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Comparison of Weather Research Center's [WRC] OCSI Atlantic Annual Seasonal Hurricane Forecasts with Colorado State Professor Bill Gray's Seasonal Forecasts

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The following is a comparison of Weather Research Center's [WRC] Orbital Cyclone Strike Index [OCSI] Atlantic hurricane outlook to William Gray's Atlantic Seasonal hurricane outlooks. The number of tropical cyclones, number of hurricanes, number of tropical storm days, and number of hurricane days each year were also compared. WRC's forecast were compared to the forecast made by Colorado State Professor Bill Gray, and the forecast based on historical climatology, for the twenty four years from 1984 to 2007.

Over a twenty three year period the forecasts generated by WRC's OCSI model are as accurate, or even more accurate than Professor Gray's model. Gray's spring forecast was used for this comparison since Gray updates and modifies his forecast through out the season and WRC does not. The advantage of the OCSI model is that WRC's model can make a prediction years in advance. Table 1 gives an overall summary of the forecast comparisons shown in Tables 2 through 5. Table 1 includes the number of years that each model was closest within the limits indicated.

There were nine years out of the twenty-three years when WRC's forecast of the number of named storms in the Atlantic was within plus or minus one storm and Professor Gray's forecast of the number of named storms was only within one storm six out of the twenty-three years. The forecast based on climatology [the average number of named storms in the Atlantic which is 10] was only within one storm three of the twenty-three years. The Atlantic hurricane seasons number of named storms observed each year versus the number predicted by Weather Research Center, Professor Gray and climatology are shown in Table 2 for 1984 through 2006. Figure 1 is a graph comparing the plus or minus error in the forecast number of named storms versus the number of observed named storms. A positive number indicates when there were fewer observed cyclones than predicted. A negative number indicates when there were more observed cyclones than predicted.

The number of hurricanes expected each year in the Atlantic was also predicted by both WRC and Professor Gray. The number of hurricanes forecast by WRC verified within one hurricane eleven out of the twenty-three years and within one hurricane nine of the twenty three years with Professor Gray's method. Climatology with 6 hurricanes expected each

year on average was within one hurricane six out of the 23 years. Table 3 is a list by year from 1984 to 2006 of the number of observed hurricanes versus the number of predicted hurricanes each year.

Table 4 lists the observed number of hurricane days and compares WRC's, Professor Gray's forecasts, and climatology each year from 1984 to 2006. WRC's forecast of the number of expected hurricane days verified within plus or minus five days in nine of the twenty-three years. Professor Gray's forecast verified as being within five days six of the twenty three years. The yearly average of expected hurricane days is 25. Using this average as the forecast, the number of hurricane days were plus or minus five days in five out of the twenty-three years.

Table 5 lists the observed number of storm days in the Atlantic as opposed to WRC's and Professor Gray's forecast of the number of expected storm days. WRC's model forecast the number of storm days within ten days for ten of the twenty-three years. Professor Gray's model forecast the number of storm days within ten days for seven of the twenty-three years. Based on climatology one would expect an average of 49 storm days in the Atlantic each year. Using this as a forecast, the number of storm days forecast is six out of the twenty-three years.

As can be seen in Tables 1 through 5 and in Figure 1, WRC' OCSI forecasts are more accurate than Gray's early season forecasts [Forecast issued by May]. The advantage of WRC's OCSI forecast is that predications can be made years in advance.

The OCSI was developed in the mid 80's to predict which section of the United States Coast had the highest probability of experiencing landfall of a tropical storm or hurricane in a particular year. The index was developed using the sun spot cycle as an indication of the orbit of the sun around the center of the solar system and corresponds to the phase's in the sun's orbit. This leads to the premise is that the sunspot cycle is caused by orbital influences. Large scale circulation patterns of the earth are also subjected to these orbital influences which would then influence the tracks of cyclones. The OCSI index was developed using the year of the sunspot minimum as Phase 1 of the index.

WRC has been making predictions each year since 1984 for which coast has the highest risk of experiencing a tropical storm or hurricane. There have only been 3 years since 1984 when a tropical cyclone did not make landfall on the section of the coast with the highest probability. Those years were 1987, 1992, and 1999. WRC's accurracy rate for these predictions is of 87%.

