

Statistical Hurricane Intensity  
Prediction Scheme  
with Microwave Imagery  
(SHIPS-MI):  
Results from 2006

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# SHIPS-MI

- Starts with SHIPS predictors
- Adds predictors related to inner core latent heating, based on microwave brightness temperatures
- Verification here focuses on comparison with SHIPS

**SHIPS-MI**  
**Forecast**  
**Intensity Change**  
**(DELV)**

=

**Sample**  
**Mean**

+

<b>Climatology and Persistence</b>	
MSW0	Initial Max Sustained Winds
PER	Persistence (previous 12-h intensity change)
VPER	MSW0 x Persistence
EDAY	Function of Julian Day
USPD	Zonal Component of Storm Motion

<b>Environmental Terms</b>	
POT	MPI - MSW0 (Potential for further intensification)
POT2	POT squared
SHRD	200-850 hPa wind shear
SHRDLAT	SHRD x LAT
MSWSHRD	MSW0 x SHRD
EPOS	$\theta_E$ excess of a lifted parcel
T200	200 hPa temperature
Z850	850 hPa vorticity
PSLV	Pressure at the Steering Level
T250n	250 hPa temperature

<b>Microwave Terms</b>	
MEANH19	0-100 km Mean 19 GHz Horizontal TB
MAXH19	0-100 km Maximum 19 GHz Horizontal TB

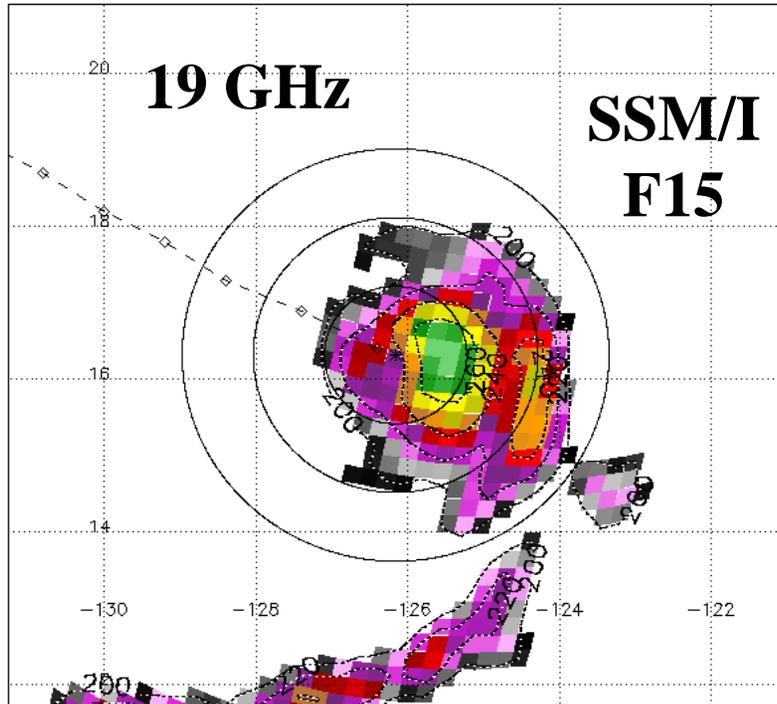
**In E. Pacific:**  
**Latitude and 200 hPa Divergence added**  
**PSLV and VPER removed**

# 2006 Status

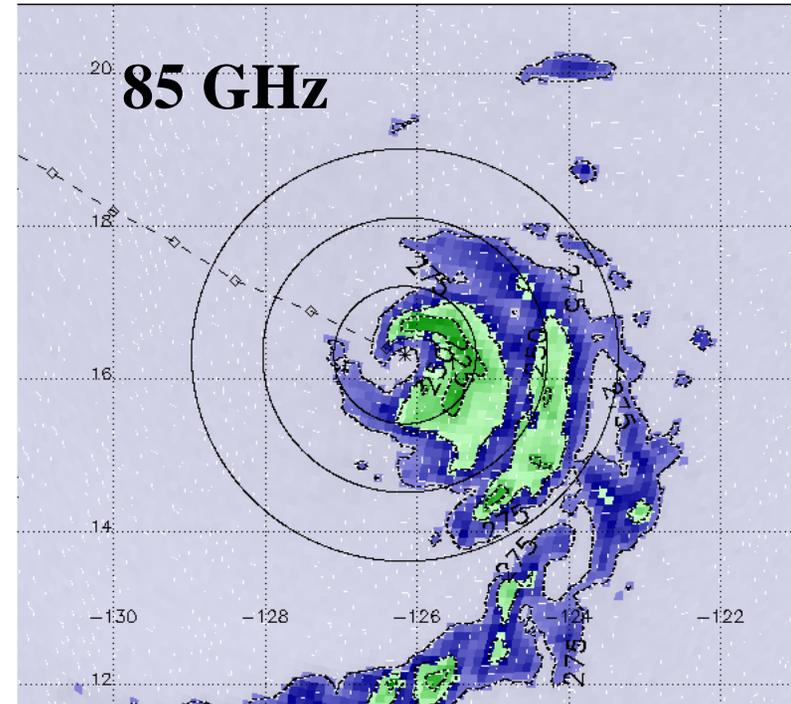
- Requires TB data from SSMI, TMI, or AMSR-E
- Timely data only available for  $\sim 1/3$  of all advisories
- SHIPS-MI run at NHC in 2006

# Example: Hurricane Hector

H19 (K) 200 210 220 230 240 250 260 270 280 290  
MSW0=85.0000 100km\_mean=237.330 200km\_mean=215.587



