

"CMA CGM TANCREDI"

Saturday 9th October, 2021

Vessel Basic Info:

IMO: 9436355

Vessel Type: Container

Deadweight:

Beam:

Length:

Min Draft: 10.0 m

Max Draft: 14.0 m

Max Speed: Sea speed Ballast 24.3. Laden 22.9

Dates of last two propeller cleanings:

Dates of last two dry docks:

Voyages the vessel most commonly Performs:

1 Models Performance Overview

Table 1: Neural Net

Total Actual FOC (MT), Total Predicted FOC (MT), Percentage Difference(Actual / Predicted), Mean STW (knt), Mean Draft (m) for each leg

Neural Net	Info per leg				
	Total Act FOC (MT)	Total Pred FOC (MT)	FOC Perc Diff	Mean STW (kt)	Mean Draft (m)
HOUSTON - MOBILE	70.83	71.84	1.42 %	13.99	11.58
MOBILE - TAMPA	190.36	182.67	4.12 %	14.98	11.79
TAMPA - TANGER MED	746.55	745.52	0.14 %	16.53	11.40
TANGER MED - SUEZ	384.81	390.20	1.39 %	18.90	11.72
SUEZ - SINGAPORE	1,015.73	1,026.19	1.02 %	19.08	11.72
SINGAPORE - VUNG TAU	77.82	78.85	1.31 %	16.29	10.21
VUNG TAU - HONG KONG	188.01	185.73	1.22 %	18.83	10.93
SHEKOU - NINGBO	119.35	120.30	0.79 %	13.25	10.32
SHANGHAI - PUSAN	77.57	76.24	1.73 %	19.45	11.20
PANAMA - HOUSTON	348.23	348.10	0.04 %	19.90	13.19
MOBILE - NEW ORLEANS	49.38	46.54	5.92 %	14.72	11.40
NEW ORLEANS - TAMPA	61.04	56.93	6.97 %	14.27	11.60
TAMPA - MIAMI	85.09	81.97	3.74 %	19.33	11.40
MIAMI - KINGSTON	197.74	202.11	2.19 %	23.05	11.10
KINGSTON - NINGBO	1,196.27	1,210.07	1.15 %	18.47	11.65
Total	4,808.78	4,823.26	0.30 %	17.4 (Avg)	11.4 (Avg)

Table 2: Neural DT

Total Actual FOC (MT), Total Predicted FOC (MT), Percentage Difference(Actual / Predicted), Mean STW (knt), Mean Draft (m) for each leg

Neural DT	Info per leg				
	Total Act FOC (MT)	Total Pred FOC (MT)	FOC Perc Diff	Mean STW (kt)	Mean Draft (m)
HOUSTON - MOBILE	70.83	76.03	7.08 %	13.99	11.58
MOBILE - TAMPA	190.37	185.19	2.76 %	14.98	11.79
TAMPA - TANGER MED	746.55	721.38	3.43 %	16.53	11.40
TANGER MED - SUEZ	384.81	371.78	3.44 %	18.90	11.72
SUEZ - SINGAPORE	1,015.73	1,000.46	1.51 %	19.08	11.72
SINGAPORE - VUNG TAU	77.82	78.75	1.19 %	16.29	10.21
VUNG TAU - HONG KONG	188.01	172.78	8.44 %	18.83	10.93
SHEKOU - NINGBO	119.35	115.89	2.94 %	13.25	10.32
SHANGHAI - PUSAN	77.57	69.07	11.59 %	19.45	11.20
PANAMA - HOUSTON	348.23	331.37	4.96 %	19.90	13.19
MOBILE - NEW ORLEANS	49.38	47.61	3.65 %	14.72	11.40
NEW ORLEANS - TAMPA	61.04	60.93	0.18 %	14.27	11.60
TAMPA - MIAMI	85.09	77.80	8.95 %	19.33	11.40
MIAMI - KINGSTON	197.74	162.63	19.49 %	23.05	11.10
KINGSTON - NINGBO	1,196.27	1,127.19	5.95 %	18.47	11.65
Total	4,808.79	4,598.86	4.46 %	17.4 (Avg)	11.4 (Avg)

Overall Accuracy

Legs Summary Info

- Total records: **88,059 instances**
- Total Sailing Time: **1,482 hours**
- Total Distance Travelled: **21,010.16 n mi**