Table 1. Summary of Model Comparison

# of Storms in Atlantic within 1 storm	**WRC OCSI** 9 Years	**CLIMATOLOGY** 3 years	**Gray's Fcst** 6 years
# hurricanes in Atlantic within 1 storm	11 years	6 years	9 years
# of hurricane days with 5 days	9 years	5 years	6 years
# of storm days within 10 days	10 years	6 years	7 years

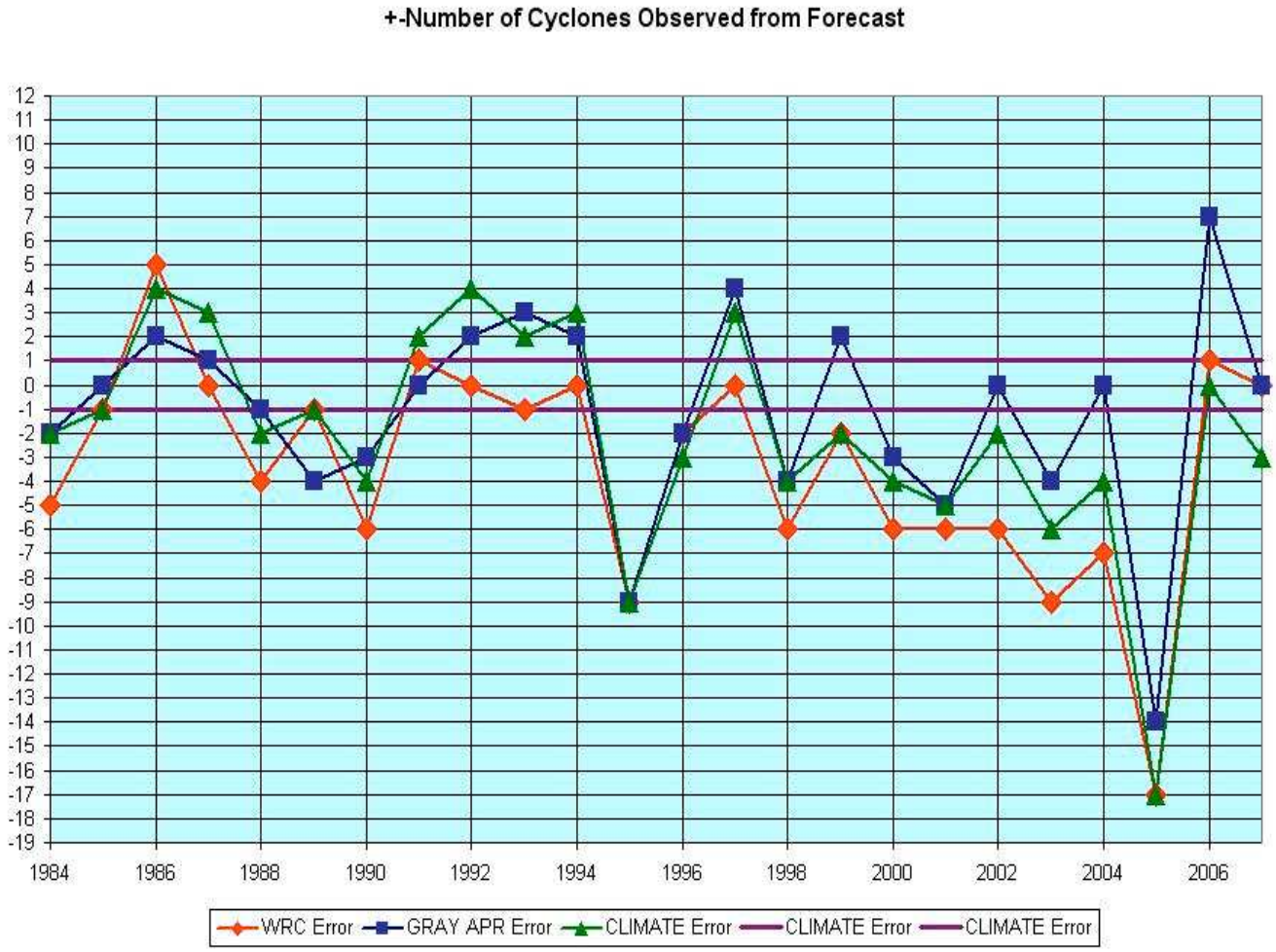

Figure 1: Comparison of the Error on the number of forecast storm.