PCT85 (K) 50 75 100 125 150 175 200 225 250 275  
MSW0=85.0000 100km\_mean=255.248 200km\_mean=265.464



1800 UTC 18 August 2006: Hector 85 kt, weakening

237 K Mean 19 GHz TB is well above sample mean,  
contributes +8 kt to forecast

Hector weakened much more slowly than forecast by  
SHIPS; SHIPS-MI errors were small

# 2006 Performance - Atlantic

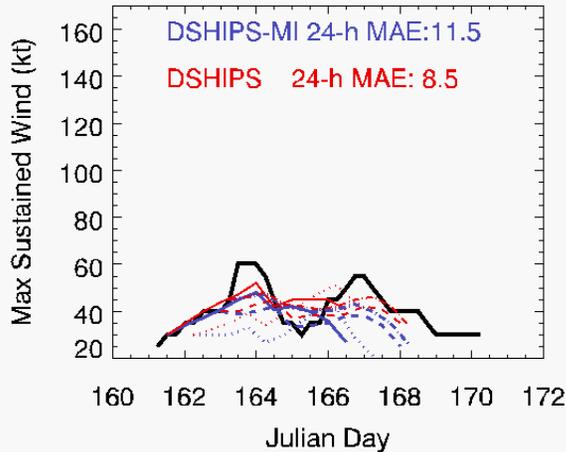
*Mean Absolute Errors (kt)*

<i>duration</i>	0	12	24	36	48	60	72	84	96	108	120
<b>DSHM</b>	<b>2.5</b>	<b>6.4</b>	<b>9.4</b>	<b>13.2</b>	<b>16.2</b>	<b>20.6</b>	<b>23.2</b>	<b>25.4</b>	<b>23.4</b>	<b>21.7</b>	<b>21.3</b>
<b>DSHP</b>	<b>2.4</b>	<b>6.5</b>	<b>9.6</b>	<b>13.7</b>	<b>17.2</b>	<b>22.3</b>	<b>24.1</b>	<b>24.6</b>	<b>22.2</b>	<b>19.0</b>	<b>16.2</b>
OFCL	<b>1.8</b>	6.4	10.4	13.7	15.3		20.7		21.8		17.3
SHF5	2.4	6.4	8.3	<b>10.2</b>	<b>11.2</b>	<b>12.8</b>	<b>12.9</b>	<b>13.7</b>	<b>11.3</b>	<b>13.0</b>	<b>12.4</b>
LGEM	2.4	<b>6.4</b>	<b>8.1</b>	11.2	14.2	17.7	19.0	20.1	19.4	17.6	16.4
GFDI	2.8	7.7	9.5	11.4	13.3	16.4	18.3	19.3	20.2	18.5	21.9
NGPI	6.4	11.5	14.5	17.3	18.9	22.4	24.7	27.9	30.1	33.6	34.5
<i># forecasts</i>	74	70	64	57	54	45	42	36	33	30	26

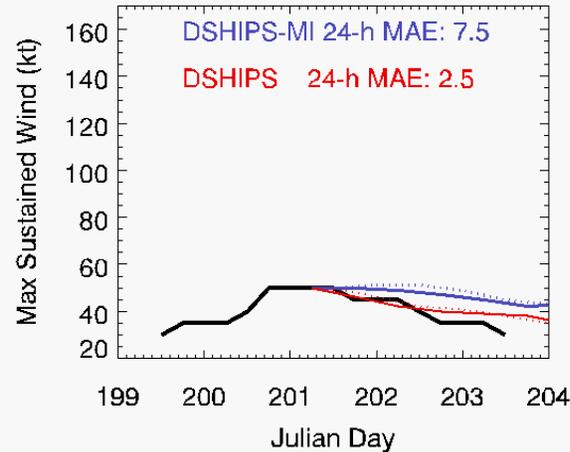
DSHM = “Decay SHIPS-MI”

