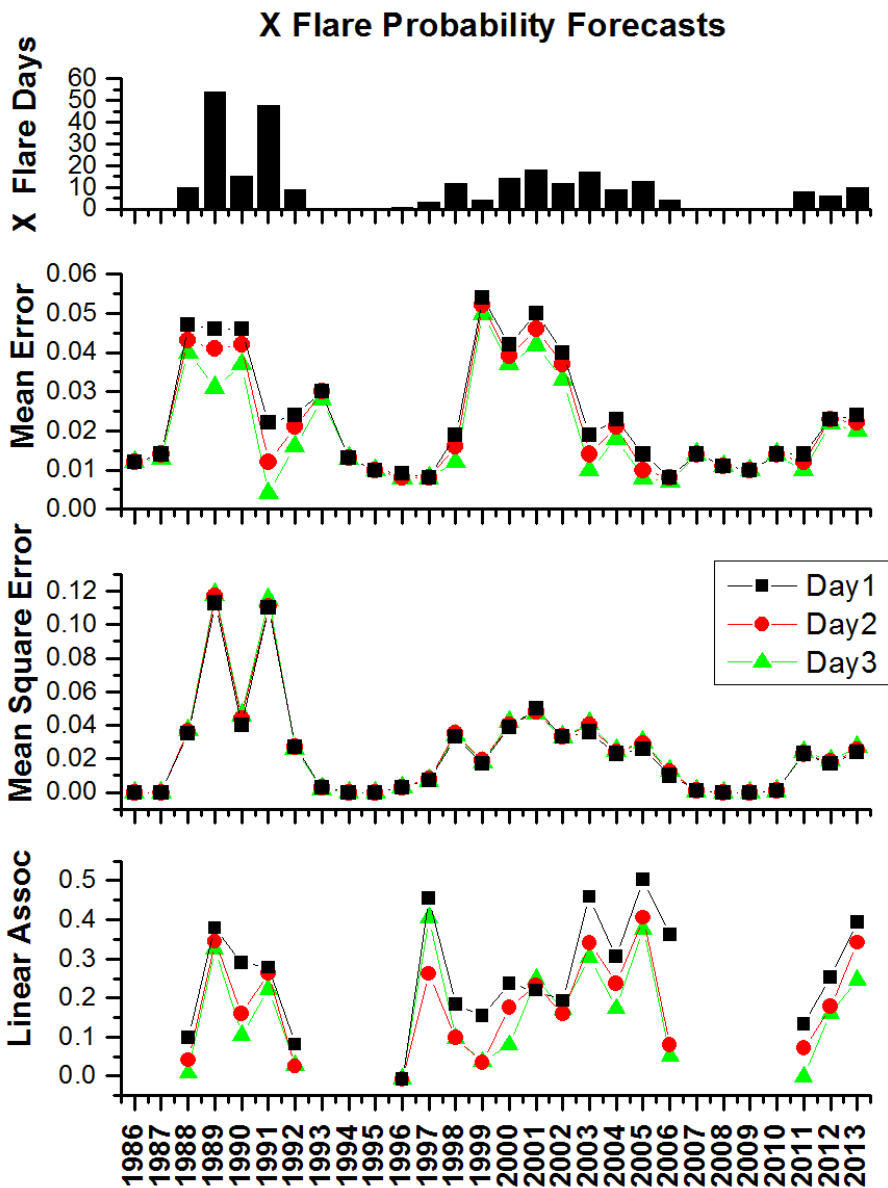
Year:	1987		
Start:	1/1/87		
End:	12/31/87		
Lead Time:	Day 1	Day 2	Day 3
Total Records:	365	365	365
Event Days:	0	0	0
Mean (f):	0.014	0.014	0.013
Mean (x):	0.000	0.000	0.000
Median (f):	0.010	0.010	0.010
Std Dev (f):	0.013	0.013	0.012
Std Dev (x):	0.000	0.000	0.000
Std Dev (f-x):	0.013	0.013	0.012
Mean (f x=1):	-99999	-99999	-99999
Mean (f x=0):	0.014	0.014	0.013
Median (f x=1):	-99999	-99999	-99999
Median (f x=0):	0.010	0.010	0.010
Std Dev (f x=1):	-99999	-99999	-99999
Std Dev (f x=0):	0.013	0.013	0.012
Discrimination:	-99999	-99999	-99999
ME:	0.014	0.014	0.013
MAE:	0.014	0.014	0.013
MSE:	0.000	0.000	0.000
RMSE:	0.019	0.018	0.018
Linear Assoc:	-99999	-99999	-99999
Skill:	-99999	-99999	-99999


