## Creation of a Statistical Ensemble for Tropical Cyclone Intensity Prediction

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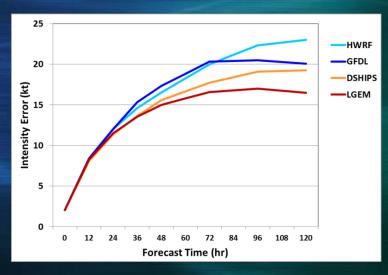




### Motivation for Statistical Ensemble

- The Logistic Growth Equation Model (LGEM) and the Statistical Hurricane Intensity Prediction Scheme (SHIPS) model are two statistical-dynamical intensity guidance models
- SHIPS and LGEM are competitive with dynamical models
- Both SHIPS and LGEM use model fields from the Global Forecast System (GFS) to determine the large-scale environment
- Runs extremely fast (under 1 minute), using model fields from previous 6 hr run to produce 'early' guidance

Atlantic Operational Intensity
Model Errors 2007-2011

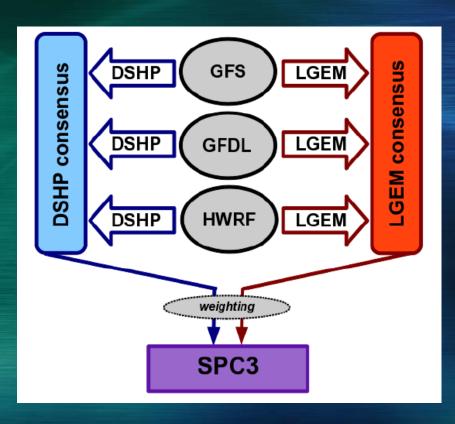


 JTWC experience with a similar statistical model shows improvements with multiple inputs

We focus on using Decay-SHIPS (DSHP) and LGEM, initialized with model fields from GFS, the Hurricane Weather Research and Forecasting (HWRF) model, and the Geophysical Fluid Dynamics Laboratory (GFDL) model to create an ensemble

# **SPICE** (Statistical Prediction of Intensity from a Consensus Ensemble)

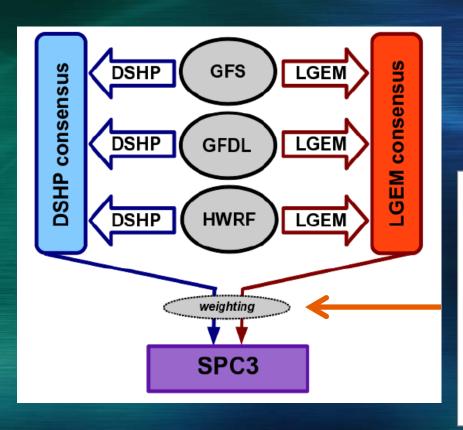
#### **Model Configuration for Consensus**



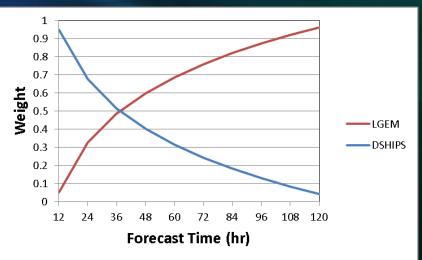
- SPICE forecasts TC intensity using a combination of parameters from:
  - Current TC intensity and trend
  - Current TC GOES IR
  - TC track and large-scale environment from GFS, GFDL, and HWRF models
- These parameters are used to run DSHP and LGEM based off each dynamical model
- The forecasts are combined into two unweighted consensus forecasts, one each for DSHP and LGEM
- The two consensus are combined into the weighted SPC3 forecast

# **SPICE** (Statistical Prediction of Intensity from a Consensus Ensemble)

#### **Model Configuration for Consensus**



## DSHP and LGEM Weights for Consensus



Weights determined empirically from 2008-2010 Atlantic and East Pacific sample

```
(HR)
          (DEG)
                                                                       22.8
                                                                                     23.9
                                                                                                                        27.8
                                                                              23.4
                                                                                            24.3
MAXWIND
          (KM)
                      164
                                    152
                                           147
                                                                                       38
                                                                                                                                  53
                                                                                                                                                                            74
MIN SLP
SHR MAG
                                     19
                                             20
                                                           17
                                                                                       14
                                                                                              11
                                                                                                            17
                                                                                                                           22
                                                                                                                                                27
                                                                                                                                                                     39
SHR DIR
          (DEG
                                    235