# 2006 Atlantic storms

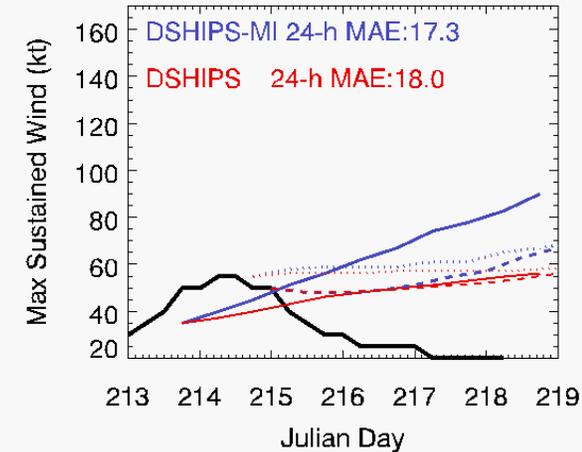
bal012006.dat Alberto



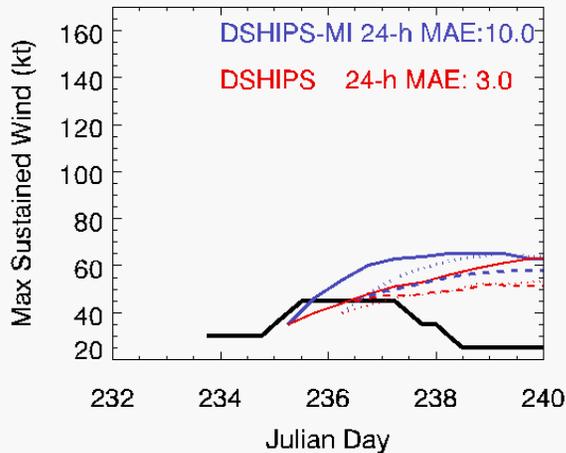
bal032006.dat Beryl



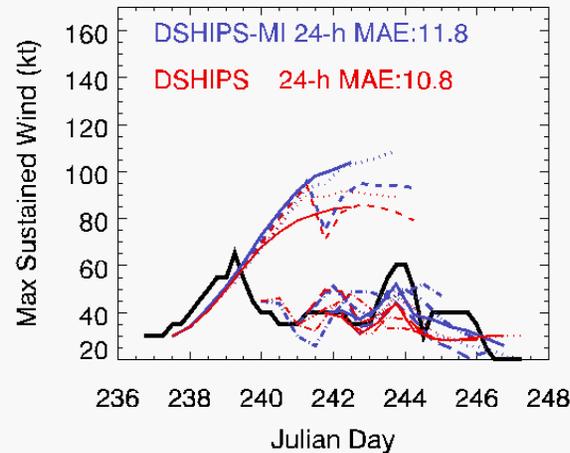
bal042006.dat Chris



bal052006.dat Debby

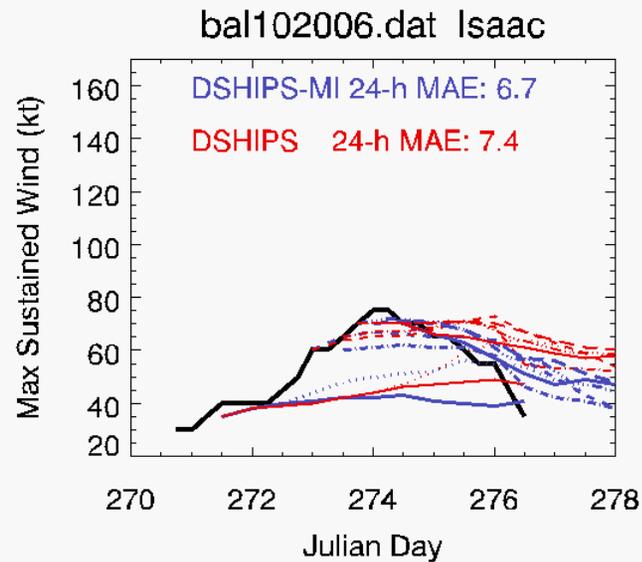
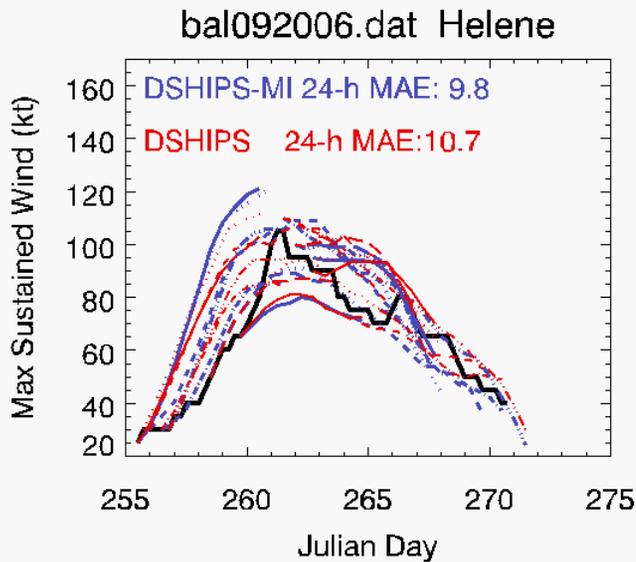
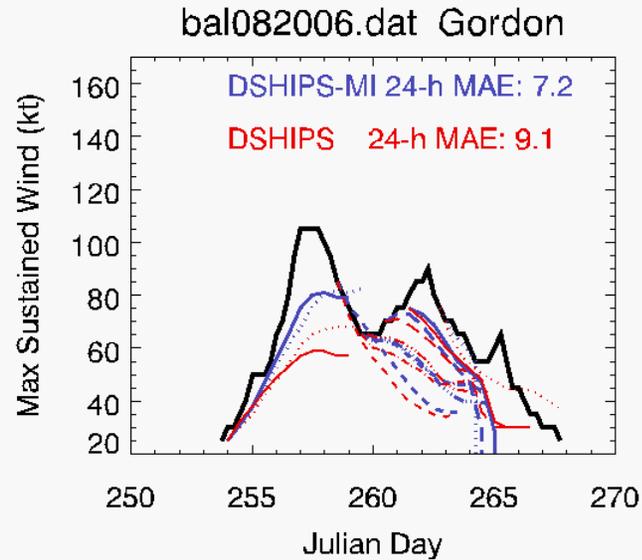
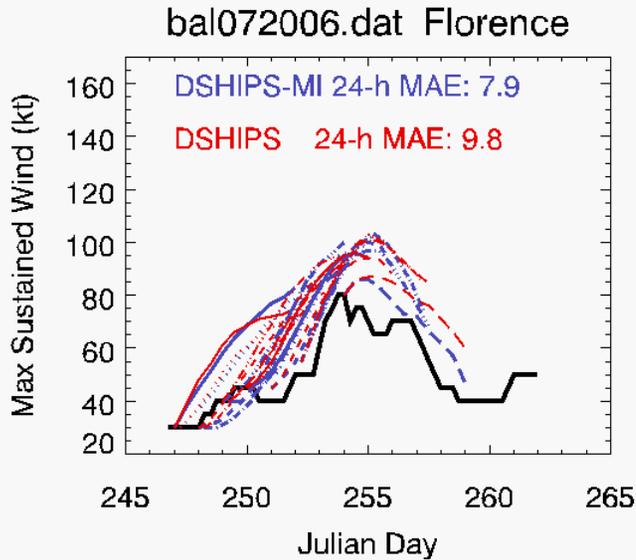


bal062006.dat Ernesto



Poor performance  
(relative to SHIPS)  
on early-season  
Tropical Storms;  
SHIPS-MI forecasts  
usually too strong for  
these cases

# 2006 Atlantic storms



Better performance (relative to SHIPS) on the hurricanes that came later.