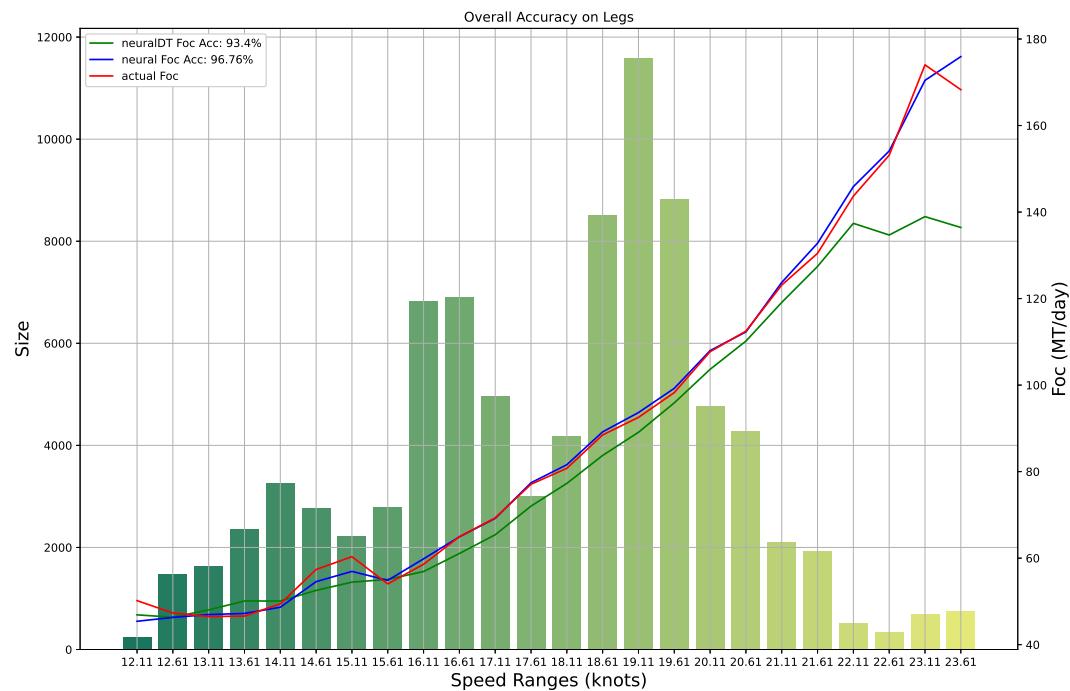


Figure 1: FOC Actual vs Predicted / Speed Ranges, Overall on Legs

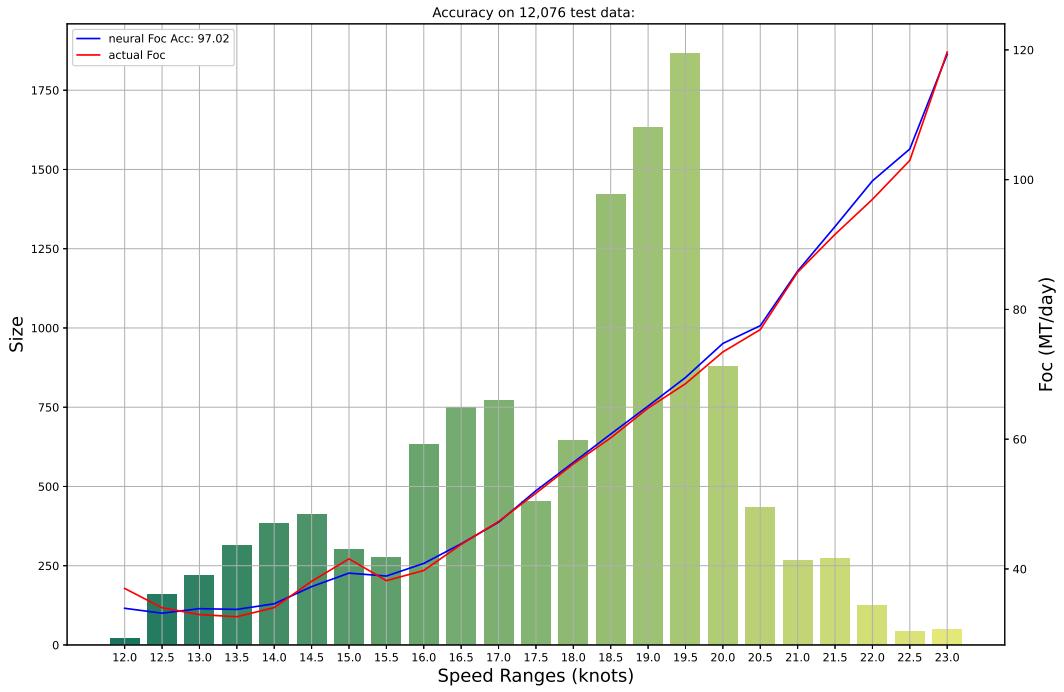


Figure 2: FOC Actual vs Predicted / Speed Ranges, Overall on Legs Test Data

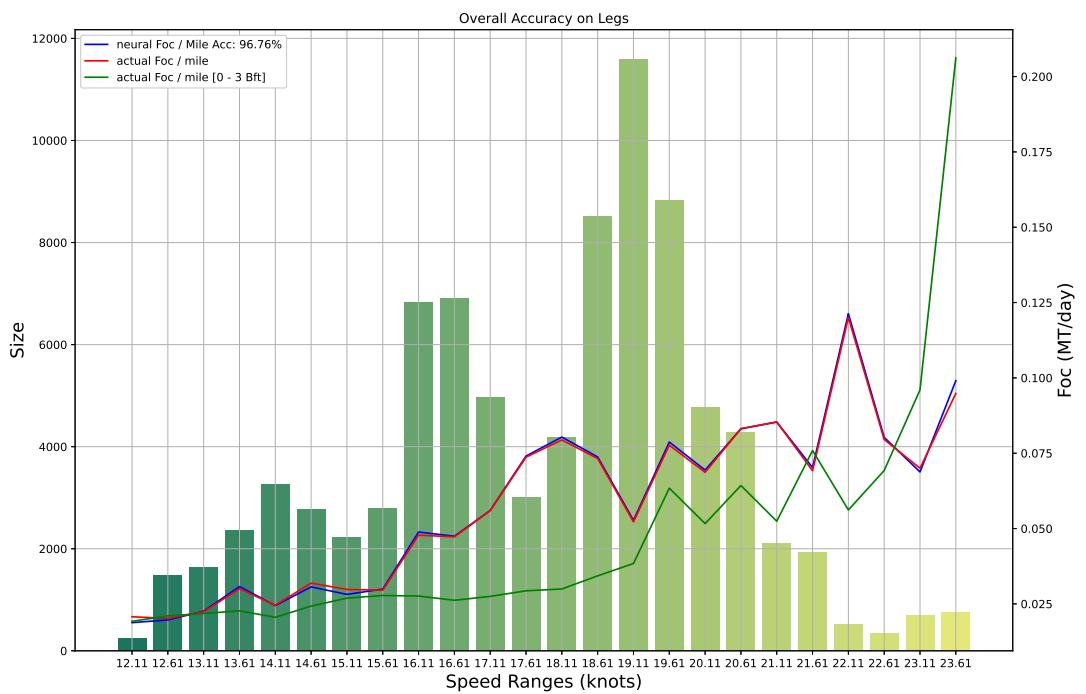


Figure 3: FOC/mile Actual vs Predicted / Speed Ranges, Overall on Legs

2 FOC estimation models performance on legs

Leg 1 # Basic INFO:

- Total Actual FOC : **70.83 MT**
 - Total Predicted FOC (Neural Net): **71.84 MT**
 - Total Predicted FOC (Neural DT): **76.03 MT**
 - FOC Perc Diff (Neural Net): **1.42 %**
 - FOC Perc Diff (Neural DT): **7.08 %**
- Departure Port : **HOUSTON / 2019-09-13 12:09:00**
- Arrival Port : **MOBILE / 2019-09-15 01:30:00**
- Total Sailing Time: **37 hours**
- Distance Travelled: **388.01 n mi**
- Draft: **11.6 m**

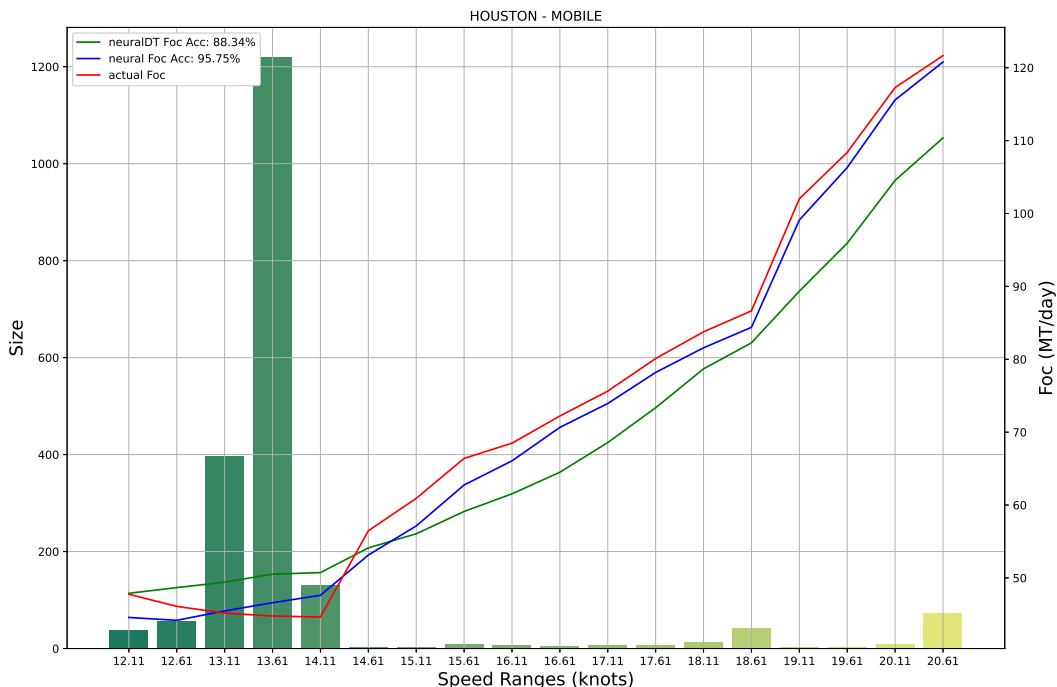


Figure 4: FOC Actual vs Predicted / Speed Ranges, HOUSTON - MOBILE

Weather Comparison - Sensor / Weather Service (NOA)