Table 2: Number of Named Storms in the Atlantic

Year	OBS	WRC FCST	WRC Error	Gray APR FCST	GRAY APR Error	CLIMATE Error 10
1984	12	7	-5	10	-2	-2
1985	11	10	**-1**	11	**0**	**-1**
1986	6	11	5	8	2	4
1987	7	7	**0**	8	**1**	3
1988	12	8	-4	11	**-1**	-2
1989	11	10	**-1**	7	-4	**-1**
1990	14	8	-6	11	-3	-4
1991	8	9	**1**	8	**0**	2
1992	6	6	**0**	8	2	4
1993	8	7	**-1**	11	3	2
1994	7	7	**0**	9	2	3
1995	19	10	-9	10	-9	-9
1996	13	11	-2	11	-2	-3
1997	7	7	**0**	11	4	3
1998	14	8	-6	10	-4	-4
1999	12	10	-2	14	2	-2
2000	14	8	-6	11	-3	-4
2001	15	9	-6	10	-5	-5
2002	12	6	-6	12	**0**	-2
2003	16	7	-9	12	-4	-6
2004	14	7	-7	14	**0**	-4
2005	27	10	-17	13	-14	-17
2006	10	9	**-1**	17	7	**0**
2007	7	7	**0**	17	-10	-3