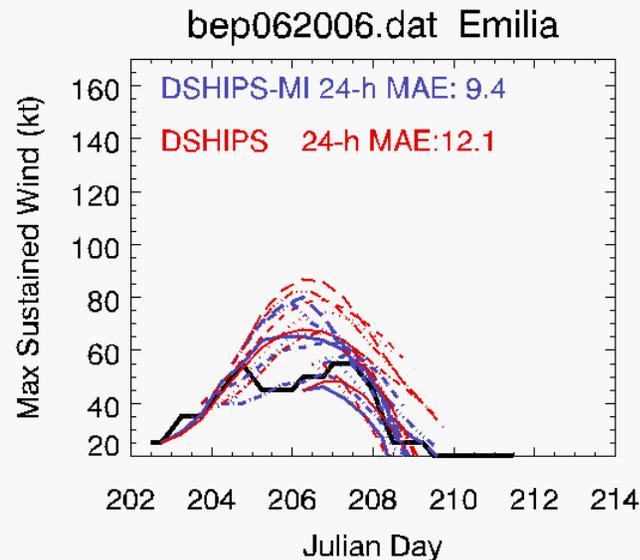
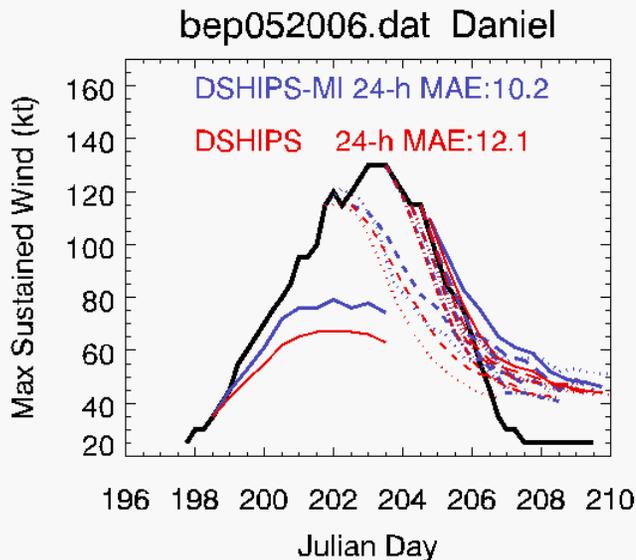
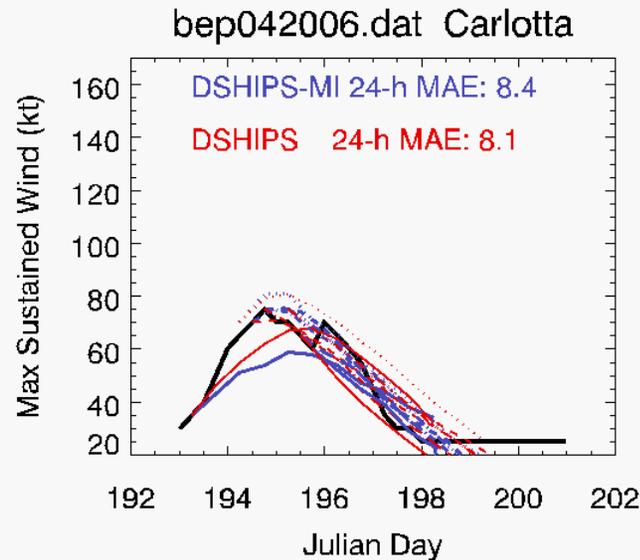
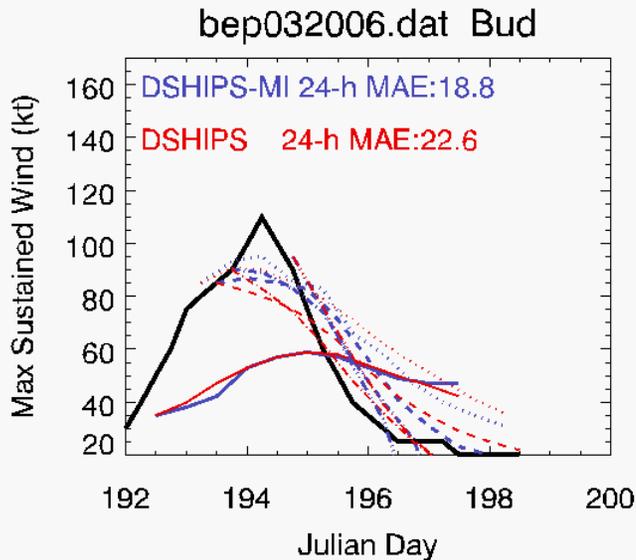
# 2006 Performance - E. Pacific