Forecast Type:	Likelihood (probability) of the occurrence of an X class flare		
Year:	1986		
Start:	7/1/86		
End:	12/31/86		
Lead Time:	Day 1	Day 2	Day 3
Total Records:	184	184	184
Event Days:	0	0	0
Mean (f):	0.012	0.012	0.012
Mean (x):	0.000	0.000	0.000
Median (f):	0.010	0.010	0.010
Std Dev (f):	0.011	0.012	0.010
Std Dev (x):	0.000	0.000	0.000
Std Dev (f-x):	0.011	0.012	0.010
Mean (f x=1):	-99999	-99999	-99999
Mean (f x=0):	0.012	0.012	0.012
Median (f x=1):	-99999	-99999	-99999
Median (f x=0):	0.010	0.010	0.010
Std Dev (f x=1):	-99999	-99999	-99999
Std Dev (f x=0):	0.011	0.012	0.010
Discrimination:	-99999	-99999	-99999
ME:	0.012	0.012	0.012
MAE:	0.012	0.012	0.012
MSE:	0.000	0.000	0.000
RMSE:	0.016	0.017	0.015
Linear Assoc:	-99999	-99999	-99999
Skill:	-99999	-99999	-99999



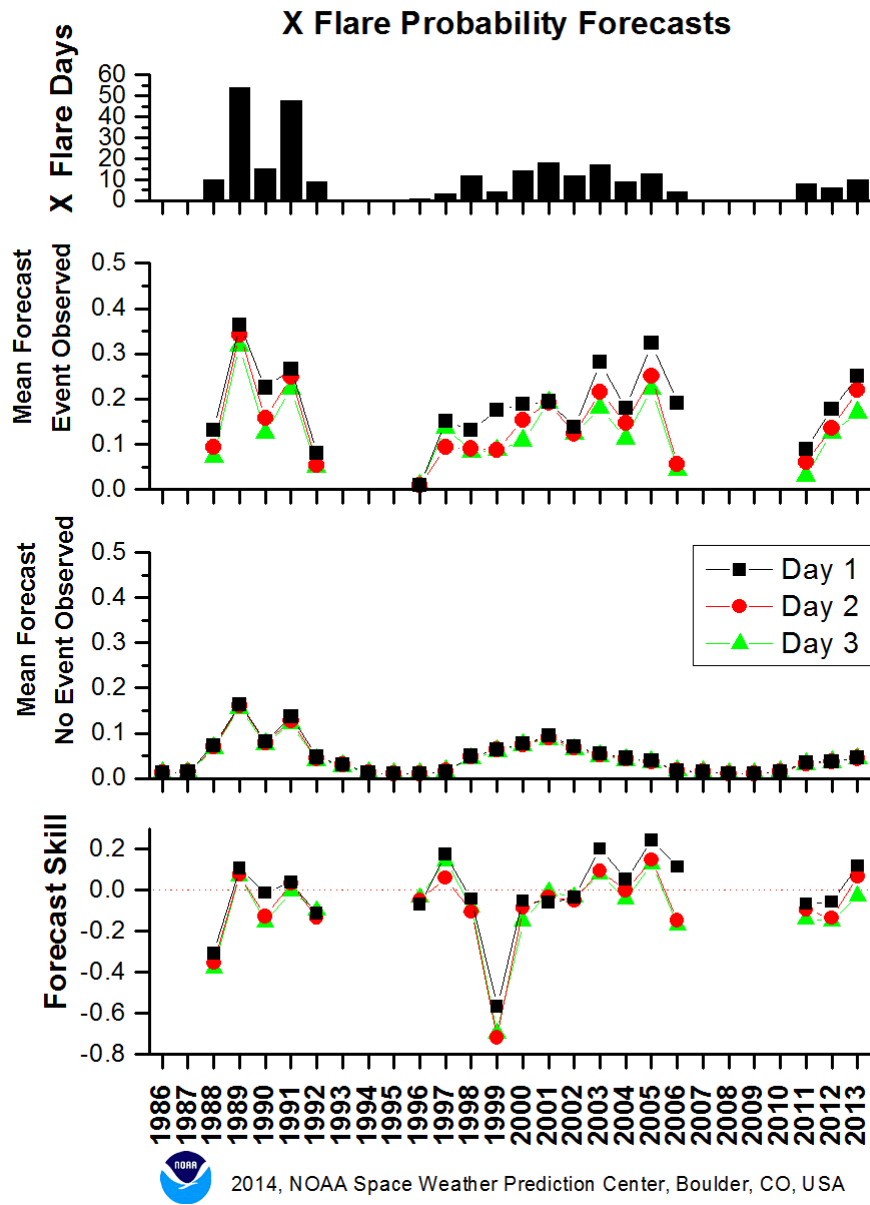


Next-day (1-day lead time) X flare forecast "reliability" during the period 1986 to 2013. The top panel plots the observed relative frequency of X flare days (days on which an X flare occurred) against their corresponding forecasts, grouped in 5% (0.05) bins. The dashed diagonal line represents perfect correspondence. Points falling below the diagonal indicate a tendency of the forecasts within that bin to overpredict the occurrence of X flares while points above the diagonal indicate underprediction. The error bars in the top panel correspond to the standard error associated with the number of forecasts in each bin. The number of forecasts in each bin is plotted in the bottom panel histogram. Note that the histogram Y-axis scale is logarithmic.