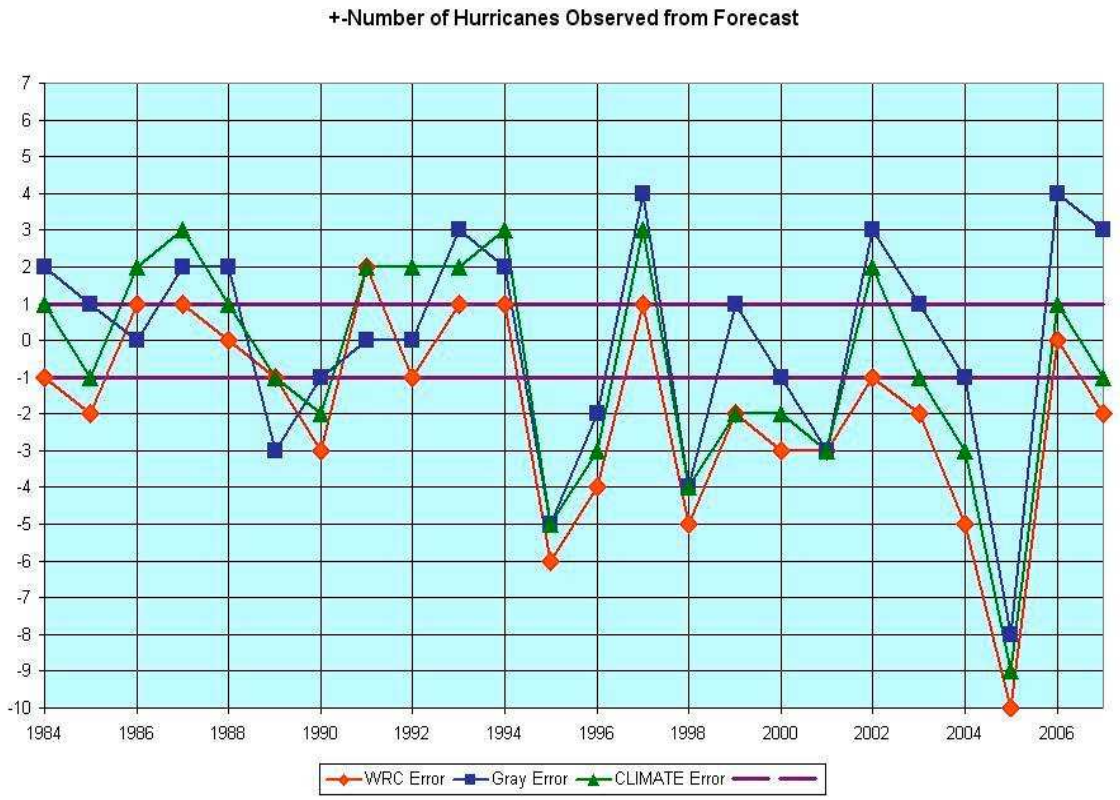

Table 3: Number of Hurricanes in the Atlantic Basin

Year	OBS	WRC FCST	WRC Error	Gray Apr/Jun	Gray Error	CLIMATE Error 6
1984	**5**	4	**-1**	7	2	**1**
1985	**7**	5	-2	8	**1**	**-1**
1986	**4**	5	**1**	4	**0**	2
1987	**3**	4	**1**	5	2	3
1988	**5**	5	**0**	7	2	**1**
1989	**7**	6	**-1**	4	-3	**-1**
1990	**8**	5	-3	7	**-1**	-2
1991	**4**	6	2	4	**0**	2
1992	**4**	3	**-1**	4	**0**	2
1993	**4**	5	**1**	7	3	2
1994	**3**	4	**1**	5	2	3
1995	**11**	5	-6	6	-5	-5
1996	**9**	5	-4	7	-2	-3
1997	**3**	4	**1**	7	4	3
1998	**10**	5	-5	6	-4	-4
1999	**8**	6	-2	9	**1**	-2
2000	**8**	5	-3	7	**-1**	-2
2001	**9**	6	-3	6	-3	-3
2002	**4**	3	**-1**	7	3	2
2003	**7**	5	-2	8	**1**	**-1**

2004	**9**	4	-5	8	**-1**	-3
2005	**15**	5	-15	7	-8	-9
2006	**5**	4	**-1**	9	4	**1**
2007	**6**	4	-2			