*Mean Absolute Errors (kt)*

<i>duration</i>	0	12	24	36	48	60	72	84	96	108	120
<b>DSHM</b>	<b>2.5</b>	<b>8.5</b>	<b>11.6</b>	<b>12.3</b>	<b>13.1</b>	<b>13.6</b>	<b>15.1</b>	<b>15.5</b>	<b>15.2</b>	<b>18.0</b>	<b>18.8</b>
<b>DSHP</b>	<b>2.5</b>	<b>8.5</b>	<b>12.9</b>	<b>14.1</b>	<b>15.3</b>	<b>16.2</b>	<b>17.2</b>	<b>17.6</b>	<b>18.4</b>	<b>20.5</b>	<b>20.6</b>
OFCL	<b>2.0</b>	<b>7.4</b>	11.8	13.0	14.0		17.3		15.6		17.2
SHF5	2.5	9.4	13.4	14.5	16.6	18.3	19.0	19.2	19.2	18.9	20.8
LGEM	2.5	8.9	12.9	13.2	14.8	15.8	16.6	<b>15.5</b>	<b>14.8</b>	<b>16.2</b>	16.6
GFDI	3.0	9.9	13.5	14.8	16.9	19.4	23.0	20.1	18.7	16.5	<b>15.8</b>
NGPI	5.7	13.4	19.0	23.1	26.8	30.8	33.3	30.4	27.3	25.4	26.4
<i># forecasts</i>	<i>132</i>	<i>119</i>	<i>105</i>	<i>93</i>	<i>83</i>	<i>66</i>	<i>56</i>	<i>50</i>	<i>42</i>	<i>31</i>	<i>25</i>

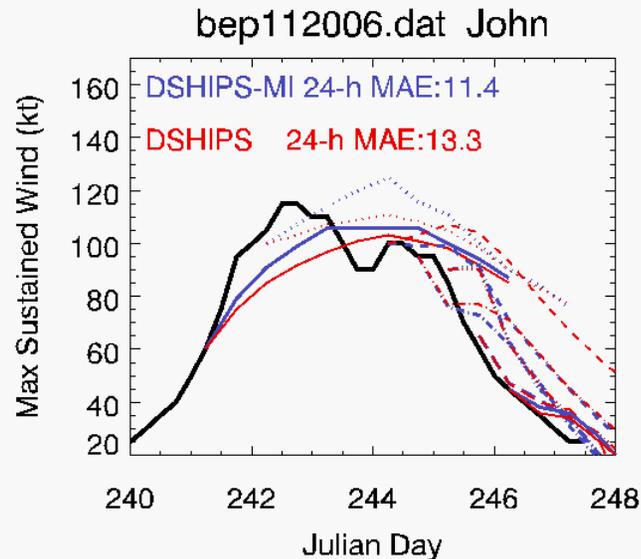
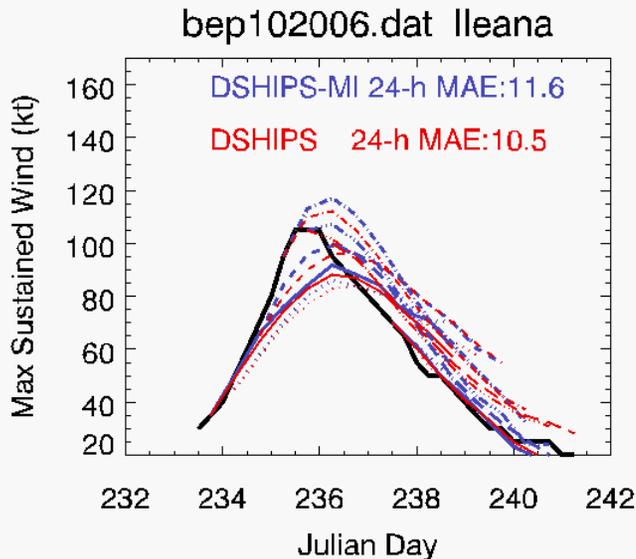
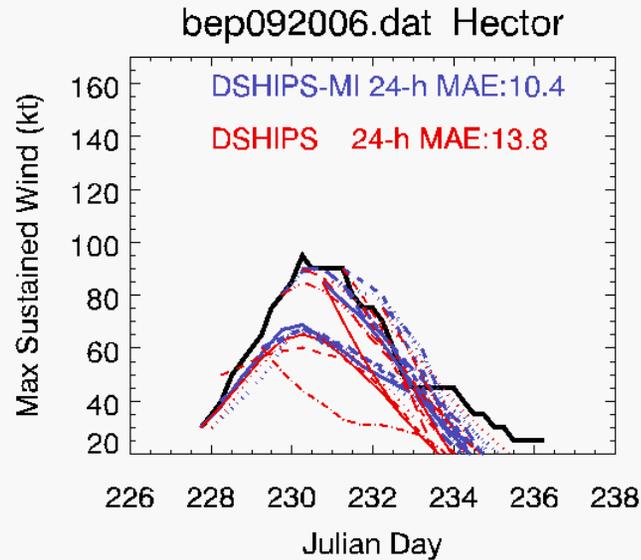
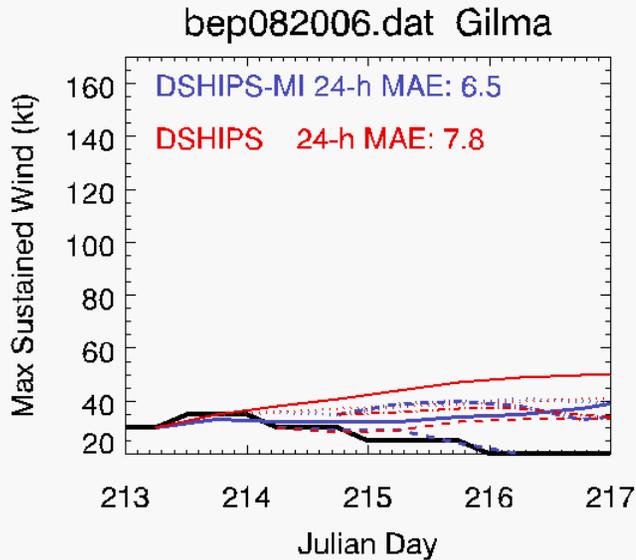
DSHM = “Decay SHIPS-MI”