                                                                               254
                                                                                             246
                                                                                                                          209
                                                                                                                                 190
                                                                                                                                        180
STM SPD
                       11
                                     12
                                            10
                                                   10
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                                                                                                                           15
                                                                                                                                  15
STM HDG
          (DEG)
                             321
                                    333
                                            333
                                                                 328
                                                                        317
                                                                               308
                                                                                      306
                                                                                             336
                                                                                                                                                19
                                                                                                                                                              37
                                                                                                                                                                          9999
                                                                                      289
SST
          (10C)
                      294
                             291
                                    291
                                            291
                                                          292
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                                                                                             288
                                                                                                           285
                                                                                                                          283
OHC
                     9999
                                          9999
                                                                       9999
                                                                                     9999
                                                                                            9999
                                                                                                          9999
                                                                                                                         9999
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                                                                                                                                       9999
                                                                                                                                              9999
                                                                                                                                                            9999
          (KJ/CM2)
                                   9999
TPW
                                          9999
                                                                9999
                                                                                     9999
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                                                                                                                                9999
                                                                                                                                                            9999
         (10M/S)
                                    107
                                                                        117
                                                                                             134
                                                                                                                         151
                                                                                                                                        168
                                                                                                                                                             177
                                                                                                                                                                    177
                                                                                                                                                                           180
850TANG
                                                          116
                                                                 114
                                                                               122
                                                                                                                  154
                                                                                                                                                                           113
850VORT
200DVRG (/S)
                                                                                                                                        107
                                                                                       0400
                                                                                                                    0150
                                                    0700
                                                                           0500
                                                                                                                                                                           126
                                    286
                                                                 284
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                                                                                                                                                                           209
T SURF
          (10C)
                                                          284
                                                                                                                           79
R SURF
P SURF
          (MB)
                                   1013
                                                        1016
                                                                       1017
                                                                              1014
                                                                                     1016
                                                                                                                         1010
                                                                                                                                1011
                                                                                                                                       1009
