Supplementary Material

1 SUPPLEMENTARY TABLES AND FIGURES

1.1 Tables

Table S1. Complete List of All 120 Predictors Used in the Physics Incorporated Network to Estimate Wind Structure

Predictor description	Predictor acronym
Average GOES channel-4 brightness temperature (BT) ($^\circ$C $\times$ 10), r = 0–200 km	IR00_v2
Std dev of GOES BT ($^\circ$C $\times$ 10), r = 0–200 km	IR00_v3
Average GOES channel-4 brightness temperature (BT) ($^\circ$C $\times$ 10), r = 100–300 km	IR00_v4
Std dev of GOES BT ($^\circ$C $\times$ 10), r = 100–300 km	IR00_v5
Percent area r = 50–200 km of GOES channel 4 BT $< -10^\circ$C	IR00_v6
Percent area r = 50–200 km of GOES channel 4 BT $< -20^\circ$C	IR00_v7
Percent area r = 50–200 km of GOES channel 4 BT $< -30^\circ$C	IR00_v8
Percent area r = 50–200 km of GOES channel 4 BT $< -40^\circ$C	IR00_v9
Percent area r = 50–200 km of GOES channel 4 BT $< -50^\circ$C	IR00_v10
Percent area r = 50–200 km of GOES channel 4 BT $< -60^\circ$C	IR00_v11
Max BT from 0 to 30 km radius ($^\circ$C $\times$ 10)	IR00_v12
Avg BT from 0 to 30 km radius ($^\circ$C $\times$ 10)	IR00_v13
Radius of max BT (km)	IR00_v14
Min BT from 20 to 120 km radius ($^\circ$C $\times$ 10)	IR00_v15
Avg BT from 20 to 120 km radius ($^\circ$C $\times$ 10)	IR00_v16
Radius of min BT (km)	IR00_v17
IR-based estimate of the tangential wind speed at 500 km from the TC center	IR00_v18
IR-based estimate of the radius (km) of the 5 knot wind	IR00_v19
A scaling factor for R5 based on climatological values based just on intensity	IR00_v20
Same as IR00 but at 1.5 hours before initial time	IRM1
Same as IR00 but at three hours before initial time	IRM3
Pressure of the center of mass (hPa) of the layer where storm motion best matches environmental flow	PSLV_v1
The observed zonal storm motion component ($\mathrm{ms}^{-1} \times 10$)	PSLV_v2
The observed meridional storm motion component ($\mathrm{ms}^{-1} \times 10$)	PSLV_v3
As in PSLV_v2, but for the 1000–100-hPa mass weighted deep layer environmental wind ($\mathrm{ms}^{-1} \times 10$)	PSLV_v4
As in PSLV_v3, but for the 1000–100-hPa mass weighted deep layer environmental wind ($\mathrm{ms}^{-1} \times 10$)	PSLV_v5
As in PSLV_v2, but for the optimally weighted deep layer mean flow ($\mathrm{ms}^{-1} \times 10$)	PSLV_v6
As in PSLV_v3, but for the optimally weighted deep layer mean flow ($\mathrm{ms}^{-1} \times 10$)	PSLV_v7
The parameter alpha that controls the constraint on the weights from being not too "far" from the deep layer mean weights (nondimensional $\times$100)	PSLV_v8
The optimal vertical weights for p = 100 hPa (nondimensional $\times$1000)	PSLV_v9
The optimal vertical weights for p = 150 hPa (nondimensional $\times$1000)	PSLV_v10
The optimal vertical weights for p = 200 hPa (nondimensional $\times$1000)	PSLV_v11
The optimal vertical weights for p = 250 hPa (nondimensional $\times$1000)	PSLV_v12
The optimal vertical weights for p = 300 hPa (nondimensional $\times$1000)	PSLV_v13
The optimal vertical weights for p = 400 hPa (nondimensional $\times$1000)	PSLV_v14
The optimal vertical weights for p = 500 hPa (nondimensional $\times$1000)	PSLV_v15
The optimal vertical weights for p = 700 hPa (nondimensional $\times$1000)	PSLV_v16
The optimal vertical weights for p = 850 hPa (nondimensional $\times$1000)	PSLV_v17
The optimal vertical weights for p = 1000 hPa (nondimensional $\times$1000)	PSLV_v18
Climatological SST ($^\circ$C $\times$ 10)	CSST
Climatological depth (m) of ($^\circ$C $\times$ 10) isotherm from 2005 to 2010 NCODA analyses	CD20
As for CD20, but for the 26°C isotherm	CD26
As above, but for ocean heat content (kJcm^{-2})	COHC
Distance to nearest major landmass (km)	DTL
Reynolds SST ($^\circ$C $\times$ 10)	RSST
200-hPa zonal wind (kt $\times$10) (r = 200–800 km)	U200
As in U200, but for r = 0–500 km	U20C
As in U20C, but for the v component of the wind	V20C
1000 hPa theta_e (r = 200–800 km) vs time (K $\times$10)	E000
The average theta_e difference between a parcel lifted from the surface and its environment (200–800-km average) vs time ($^\circ$C $\times$ 10)	EPOS
As in EPOS, but only negative differences are included and the parcel theta_e is compared with the saturated theta_e of the environment. The minus sign is not included	ENSS
850–700-hPa relative humidity (%) vs time (200–800 km)	RHLO
As in RHLO, but for 700–500 hPa	RHMD
As in RHLO, but for 500–300 hPa	RHHI