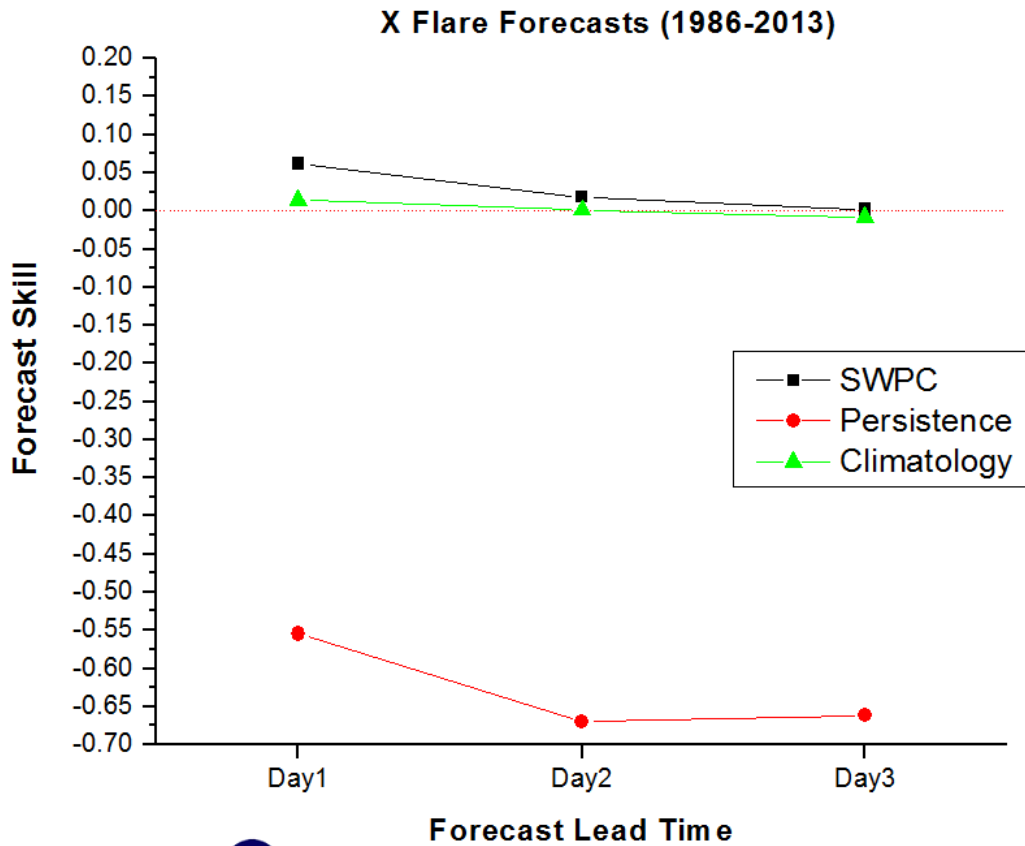



 2014, NOAA Space Weather Prediction Center, Boulder, CO, USA

These plots show the annual trend, from 1986 to 2013, of various verification metrics for X flare forecasts with lead times of one to three days. The top panel plots the number of days on which an X flare occurred during the year (event climatology), the second panel plots the mean error (or bias) of the forecasts, the third panel shows the mean square error of the forecasts, and the bottom panel displays the linear association (correlation) between the forecasts and observations.



These plots show the annual trend, from 1986 to 2013, of various verification metrics for X flare forecasts with lead times of one to three days. The top panel plots the number of days on which an X flare occurred during the year (event climatology), the second panel plots the mean value of the forecasts associated with days on which an X flare occurred, the third panel plots the mean value of the forecasts associated with days on which an X flare did not occur, and the bottom panel displays annual SWPC forecast skill relative to sample climatology forecasts (prediction efficiency).



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

This plot shows SWPC forecast skill as a function of lead-time for X flare probability forecasts during the period 1986 to 2013. The skill of forecasts produced by SWPC is compared to that of forecasts produced by short-term (30-day) climatology and 1-day persistence. 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.