                                                                                                                                             1010
                                                                                                                                                            1009
                                                                                                                                                                   1008
                                                                                                                                                                          1009
U SURF
          (10KT)
                                   -121
                                          -112
                                                  -105
                                                         -102
                                                                 -85
                                                                        -85
                                                                               -85
                                                                                      -82
                                                                                             -68
                                                                                                            -68
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                                                                                                                                 -37
                                                                                                                                        -13
                                                                                                                                                                           106
V SURF
                                                                                                                                  25
                             277
  1000
                                    274
                                            270
                                                   269
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                                                                                                                                 265
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                                                                                                                                               264
                                                                                                                                                                           210
R 1000
                                     75
                                                                                       81
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                                                                                                                           79
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                                                                                                                                                                            81
Z 1000
                                     11
                                            13
                                                    13
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                                                                                      -99
                                                                                                                          -68
                                                                                                                                 -43
                                                                                                                                                                           121
V 1000
                               -5
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                                                                                                                                  32
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T 0950
                                                          227
                                                                 225
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	*	HWRI AL14		1091018 MARIA																			
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													TA										
NTIME OF	22 DFI.T	AT 006																					
TIME	(HR)	0	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120	126
LAT	(DEG)	17.5	18.3	19.0	20.1	21.0	21.7	22.2	22.8	23.4	23.9	24.3	24.9	25.7	26.6	27.8	29.3	30.8	32.4	34.1	36.0	38.2	40.9
LON MAXWIND	(DEG)	298.1	297.3		296.1 42		294.9	294.4	294.0	293.4	292.7 71	292.1 76	291.8	291.4	291.3	291.1	291.1	291.2 92	291.7 91	292.4	293.8	295.9	299.0 91
RMW	(KI)	41 164	142	41 152	147	44 132	89	48	49	51	38	41	41	46	52	52	53	56	59	64	67	66	74
MIN SLP		1006	1005	1003	1004	1001	997	990	987	979	970	962	956	951	951	945	945	942	942	943	946	946	951
SHR MAG		18	19	19	20	18	17	16	16	16	14	11	12	17	20	22	25	28	27	26	32	39	44
SHR_DIR	(DEG)	237	229	235	244	246	248	260	246	254	253	246	227	221	223	209	190	180	183	180	180	189	202
STM_SPD	(KT)	11	9	12	10	10	7	7	8	8	7	7	9	9	12	15	15	17	18	22	28	36	9999
STM_HDG	(DEG)	316	321	333	333	317	317	328	317	308	306	336	336	354	352	0	3	15	19	31	37	42	9999
SST	(10C)	294	291	291	291	290	292	291	290	290	289	288	285	285	284	283	282	278	275	273	275	258	250
OHC	(KJ/CM2) (MM)	9999	9999 9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999 9999	9999	9999	9999	9999 9999
LAND	(KM)	9999 412	316	264	275	324	368	413	478	529	538	551	604	9999 680	776	906	941	837	780	775	730	601	453
850TANG		104	108	107	102	109	116	114	117	122	130	134	142	148	154	151	157	168	170	170	177	177	180
850VORT	(/S)	18	15	8	-1	3	9	5	2	11	19	16	26	49	66	61	68	80	77	72	91	98	113
200DVRG	(/S)	90	61	34	48	71	64	50	39	39	31	29	29	57	48	62	77	107	106	105	138	145	137
											SC	UNDING	DATA										
NLEV 020	SURF 10	00 0950	0900	0850 0	800 07	750 070	0 0650	0600	0550 0	500 04	150 040	0 0350	0300	0250	200 0	150 010	00						
TIME	(HR)	0	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120	126
T_SURF	(10C)	287	286	286	285	284	284	284	283	283	282	282	281	280	279	277	274	271	267	261	249	233	209
R_SURF	(육)	79	79	79	79	78	78	78	78	78	78	78	78	78	79	79	78	78	78	78	78	76	74
P_SURF	(MB)	1012	1013	1013	1015	1015	1016	1015	1017	1014	1016	1013	1014	1012	1013	1010	1011	1009	1010	1008	1009	1008	1009
U_SURF	(10KT)	-117	-121	-121	-112	-105	-102	-85	-85	-85	-82	-68	-65	-68	-75	-59	-37	-13	-2	39	60	85	106
V_SURF	(10KT)	11	-5	13	17	19	260	28	12	22	15	29	19	23	26	35	25	26	31	48	30	24	26
T_1000 R 1000	(10C) (%)	277 73	277 73	274 75	270 77	269 78	269 79	266 80	264 81	266 81	267 81	266 81	265 81	268 80	269 79	267 79	265 78	265 76	264 75	257 78	242 80	229 80	210 81
Z 1000	(DM)	11	12	11	13	13	14	13	15	12	14	11	13	10	11	9	10	8	9	7	8	7	7
U 1000	(10KT)	-141	-143	-142	-132	-124	-122	-101	-102	-101	-99	-81	-78	-80	-89	-68	-43	-14	-1	45	70	96	121
V_1000	(10KT)	14	-5	17	23	24	13	35	17	27	19	35	25	29	34	44	32	32	40	58	39	32	35
T_0950	(10C)	235	235	232	228	228	227	225	223	225	226	225	224	226	227	226	224	224	223	217	204	192	175
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	*	HWRI AL1		L091018 MARIA																			
											SI	ORM DA	TA										
	FIME 022 DELTAT 006																						
NTIME (			_	10	10	2.4	20	26	40	40	F.4			70	7.0	0.4	00	0.0	100	100	114	100	100
LAT	(HR) (DEG)	17.5	18.3	19.0	20.1	21.0	21.7	22.2	22.8	23.4	23.9	24.3	24.9	72 25.7	78 26.6	27.8	90 29.3	96 30.8	102 32.4	108 34.1	36.0	120 38.2	126 40.9
LON	(DEG)				296.1						292.7	292.1			291.3		291.1		291.7	292.4	293.8		299.0
MAXWINI		41	45	41	42	99	49	52	56	63	71	76	83	83	93	91	93	92	91	95	99	98	91