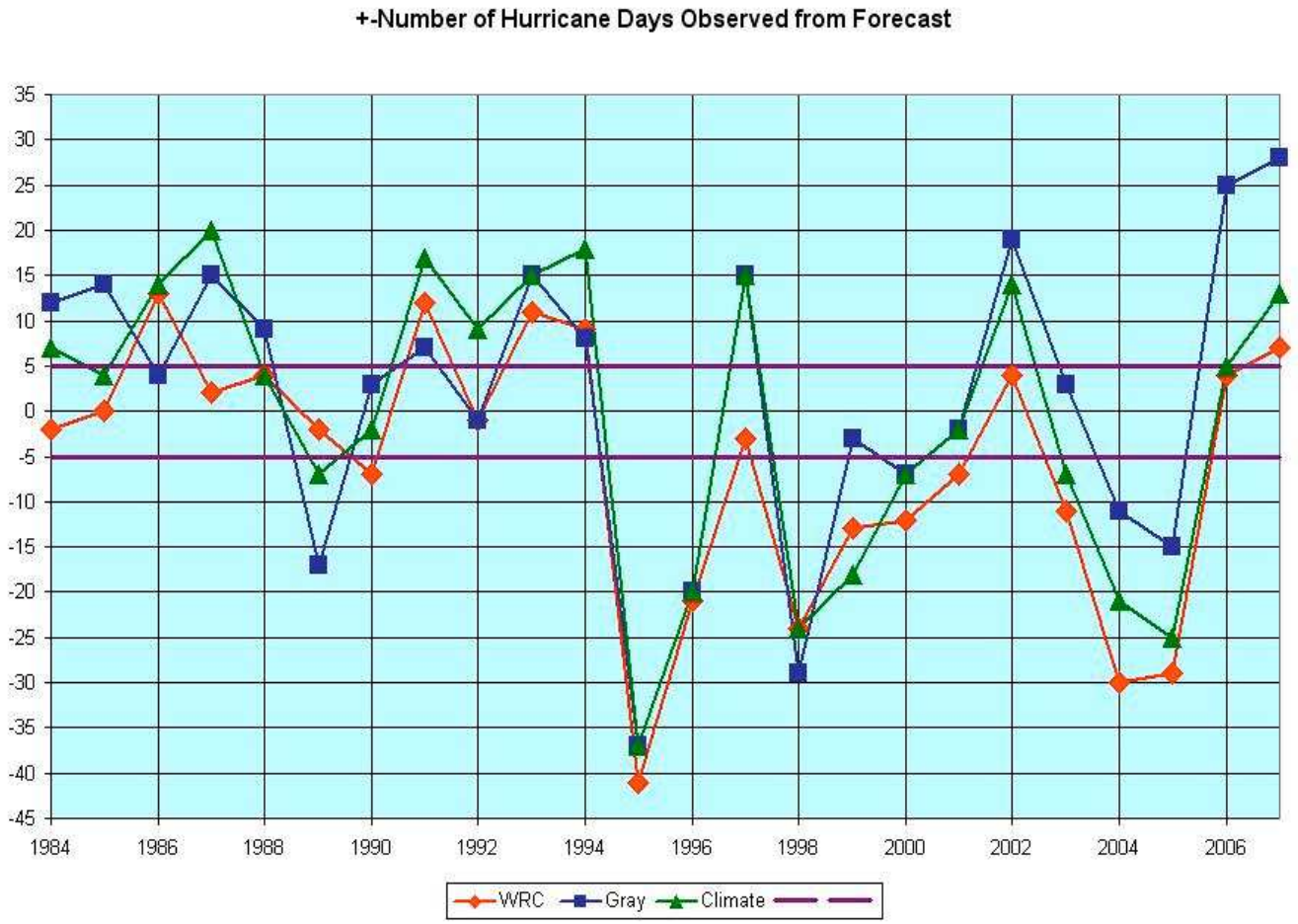

Table 4: Number of Hurricane Days

Year	OBS	WRC FCST	WRC Error Plus/Minus Days	Gray Apr/Jun FCST	Gray Error Plus/Minus Days	Climate Error 25
1984	**18**	16	**-2**	30	12	7
1985	**21**	21	**0**	35	14	**4**
1986	**11**	24	13	15	**4**	14
1987	**5**	7	**2**	20	15	20
1988	**21**	25	**4**	30	9	**4**
1989	**32**	30	**-2**	15	-17	-7
1990	**27**	20	-7	30	**3**	**-2**
1991	**8**	20	12	15	7	17
1992	**16**	15	**-1**	15	**-1**	9
1993	**10**	21	11	25	15	15
1994	**7**	16	9	15	8	18
1995	**62**	21	-41	25	-37	-37
1996	**45**	24	-21	25	-20	-20
1997	**10**	7	**-3**	25	15	15
1998	**49**	25	-24	20	-29	-24
1999	**43**	30	-13	40	**-3**	-18
2000	**32**	20	-12	25	-7	-7
2001	**27**	20	-7	25	**-2**	**-2**
2002	**11**	15	**4**	30	19	14
2003	**32**	21	-11	35	**3**	-7
2004	**46**	16	-30	35	-11	-21
2005	**50**	21	-29	35	-15	-25
2006	**20**	16	**-4**	45	25	**5**
2007	**32**	20	-12			