Table S1. (Continued)

Predictor description	Predictor acronym
Last 12-h intensity change (kt)	DELV
850-hPa vorticity ($s^{-1} \times 10^7$) vs time (r = 0–1000 km)	Z850
200-hPa divergence vs time (r = 0–1000 km)	D200
Relative eddy momentum flux convergence (ms^{-1} day $^{-1}$, 100–600-km avg)	REFC
Planetary eddy momentum flux convergence (ms^{-1} day $^{-1}$, 100–600-km avg)	PEFC
1000-hPa temperature ($^\circ C \times 10$) (200–800-km average)	T000
1000-hPa relative humidity (200–800-km average)	R000
1000-hPa height deviation (m) from the U.S. standard atmosphere	Z000
Latitude of 850-hPa vortex center in NCEP analysis ($^\circ N \times 10$)	TLAT
Longitude of 850-hPa vortex center in NCEP analysis ($^\circ N \times 10$)	TLON
0–600-km average symmetric tangential wind at 850 hPa from NCEP analysis ($ms^{-1} \times 10$)	TWAC
Maximum 850-hPa symmetric tangential wind at 850 hPa from NCEP analysis ($ms^{-1} \times 10$)	TWXC
Azimuthally averaged surface pressure at outer edge of vortex [(hPa - 1000) $\times 10$]	PENC
850–200-hPa shear magnitude (kt $\times 10$) vs time (200–800 km)	SHRD
Heading ($^\circ$) of above shear vector. Westerly shear has a value of 90°.	SHTD
850–500-hPa shear magnitude (kt $\times 10$)	SHRS
Heading of above shear vector	SHTS
Generalized 850–200-hPa shear magnitude (kt $\times 10$) vs time (takes into account all levels from 1000 to 100 hPa)	SHRG
As in SHRD, but with vortex removed and averaged from 0 to 500 km relative to 850-hPa vortex center	SHDC
Heading ($^\circ$) of above shear vector. Westerly shear has a value of 90°.	SDDC
As in SHRG, but with vortex removed and averaged from 0 to 500 km relative to 850-hPa vortex center	SHGC
As in D200, but centered at 850-hPa vortex location	DIVC
200–800-km area average 150-hPa temperature ($^\circ C \times 10$)	T150
As above, but for 200-hPa temperature ($^\circ C \times 10$)	T200
As above, but for 250-hPa temperature ($^\circ C \times 10$)	T250
200–800-km average surface pressure [(hPa - 1000)3 10]	PENV
Maximum potential intensity from K. Emanuel equation (kt)	VMPI
Average (0–15 km) vertical velocity ($ms^{-1} \times 100$) of a parcel lifted from the surface where entrainment, the ice phase and the condensate weight are accounted for. Note: Moisture and temperature biases between the operational and reanalysis files make this variable inconsistent in the 2001–07 sample, compared 2000 and before.	VVAV
As in VVAV, but a density weighted vertical average.	VMFX
As in VVAV, but with soundings from 0 to 500 km with GFS vortex removed	VVAC