# 2006 E. Pacific storms



SHIPS-MI and SHIPS often have the same general idea for a weakening or intensification trend, but SHIPS-MI is usually a few kt further in the “right” direction

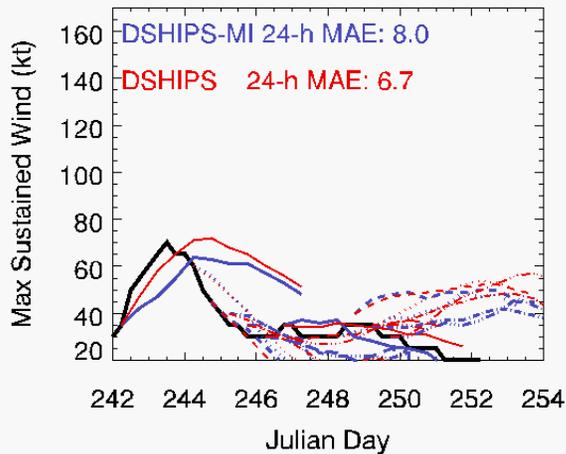
# 2006 E. Pacific storms



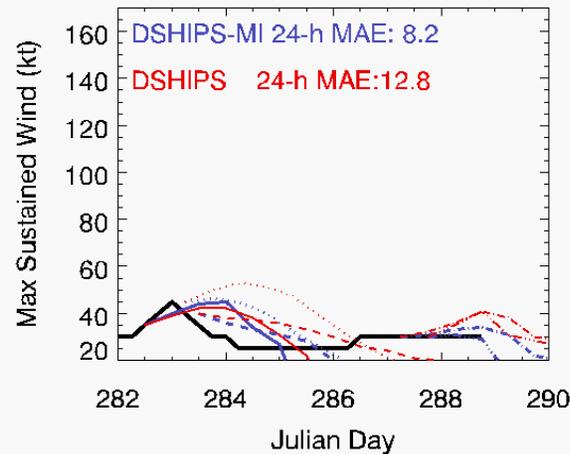
Note  
improved  
handling of  
intensification  
(Hector) and  
weakening  
(John)