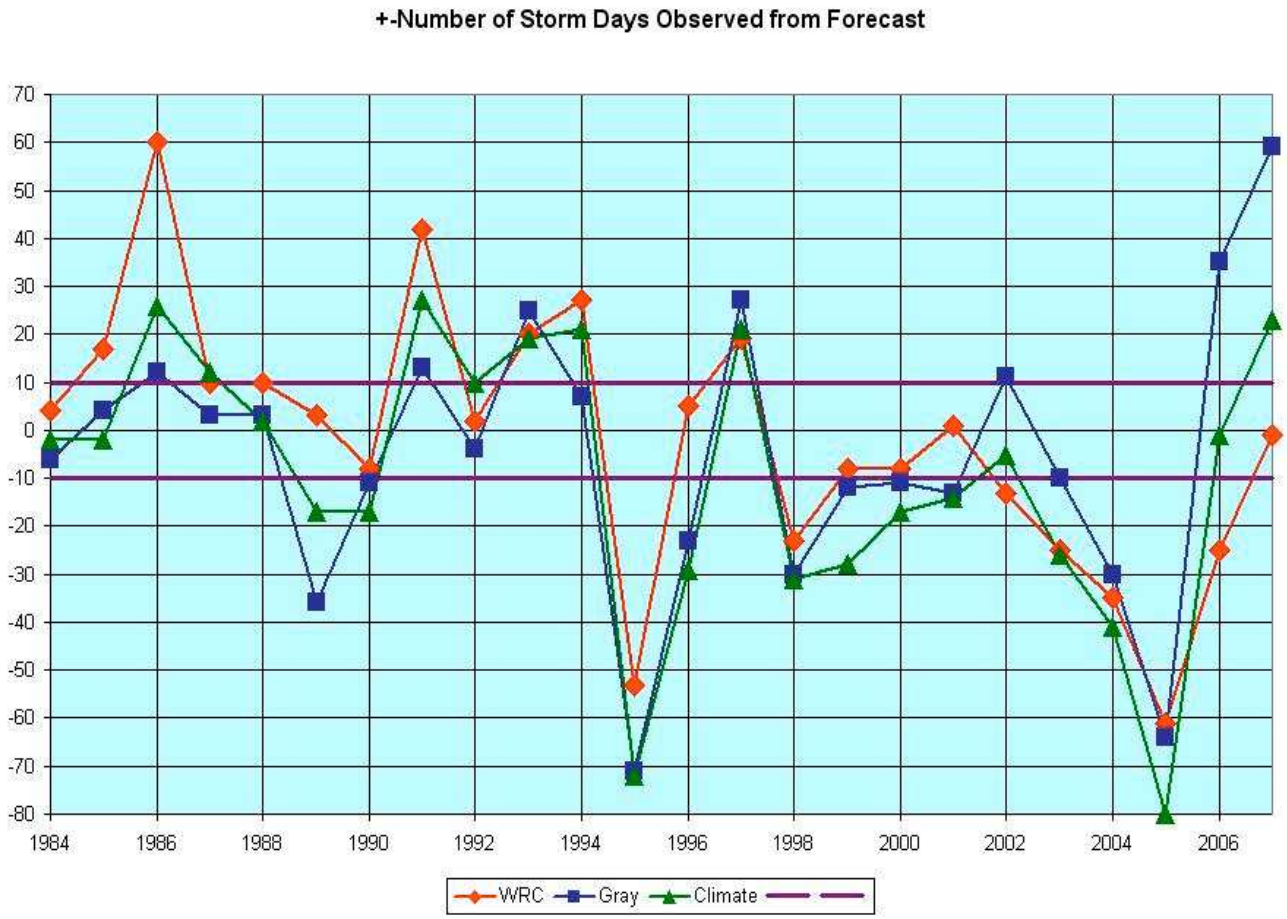

Table 5: Number of Storm Days in the Atlantic

Year	OBS	WRC FCST	WRC Error Plus/Minus Days	Gray Apr/Jun FCST	Gray Error Plus/Minus Days	Climate Error 49
1984	**51**	55	**4**	45	**-6**	**-2**
1985	**51**	68	17	55	**4**	**-2**
1986	**23**	83	60	35	12	26
1987	**37**	47	**10**	40	**3**	12
1988	**47**	57	**10**	50	**3**	**2**
1989	**66**	69	**3**	30	-36	-17
1990	**66**	58	**-8**	55	-11	-17

1991	**22**	64	42	35	13	27
1992	**39**	41	**2**	35	**-4**	**10**
1993	**30**	50	20	55	25	19
1994	**28**	55	27	35	**7**	21
1995	**121**	68	-53	50	-71	-72
1996	**78**	83	**5**	55	-23	-29
1997	**28**	47	19	55	27	21
1998	**80**	57	-23	50	-30	-31
1999	**77**	69	**-8**	65	-12	-28
2000	**66**	58	**-8**	55	-11	-17
2001	**63**	64	**1**	50	-13	-14
2002	**54**	41	-13	65	11	**-5**
2003	**75**	50	-25	65	**-10**	-26
2004	**90**	55	-35	60	-30	-41
2005	**129**	68	-61	65	-64	-80
2006	**50**	25	-25	85	35	**-1**
2007						

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