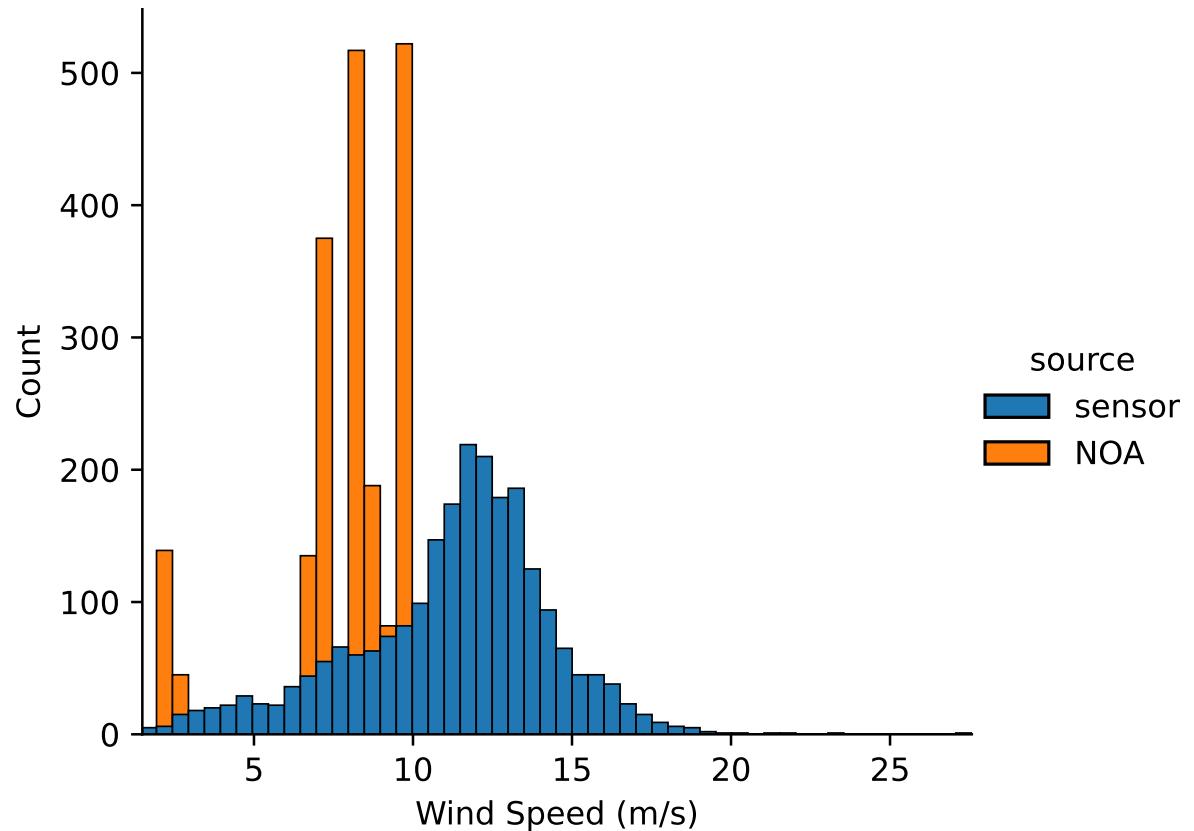


Figure 5: Wind Speed Sensor VS NOA Distributions comparison

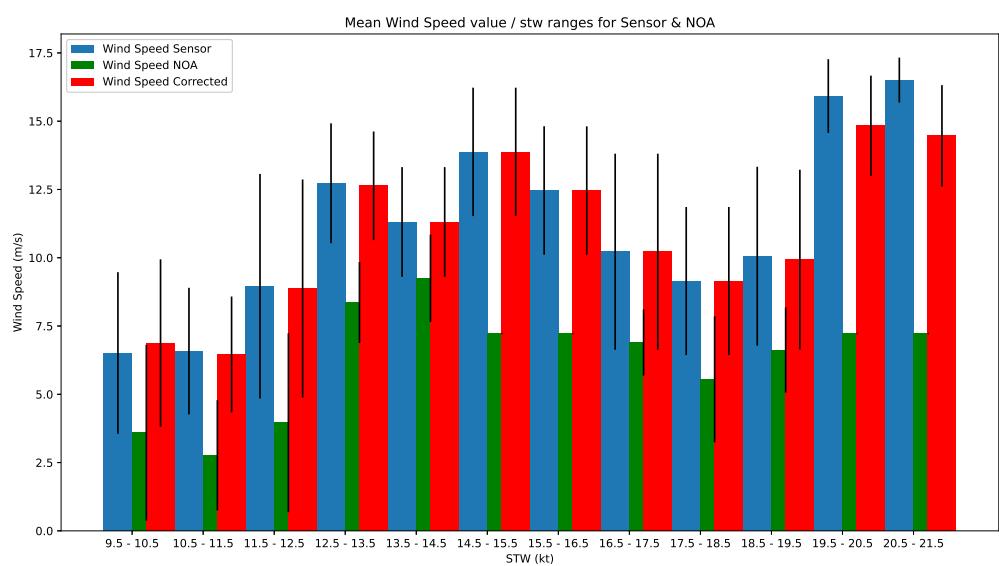


Figure 6: Initial / Weather Features Comparison per Speed Range

Routing Optimization Info :

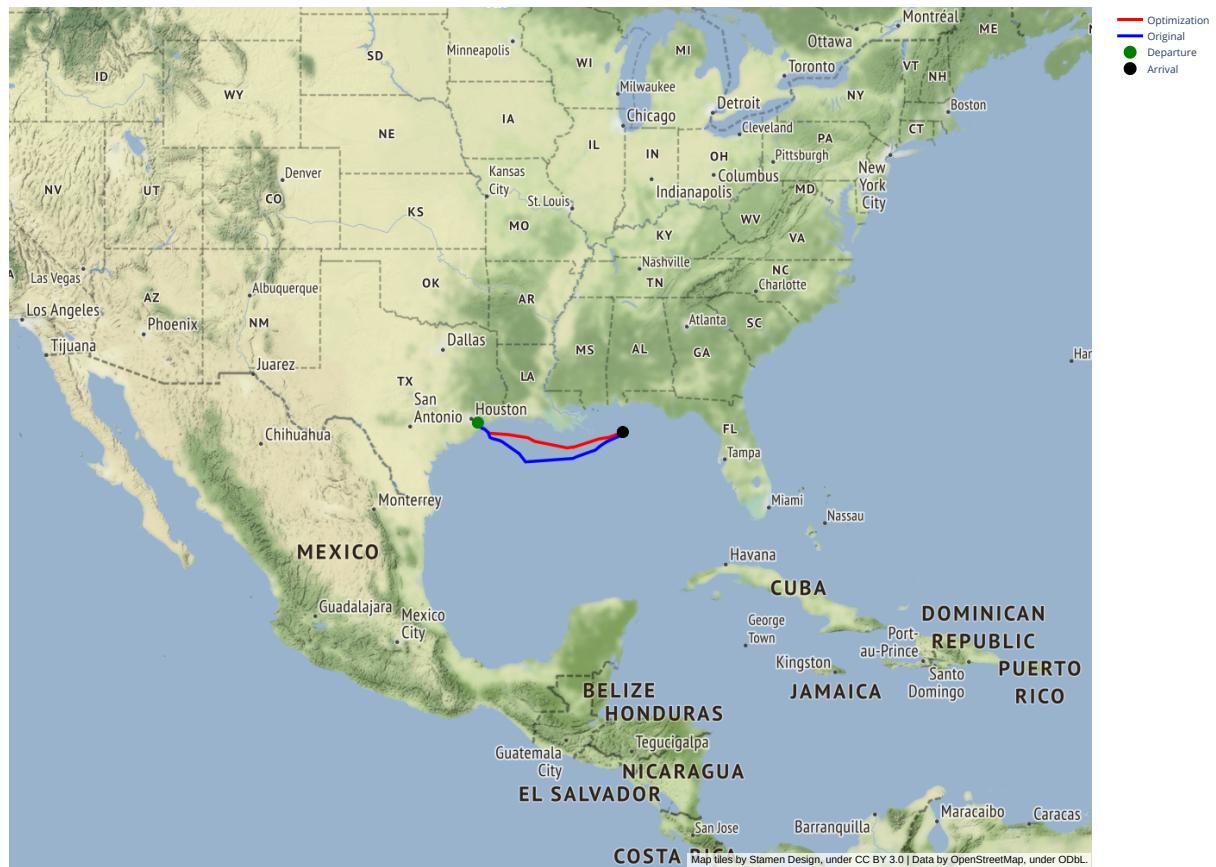


Figure 7: Initial / Optimized Route, HOUSTON - MOBILE

Voyage	Date	Latitude	Longitude
Departure	2019-09-13 12:09:00	29.0° 36.0' N	96.0° 59.0' E
Arrival	2019-09-15 01:30:00	29.0° 11.0' S	88.0° 23.0' E
BASIC COMPARISON			
Optimization(RET A = True)	Our Estimation	Optimization(RET A = False)	
Distance (nm)	439.97	522.51	414.06
Time (hours)	31.73	37.35	31.65
Avg Speed (kt)	13.62	13.99	12.87
Total FOC (MT)	68.34	71.84	66.11