# 2006 E. Pacific storms

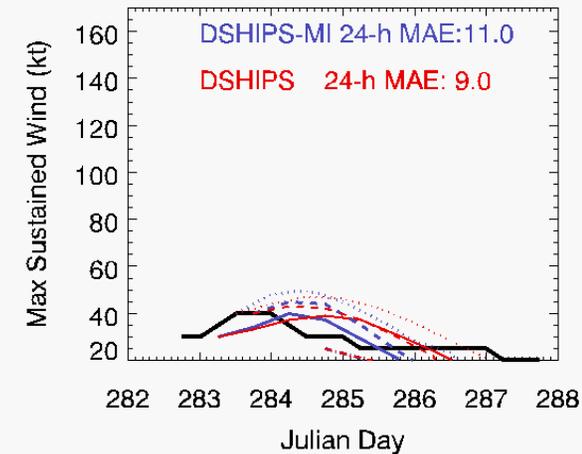
bep122006.dat Kristy



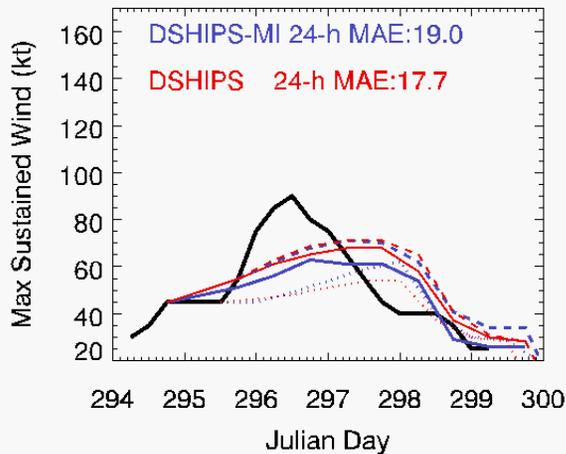
bep152006.dat Norman



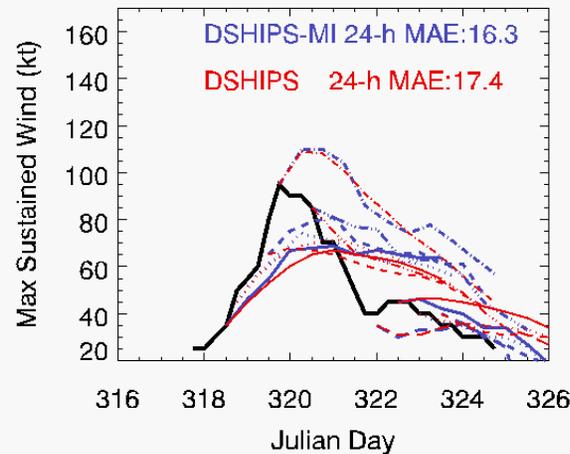
bep162006.dat Olivia



bep172006.dat Paul



bep212006.dat Sergio



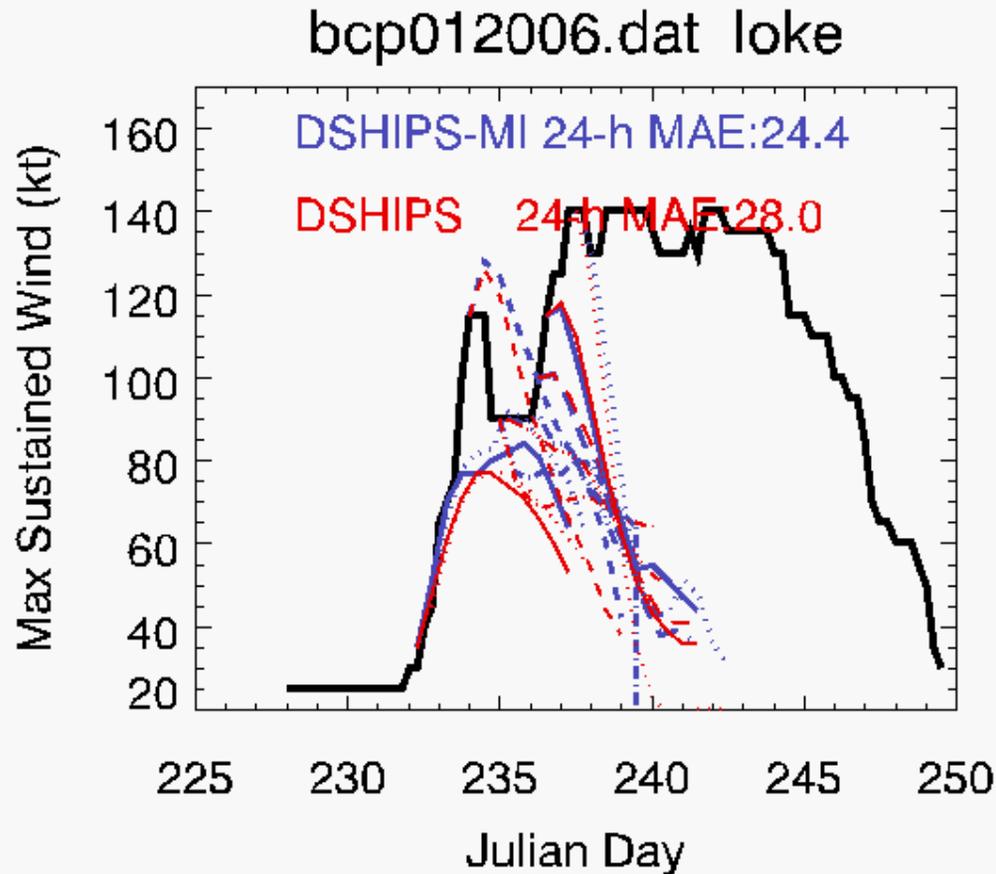
# 2006 Performance - C. Pacific (Ioke)

*Mean Absolute Errors (kt)*

<i>duration</i>	0	12	24	36	48	60	72	84	96	108	120
<b>DSHM</b>	<b>0.0</b>	<b>11.6</b>	<b>27.9</b>	<b>41.9</b>	<b>47.1</b>	<b>55.4</b>	<b>57.9</b>	<b>67.7</b>	<b>73.1</b>	<b>81.3</b>	<b>91.7</b>
<b>DSHP</b>	<b>0.0</b>	<b>14.0</b>	<b>30.7</b>	<b>44.1</b>	<b>49.3</b>	<b>62.4</b>	<b>66.9</b>	<b>78.0</b>	<b>82.4</b>	<b>86.5</b>	<b>94.7</b>
OFCL	0.6	10.6	20.7	27.1	27.1		31.4		40.0		48.3
SHF5	0.0	16.6	29.7	40.6	42.4	81.9	89.1	102	105	110	97.0
LGEM	0.0	12.4	28.1	38.7	41.3	52.6	55.4	65.9	70.7	77.3	87.2
GFDI	0.0	10.0	<b>19.4</b>	<b>22.4</b>	<b>19.7</b>	<b>16.7</b>	<b>11.1</b>	<b>17.7</b>	<b>18.7</b>	<b>18.5</b>	<b>16.3</b>
NGPI	0.0	<b>9.8</b>	23.1	27.9	26.3	27.4	25.0	29.9	29.7	35.7	28.2
<i># forecasts</i>	8	8	7	7	7	7	7	7	7	6	6

DSHM = “Decay SHIPS-MI”

# 2006 Central Pacific Ioke



Many problems with Ioke as it approached / crossed dateline;

Some predictors computed incorrectly;