RMW	(KM)	164	142	152	147	132	89	48	49	51	38	41	41	46	52	52	53	56	59	64	67	66	74
MIN_SLE		1006	1005	1003	1004	1001	997	990	987	979	970	962	956	951	951	945	945	942	942	943	946	946	951
SHR_MAG		18	19	19	20	18	17	16	16	16	14	11	12	17	20	22	25	28	27	26	32	39	44
SHR_DIE STM SPI		237 11	229	235 12	244 10	246 10	248	260	246	254	253	246	227	221	223 12	209 15	190 15	180 17	183 18	180 22	180 28	189 36	202 9999
STM_SPI		316	321	333	333	317	317	328	317	308	306	336	336	354	352	15	3	15	19	31	37	42	9999
SST	(10C)	294	291	291	291	290	292	291	290	290	289	288	285	285	284	283	282	278	275	273	275	258	250
OHC	(KJ/CM2)	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
TPW	(MM)	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
LAND	(KM)	412	316	264	275	324	368	413	478	529	538	551	604	680	776	906	941	837	780	775	730	601	453
850TAN	(10M/S)	104	108	107	102	109	116	114	117	122	130	134	142	148	154	151	157	168	170	170	177	177	180
850VOR1	(/S)	18	15	8	-1	3	9	5	2	11	19	16	26	49	66	61	68	80	77	72	91	98	113
200DVR0	(/S)	90	61	34	48	71	64	50	39	39	31	29	29	57	48	62	77	107	106	105	138	145	137
											50	OUNDING	DATA										
NLEV 02	0 SURF 10	00 0950	0900	0850 0	800 07	750 070	0 0650	0600	0550 0	500 04	150 040	0 0350	0300	0250 (	0200 0	150 010	00						
TIME	(HR)	0	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120	126
T_SURF	(10C)	287	286	286	285	284	284	284	283	283	282	282	281	280	279	277	274	271	267	261	249	233	209
R_SURF	(%)	79	79	79	79	78	78	78	78	78	78	78	78	78	79	79	78	78	78	78	78	76	74
P_SURF	(MB)	1012	1013	1013	1015	1015	1016	1015	1017	1014	1016	1013	1014	1012	1013	1010	1011	1009	1010	1008	1009	1008	1009
U_SURF	(10KT)	-117	-121	-121	-112	-105	-102	-85	-85	-85	-82	-68	-65	-68	-75	-59	-37	-13	-2	39	60	85	106
V_SURF	(10KT)	11	-5	13	17	19	9	28	12	22	15	29	19	23	26	35	25	26	31	48	30	24	26
T_1000	(10C)	277	277 73	274	270	269	269	266	264	266	267	266	265	268	269	267	265	265	264	257	242	229	210 81
R_1000 Z 1000	(%) (DM)	73 11	12	75 11	77 13	78 13	79 14	80 13	81 15	81 12	81 14	81 11	81 13	80 10	79 11	79 9	78 10	76 8	75 9	78 7	80	80 7	7
U 1000	(10KT)	-141	-143	-142	-132	-124	-122	-101	-102	-101	-99	-81	-78	-80	-89	-68	-43	-14	-1	45	70	96	121
V 1000	(10KT)	14	-145	17	23	24	13	35	17	27	19	35	25	29	34	44	32	32	40	58	39	32	35
T 0950	(10C)	235	235	232	228	228	227	225	223	225	226	225	224	226	227	226	224	224	223	217	204	192	175
_																							

	*	HWRF	2011	.091018	*																			
	*	AL14		MARIA	*																			
	STORM DATA																							
													DATA											
NTIME 02		AT 006	_																					
TIME	(HR)	0	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120	126	
LAT	(DEG)	17.5	18.3	19.0	20.1	21.0	21.7	22.2	22.8	23.4	23.9	24.3	24.9	25.7	26.6	27.8	29.3	30.8	32.4	34.1	36.0	38.2	40.9	
LON MAXWIND	(DEG)	298.1 41	297.3 45	296.7 41	296.1 42	295.6	294.9	294.4	294.0	293.4	292.7 71	292.1 76	291.8	291.4	291.3	291.1	291.1	291.2	291.7	292.4	293.8	295.9	299.0 91	
RMW	(KI)	164	142	152	147	132	89	48	49	51	38	41	41	46	52	52	53	56	59	64	67	66	74	
MIN SLP		1006	1005	1003	1004	1001	997	990	987	979	970	962	956	951	951	945	945	942	942	943	946	946	951	
SHR MAG		18	19	19	20	18	17	16	16	16	14	11	12	17	20	22	25	28	27	26	32	39	44	
SHR DIR		237	229	233	211	210	248	200	210	251	255	210	227	221	223	209	190	180	183	180	180	189	202	
STM SPD	(KT)	11	9	12	10	10	7	7	8	8	7	7	9	9	12	15	15	17	18	22	28	36	9999	
STM_HDG	(DEG)	316	321	333	333	317	317	328	317	308	306	336	336	354	352	0	3	15	19	31	37	42	9999	
SST	(10C)	294	291	291	291	290	292	291	290	290	289	288	285	285	284	283	282	278	275	273	275	258	250	
OHC	(KJ/CM2)	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	
TPW	(MM)	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	
LAND	(KM)	412	316	264	275	324	368	413	478	529	538	551	604	680	776	906	941	837	780	775	730	601	453	
850TANG		104	108	107	102	109	116	114	117	122	130	134	142	148	154	151	157	168	170	170	177	177	180	
850VORT		18	15	8	-1	3	9	5	2	11	19	16	26	49	66	61	68	80	77	72	91	98	113	