Weather comparison optimization / initial:

- **RestrictETA = True**

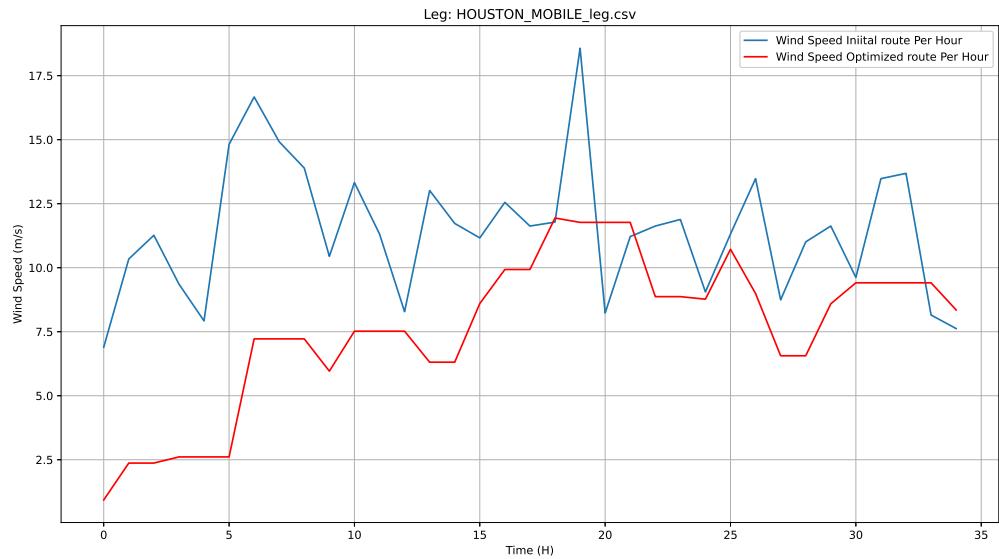


Figure 8: Wind Speed comparison Initial / Optimized Route, HOUSTON - MOBILE

- **RestrictETA = False**

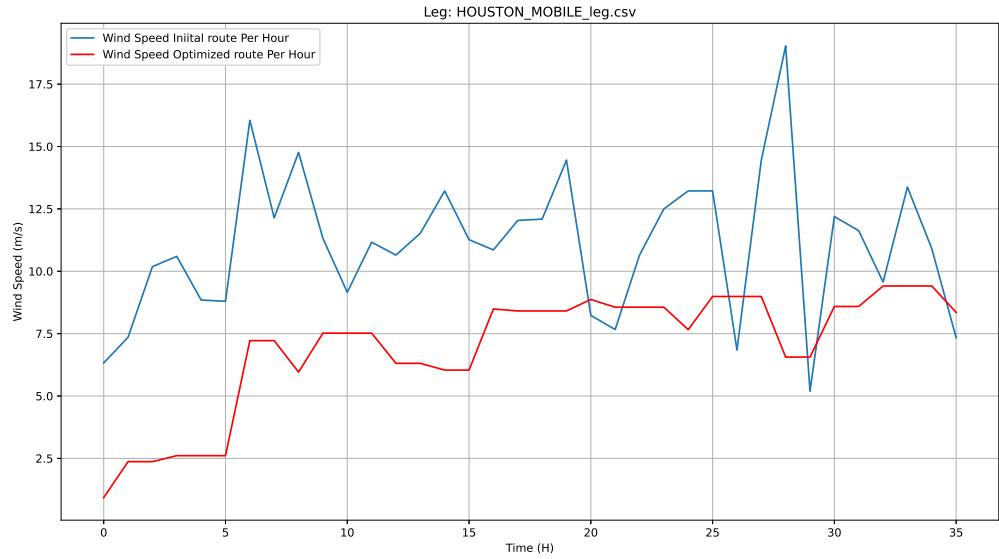


Figure 9: Wind Speed comparison Initial / Optimized Route, HOUSTON - MOBILE

Leg 2 # Basic INFO:

- Total Actual FOC : **190.36 MT**
 - Total Predicted FOC (Neural Net): **182.67 MT**
 - Total Predicted FOC (Neural DT): **185.19 MT**
 - FOC Perc Diff (Neural Net): **4.12 %**
 - FOC Perc Diff (Neural DT): **2.76 %**
- Departure Port : **MOBILE / 2019-09-16 11:34:00**
- Arrival Port : **TAMPA / 2019-09-20 01:00:00**
- Total Sailing Time: **85 hours**
- Distance Travelled: **284.77 n mi**
- Draft: **11.8 m**