Horrible statistical forecasts

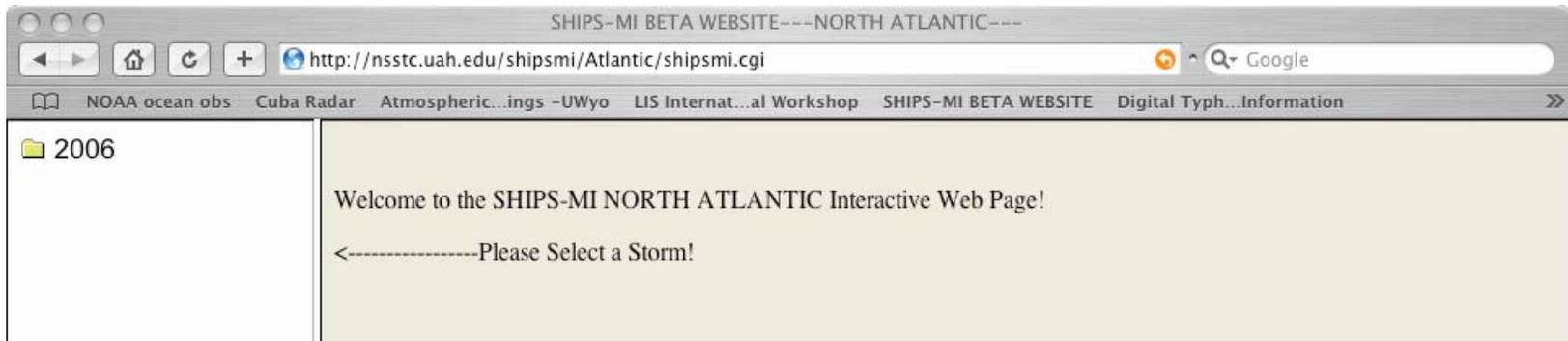
# 2006 W. Pacific

- STIPS-MI adds microwave to the set of STIPS predictors
- Ioke (a West Pacific supertyphoon with a Central Pacific name and number) required a lot of troubleshooting / debugging
- Switch from JTWC to NRL for access to STIPS predictors also required a lot of troubleshooting, eventually led to generation of ensemble STIPS-MI
- Little apparent impact from microwave in STIPS-MI, looks like more trouble than it is worth so far

# 2006 SHIPS-MI Summary

- Atlantic: SHIPS-MI did slightly better than SHIPS, worse than most other guidance
- E. Pacific: SHIPS-MI did much better than SHIPS, better than other guidance at 24-84 h
- Some of the improvement in East Pacific is due to predictors other than microwave; especially due to inclusion of Latitude predictor (not included in SHIPS)

# Interactive Web Page



<http://nsstc.uah.edu/shipsmi/Atlantic/shipsmi.cgi>

<http://nsstc.uah.edu/shipsmi/Pacific/EPA Cshipsmi.cgi>

<http://nsstc.uah.edu/shipsmi/CentralPacific/CPACshipsmi.cgi>



# <http://nsstc.uah.edu/shipsmi/Atlantic/shipsmi.cgi>

SHIPS-MI BETA WEBSITE---NORTH ATLANTIC---

http://nsstc.uah.edu/shipsmi/Atlantic/shipsmi.cgi

NOAA ocean obs Cuba Radar Atmospheric...ings -UWyo LIS Internat...al Workshop SHIPS-MI BETA WEBSITE Digital Typh...Information

2006

North Atlantic

- TEST AL80 12/28 12Z
- TEST AL85 12/07 12Z
- INVE AL95 11/25 18Z
- INVE AL95 11/25 12Z
- INVE AL95 11/25 00Z
- INVE AL95 11/24 18Z
- INVE AL93 11/03 12Z
- INVE AL93 11/03 00Z
- INVE AL93 10/28 00Z
- INVE AL90 10/20 12Z
- INVE AL90 10/19 18Z
- INVE AL90 10/19 12Z
- INVE AL92 10/15 18Z
- INVE AL92 10/15 12Z
- INVE AL90 10/14 00Z
- INVE AL91 10/13 12Z
- INVE AL90 10/13 12Z
- INVE AL91 10/13 00Z
- INVE AL90 10/13 00Z
- INVE AL90 10/12 18Z
- INVE AL91 10/12 12Z
- INVE AL90 10/12 12Z
- INVE AL90 10/12 06Z
- INVE AL90 10/12 00Z
- INVE AL90 10/11 12Z
- INVE AL99 10/07 00Z
- INVE AL99 10/06 18Z

PREDICTORS	00	06	12	18	24	36	48
<b>Climatological</b>							
VMAX (kt)	60.0	--	--	--	--	--	--
PER (kts/12hr)	0.0	--	--	--	--	--	--
VPER (kt <sup>2</sup> )	--	--	--	--	--	--	--
EDAY	0.6	--	--	--	--	--	--
USPD (kt)	-5.2	--	--	--	--	--	--
LAT (°)	30.5	31.1	31.6	32.5	33.4	36.7	41.6
Speed (kt)	7.2	7.8	8.7	10.3	13.3	20.8	24.0
SST							
Cooled SST (°C)	25.4	25.3	25.3	25.0	24.7	24.0	19.5
Reynold's SST (°C)	27.3	27.2	27.2	26.9	26.5	25.6	21.7
MPI (kt)	107.	106.	107.	105.	104.	101.	82.1
POT (kt)	--	--	--	--	--	--	--
POT <sup>2</sup> (kt <sup>2</sup> )	--	--	--	--	--	--	--
Shear							
SHRD (kt)	11.8	17.6	19.9	20.5	24.4	27.8	33.8
LSHR (kt)	--	--	--	--	--	--	--
VSHR (kt <sup>2</sup> )	--	--	--	--	--	--	--
<b>Environmental</b>							



# 2007 SHIPS-MI plans

- Try to add a SHIPS-MI subroutine to DeMaria's SHIPS code, so a line of SHIPS-MI output can be added to the same page as SHIPS
- Try to improve access to microwave data, particularly SSMIS