200DVRG	(/5)	90	61	34	48	71	64	50	39	39	31	29	29	57	48	62	77	107	106	105	138	145	137	
	_										80	UNDING	מדמם											
											50	ONDING	DAIA											
NLEV 020	SURF 100	0 0950	0900	0850 0	800 07	750 070	0 0650	0600	0550 0	500 04	50 040	0 0350	0300	0250	200 0	150 010	00							
TIME	(HR)	0	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120	126	
T_SURF	(10C)	287	286	286	285	284	284	284	283	283	282	282	281	280	279	277	274	271	267	261	249	233	209	
R_SURF	(%)	79	79	79	79	78	78	78	78	78	78	78	78	78	79	79	78	78	78	78	78	76	74	
P_SURF	(MB)	1012	1013	1013	1015	1015	1016	1015	1017	1014	1016	1013	1014	1012	1013	1010	1011	1009	1010	1008	1009	1008	1009	
U_SURF	(10KT)	-117	-121	-121	-112	-105	-102	-85	-85	-85	-82	-68	-65	-68	-75	-59	-37	-13	-2	39	60	85	106	
V_SURF	(10KT)	11	-5	13	17	19	9	28	12	22	15	29	19	23	26	35	25	26	31	48	30	24	26	
T_1000	(10C)	277	277	274	270	269	269	266	264	266	267	266	265	268	269	267	265	265	264	257	242	229	210	
R_1000	(%)	73	73	75	77	78	79	80	81	81	81	81	81	80	79	79	78	76	75	78	80	80	81	
Z_1000 U 1000	(DM)	11	12 -143	11 -142	13 -132	13 -124	14 -122	13 -101	15 -102	12 -101	14 -99	11 -81	13 -78	10 -80	11 -89	9 -68	10 -43	8 -14	9 -1	7 45	8 70	7 96	121	
V 1000	(10KT) (10KT)	-141 14	-143 -5	-142 17	23	-124 24	13	35	17	27	-99 19	-81 35	25	-80 29	-89 34	-68 44	-43 32	32	40	58 58	39	32	35	
T 0950	(10K1) (10C)	235	235	232	228	228	227	225	223	225	226	225	224	226	227	226	224	224	223	217	204	192	175	
1_0300	(200)	200	200	202	220	220	221	223	223	220	220	225	221	220	221	220	221	227	223	211	201	102	175	

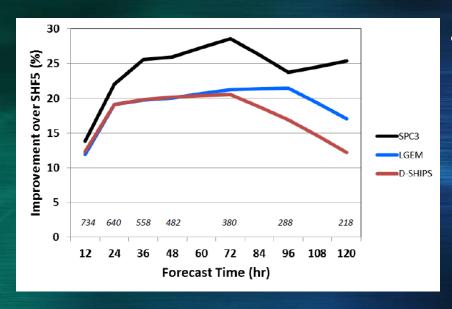
														_									
	*	HWRF	2011	091018	*																		
	*	AL14		MARIA	*																		
											C.T	ODM DA	T.3										
	STORM DATA -																						
NTIME 02	2 DELT	AT 006																					
TIME	(HR)	0	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120	126
LAT	(DEG)	17.5	18.3	19.0	20.1	21.0	21.7	22.2	22.8	23.4	23.9	24.3	24.9	25.7	26.6	27.8	29.3	30.8	32.4	34.1	36.0	38.2	40.9
LON	(DEG)	298.1		296.7	296.1	295.6	294.9	294.4	294.0	293.4	292.7	292.1	291.8	291.4	291.3	291.1	291.1	291.2	291.7	292.4	293.8	295.9	299.0
MAXWIND	(KT)	41	45	41	42	44	49	52	56	63	71	76	83	83	93	91	93	92	91	95	99	98	91
RMW	(KM)	164	142	152	147	132	89	48	49	51	38	41	41	46	52	52	53	56	59	64	67	66	74
_	(MB)	1006	1005	1003	1004	1001	997	990	987	979	970	962	956	951	951	945	945	942	942	943	946	946	951
_	(KT)	18 237	19 229	19 235	20 244	18	17 248	16 260	16 246	16 254	14 253	11 246	12 227	17 221	20 223	22 209	25 190	28 180	27 183	26 180	32 180	39 189	44 202
STM SPD	(DEG) (KT)	11	229	12	10	246 10	240	200	240	234	253	240 7	9	221	12	15	150	17	18	22	28	36	9999
_	(DEG)	316	321	333	333	317	317	328	317	308	306	336	336	354	352	0	3	15	19	31	37	42	9999
SST	(10C)	294	291	291	291	290	292	291	290	290	289	288	285	285	284	283	282	278	275	273	275	258	250
OHC	(KJ/CM2)	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
TPW	(MM)	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
LAND	(KM)	412	316	264	275	324	368	413	478	529	538	551	604	680	776	906	941	837	780	775	730	601	453
850TANG	(10M/S)	104	108	107	102	109	116	114	117	122	130	134	142	148	154	151	157	168	170	170	177	177	180
	(/S)	18	15	8	-1	3	9	5	2	11	19	16	26	49	66	61	68	80	77	72	91	98	113
200DVRG	(/S)	90	61	34	48	71	64	50	39	39	31	29	29	57	48	62	77	107	106	105	138	145	137
													D3.073										
											50	UNDING	DAIA										
NLEV 020	SURF 10	00 0950	0900	0850 0	800 07	750 070	0 0650	0600	0550 0	500 04	150 040	0 0350	0300	0250 0	200 01	50 010	00						
TIME	(HR)	0	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120	126
T SURF	(10C)	287	286	286	285	284	284	284	283	283	282	282	281	280	279	277	274	271	267	261	249	233	209
R_SURF	(%)	79	79	79	79	78	78	78	78	78	78	78	78	78	79	79	78	78	78	78	78	76	74
P_SURF	(MB)	1012	1013	1013	1015	1015	1016	1015	1017	1014	1016	1013	1014	1012	1013	1010	1011	1009	1010	1008	1009	1008	1009
U_SURF	(10KT)	-117	-121	-121	-112	-105	-102	-85	-85	-85	-82	-68	-65	-68	-75	-59	-37	-13	-2	39	60	85	106