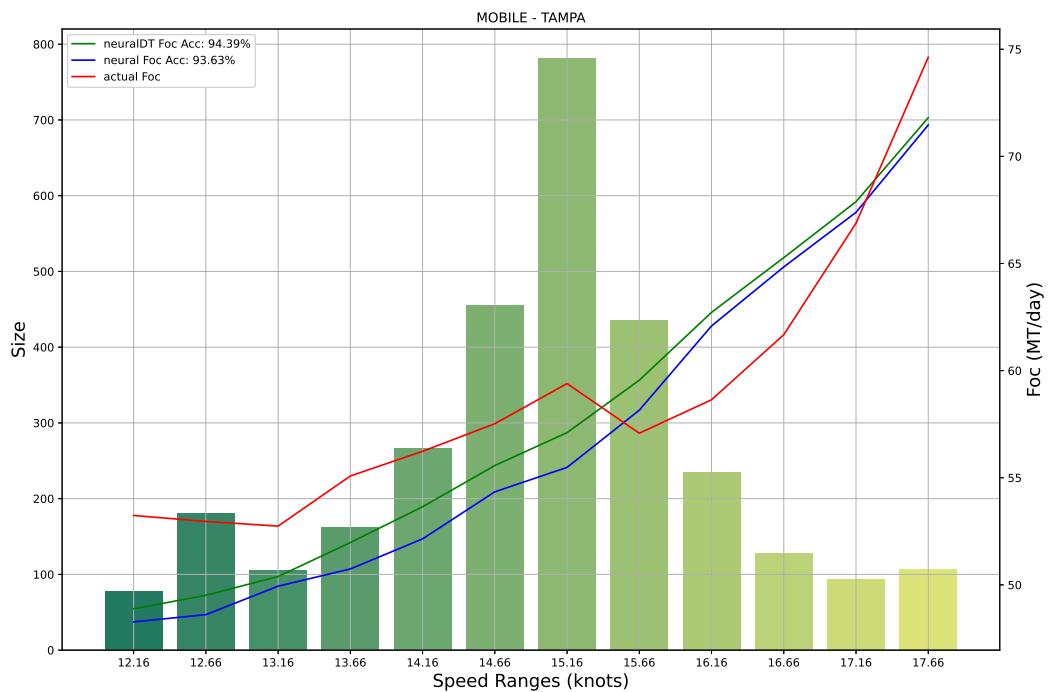


Figure 10: FOC Actual vs Predicted / Speed Ranges, MOBILE - TAMPA

Weather Comparison - Sensor / Weather Service (NOA)

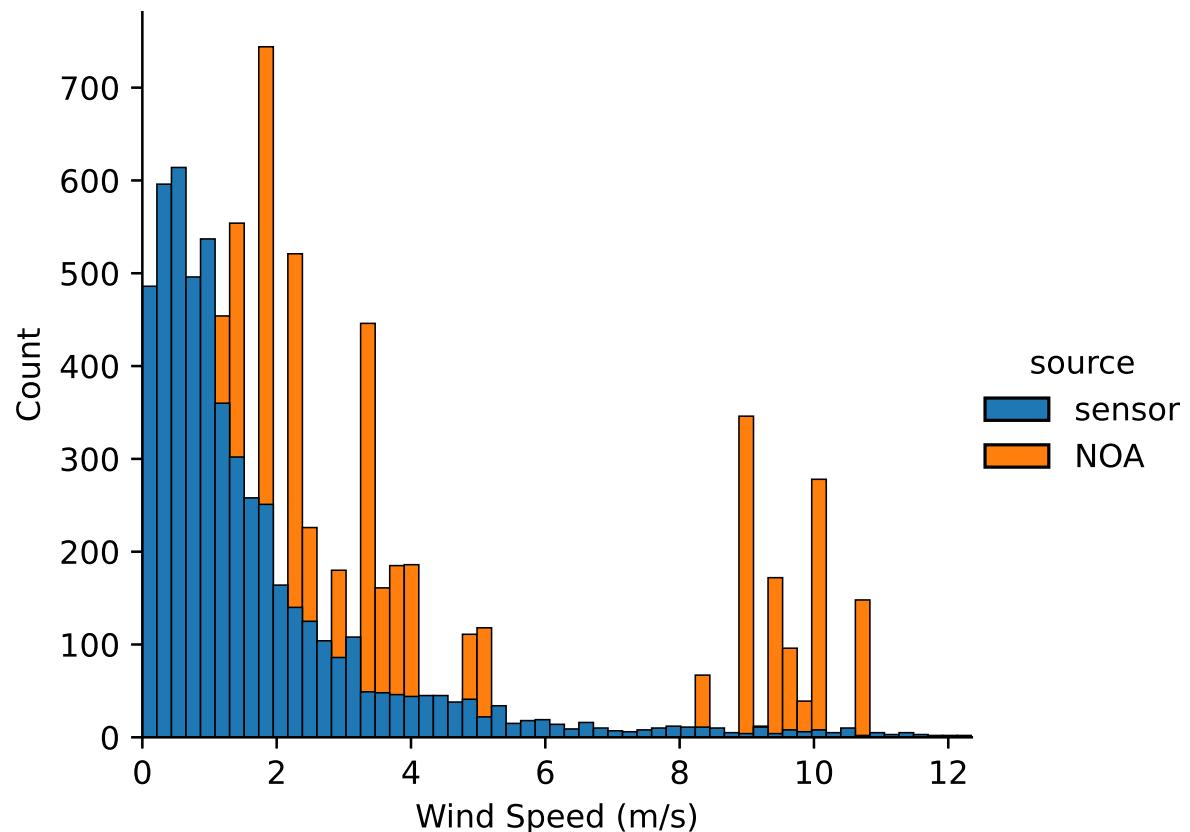


Figure 11: Wind Speed Sensor VS NOA Distributions comparison

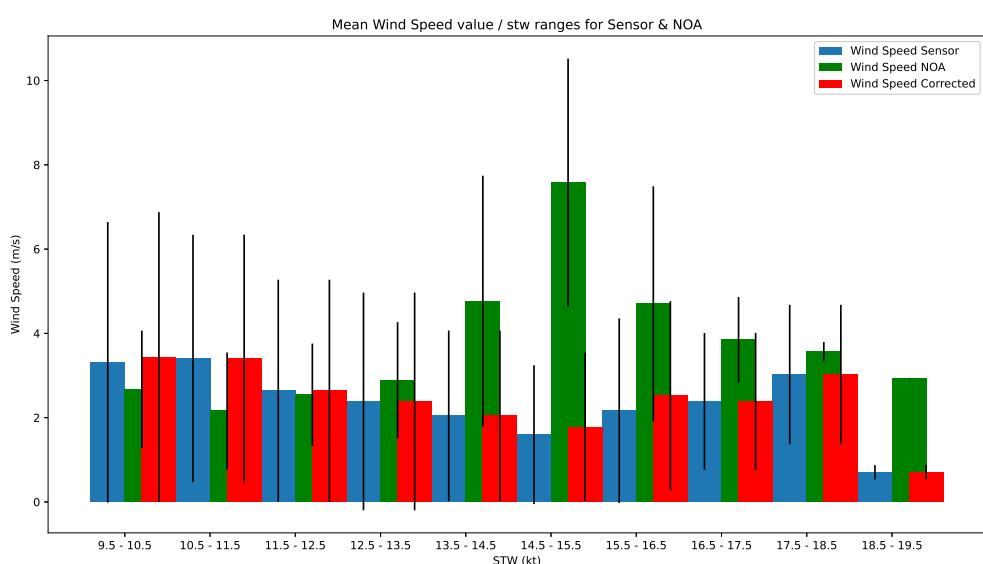


Figure 12: Initial / Weather Features Comparison per Speed Range

Routing Optimization Info :