V SURF	(10KT)	11	-5	13	17	19	9	28	12	22	15	29	19	23	26	35	25	26	31	48	30	24	26
T_1000	(10C)	277	277	274	270	269	269	266	264	266	267	266	265	268	269	267	265	265	264	257	242	229	210
R_1000	(%)	73	73	75 11	77	78 13	79	80 13	81 15	81	81 14	81 11	81 13	80 10	79 11	79	78 10	76 8	75 9	78 7	80	80 7	81 7
Z_1000 U 1000	(DM) (10KT)	11 -141	12 -143	-142	13 -132	-124	14 -122	-101	-102	12 -101	-99	-81	-78	-80	-89	-68	-43	-14	-1	45	70	96	121
V 1000	(10KI)	14	-143	17	23	24	13	35	17	27	19	35	25	29	34	44	32	32	40	58	39	32	35
T 0950	(10C)	235	235	232	228	228	227	225	223	225	226	225	224	226	227	226	224	224	223	217	204	192	175
	,,																						

For further discussion of the model diagnostic files, see 15A.3 Friday 11:00am

## Hurricane Forecast Improvement Program (HFIP)

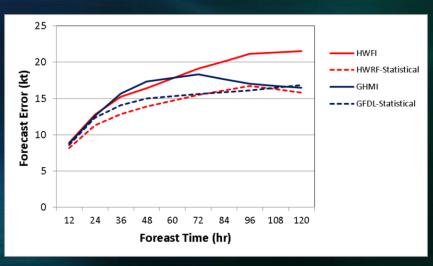
- HFIP designates three streams for the testing and implementation of models (Streams 1, 1.5, and 2)
  - Further information on HFIP is available at www.hfip.org
- SPC3 was tested with data from the 2008-2010 Atlantic and East Pacific seasons (retrospective runs) to determine if it would be used as a Stream 1.5 model in 2011
- As a Stream 1.5 model SPC3 would be run real time during the 2011 demonstration period (August-October 2011)
- Data from the 2009-2011 Atlantic and East Pacific seasons were used to test SPC3 for Stream 1.5 in 2012

## 2008-2010 Retrospective Runs for HFIP Stream 1.5 Implementation

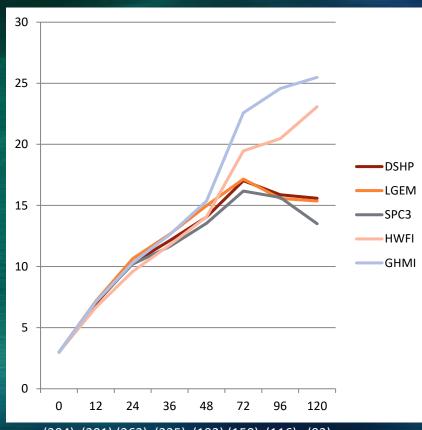


 The components of SPICE based off each individual model also showed lower forecast errors than their parent models for both HWRF and GFDL

- SPICE showed an improvement in skill over SHIFOR when compared to both DSHP and LGEM at all times
  - Percent improvements ranged up to 5-10%

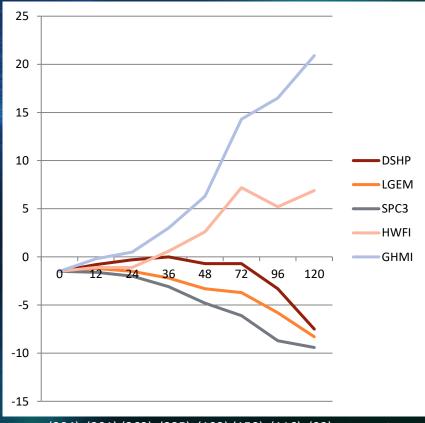


#### **Average Intensity Error (kt)**



#### (304) (301) (263) (225) (192) (150) (116) (92)

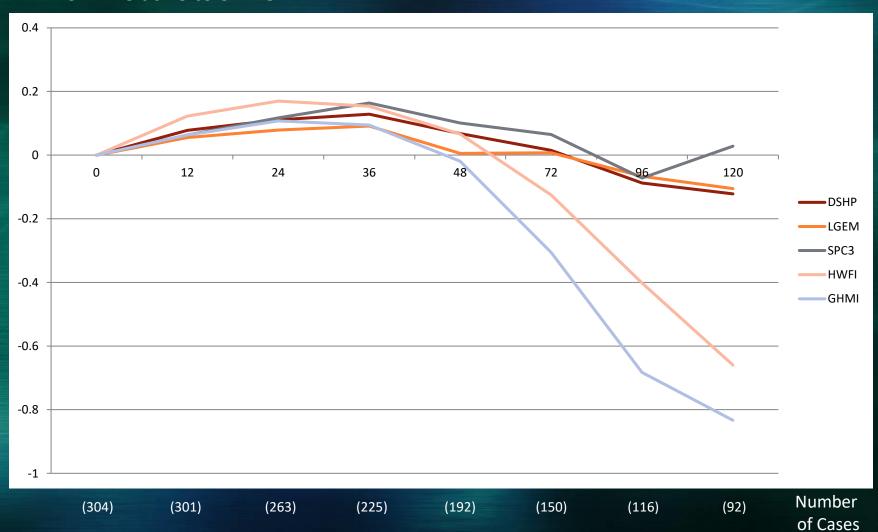
#### **Average Intensity Bias (kt)**



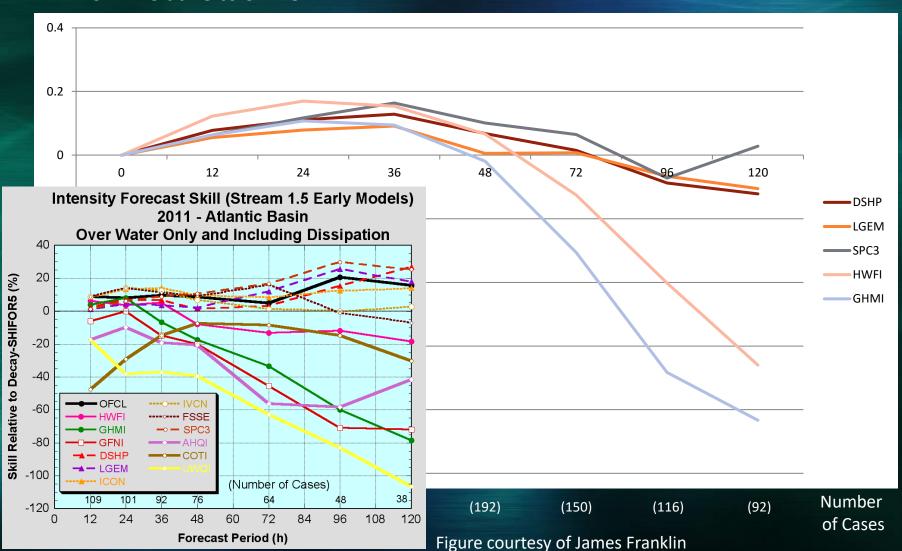
(304) (301) (263) (225) (192) (150) (116) (92)

Number of Cases

#### Skill Relative to SHIFOR

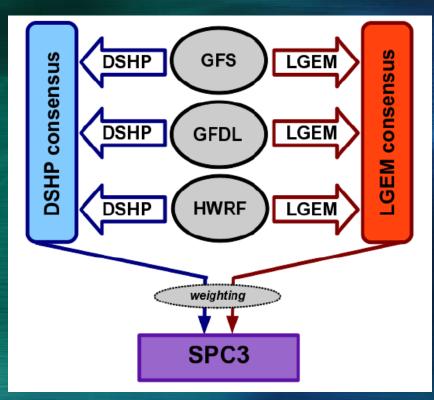


#### Skill Relative to SHIFOR

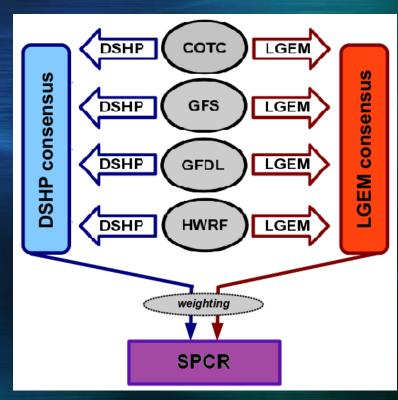


## 2012 HFIP Stream 1.5 Implementation

SPC3

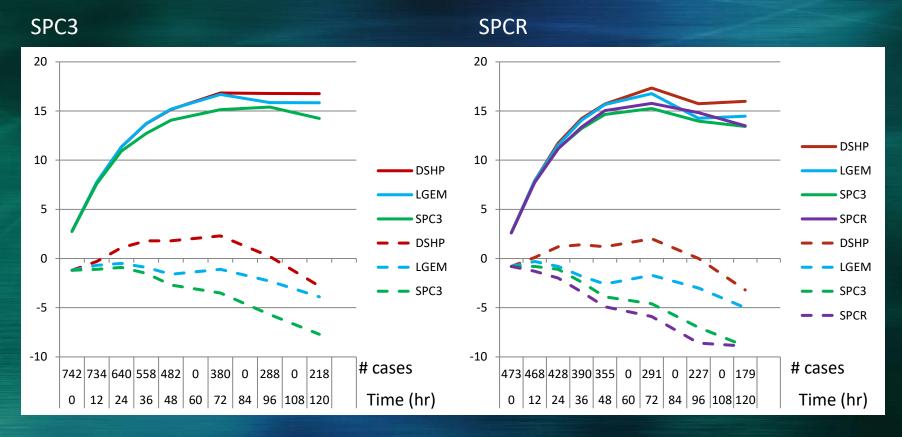


**SPCR** 

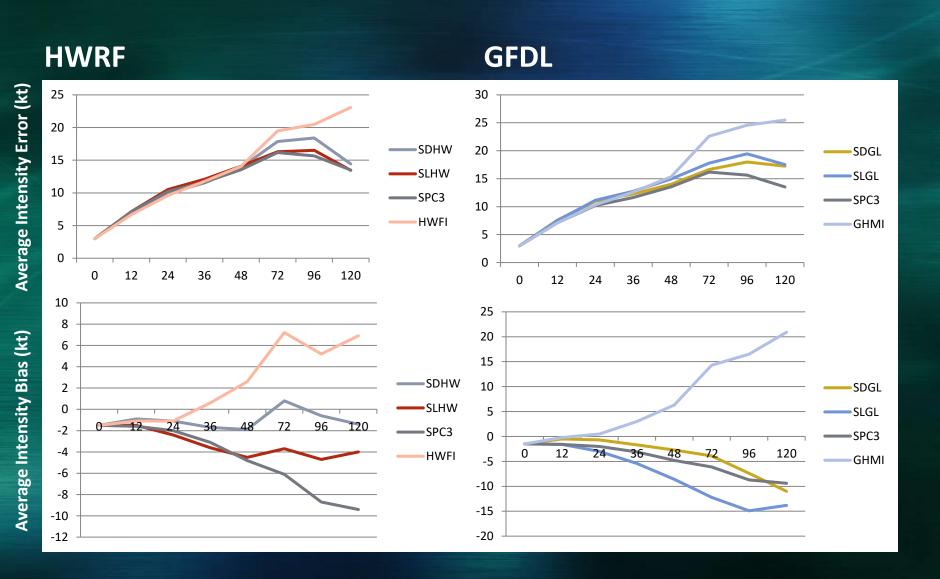


- Additional Stream 1.5 model, named SPCR
- Adds Coupled Ocean/Atmosphere Mesoscale Prediction System for Tropical Cyclones (COAMPS-TC, COTC) to regional models in ensemble

# 2009-2011 Retrospective Runs for HFIP Stream 1.5 Implementation

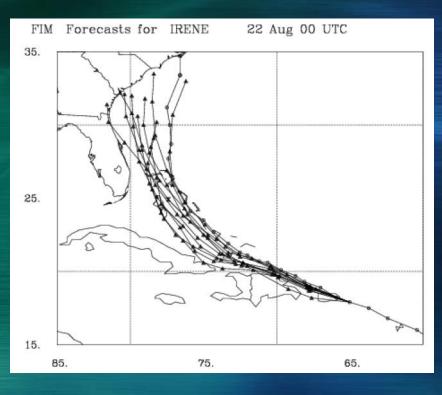


Average Intensity Error (solid) and bias (dashed) (kt)



## 2012 HFIP Stream 2 Implementation – SPCG

#### FIM 10-member Ensemble



- Stream 2 model, named SPCG
- Uses GFS and global model ensembles as input models

### Plans for 2012 Season

- In 2012 we'll run two separate versions of SPICE in HFIP Stream 1.5:
  - The first version (SPC3) is based off the 2011 SPICE model, with updated versions of SHIPS and LGEM
  - The second version (SPCR) includes COAMPS-TC
    - We'll also collect model diagnostic files for regional models from SUNY-Albany and University of Wisconsin and test after the season for inclusion in SPCR
- We'll also run a version of SPICE in HFIP Stream 2:
  - The third version (SPCG) will include HFIP global model ensembles

## Summary

- Statistical ensemble (SPICE) is a weighted consensus of DSHP and LGEM, run from multiple dynamical models
- SPICE had better error statistics than SHIPS and LGEM in the Atlantic basin, with neutral results in the Eastern Pacific basin
  - Consistent in 2008-2010 Retrospective Runs, 2011 Demonstration, and 2009-2011 Retrospective Runs
  - SPC3 showed skill improvements of up to 5-10% over SHIPS and LGEM
- SPICE model components had lower errors than parent dynamical models (GFDL, HWRF)
- Limited storm development in 2011 may have favored SPICE model
  - Confirmation from additional tests needed

## Questions?