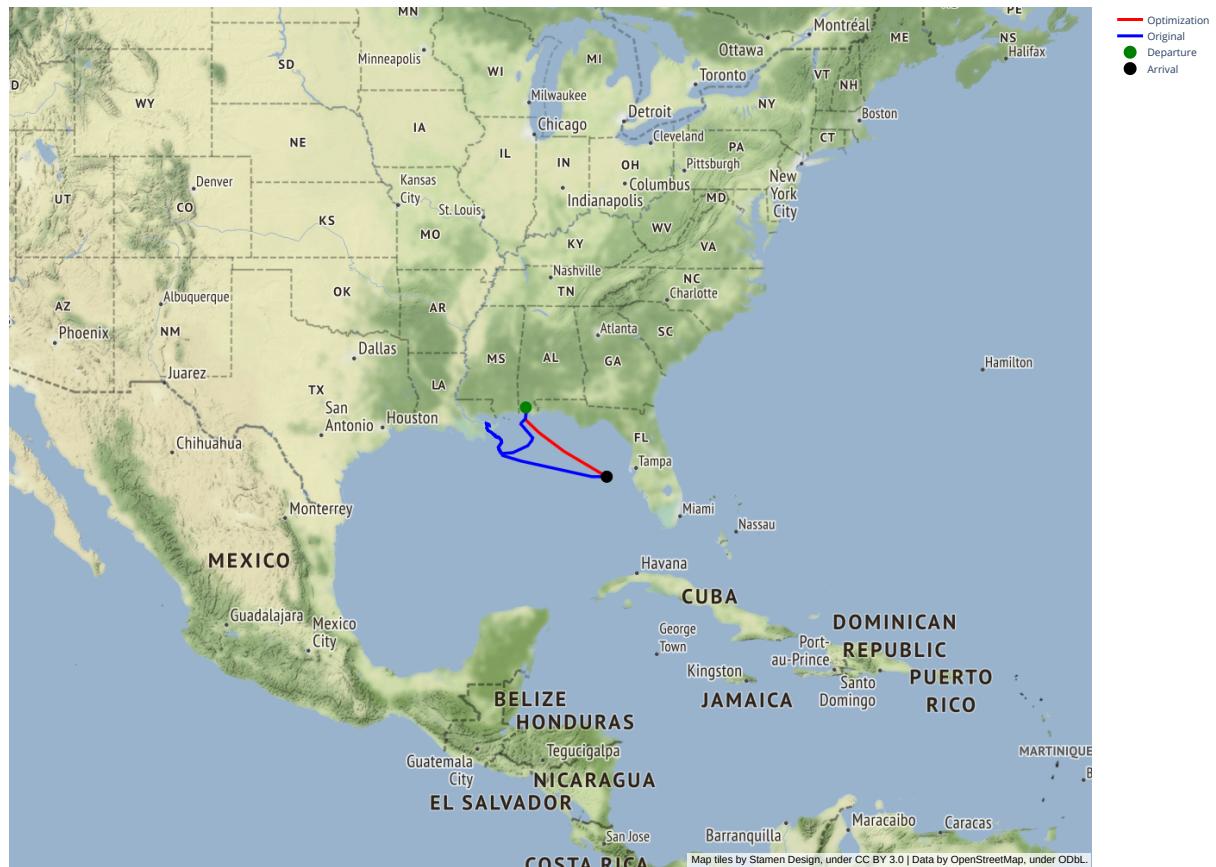


Figure 13: Initial / Optimized Route, MOBILE - TAMPA

Voyage	Date	Latitude	Longitude
Departure	2019-09-16 11:34:00	30.0° 40.0' N	89.0° 57.0' E
Arrival	2019-09-20 01:00:00	27.0° 34.0' S	84.0° 5.0' E
BASIC COMPARISON	Optimization(RET A = True)	Our Estimation	Optimization(RET A = False)
Distance (nm)	286.98	1,280.16	286.98
Time (hours)	20.38	85.43	20.45
Avg Speed (kt)	14.00	14.98	13.97
Total FOC (MT)	44.15	182.67	44.24

Weather comparison optimization / initial:

- **RestrictETA = True**

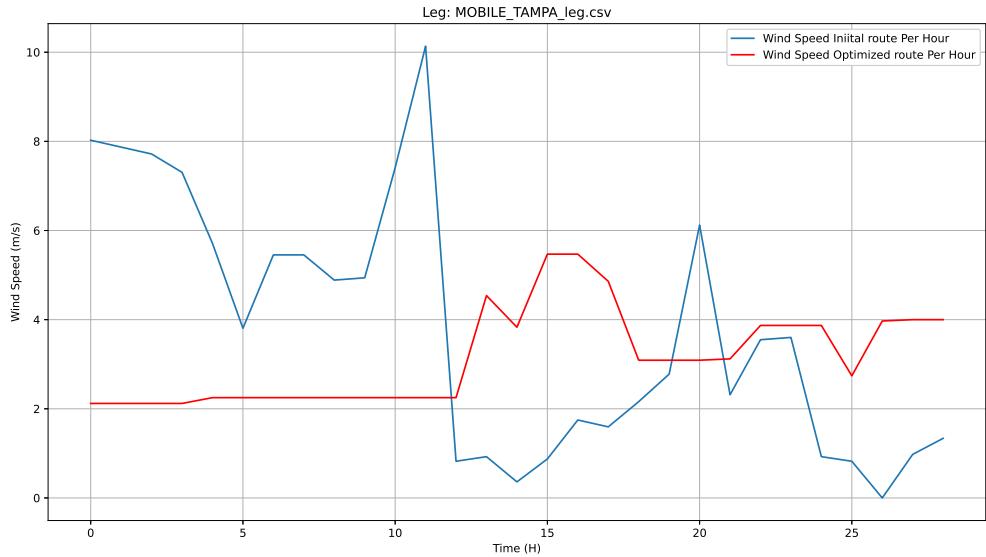


Figure 14: Wind Speed comparison Initial / Optimized Route, MOBILE - TAMPA

- **RestrictETA = False**

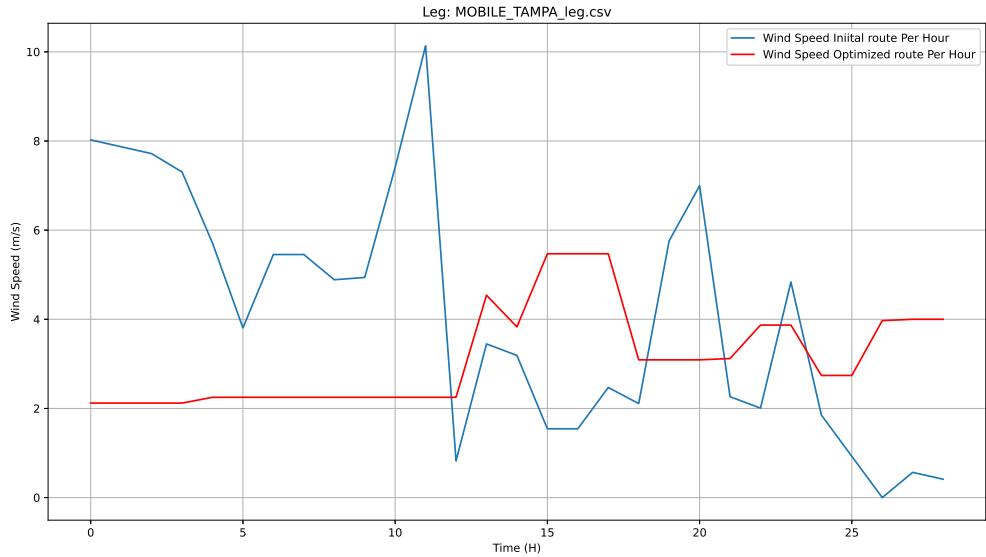


Figure 15: Wind Speed comparison Initial / Optimized Route, MOBILE - TAMPA

Leg 3 # Basic INFO:

- Total Actual FOC : **746.55 MT**
 - Total Predicted FOC (Neural Net): **745.52 MT**
 - Total Predicted FOC (Neural DT): **721.38 MT**
 - FOC Perc Diff (Neural Net): **0.14 %**
 - FOC Perc Diff (Neural DT): **3.43 %**
- Departure Port : **TAMPA / 2019-09-18 21:00:00**
- Arrival Port : **TANGER MED / 2019-09-20 01:00:00**
- Total Sailing Time: **28 hours**
- Distance Travelled: **340.51 n mi**
- Draft: **11.4 m**

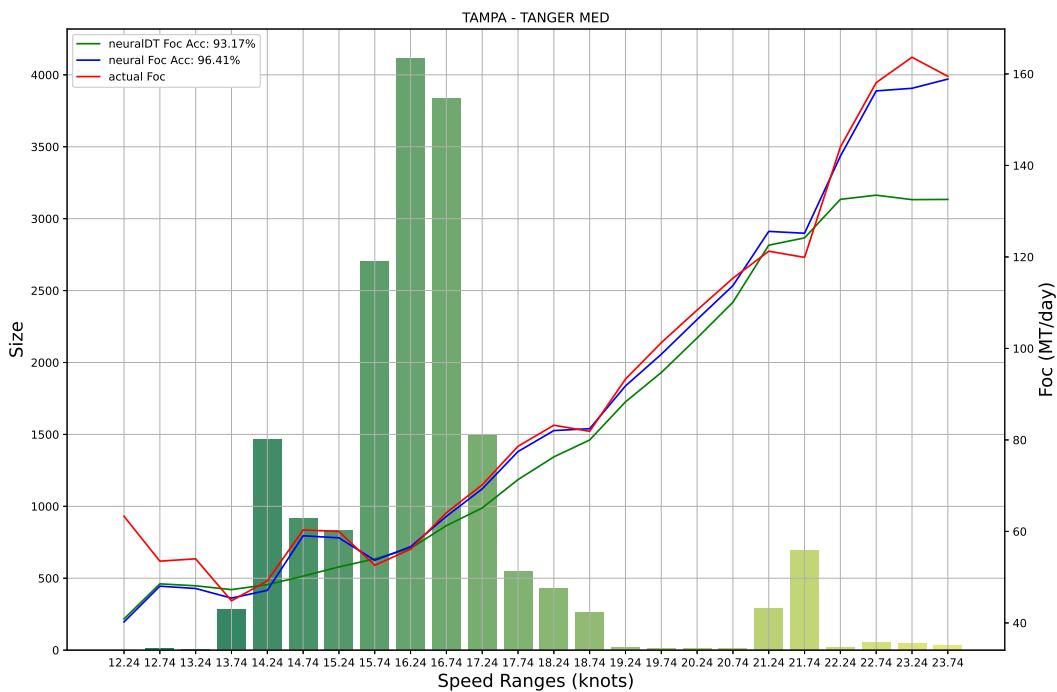


Figure 16: FOC Actual vs Predicted / Speed Ranges, TAMPA - TANGER MED

Weather Comparison - Sensor / Weather Service (NOA)

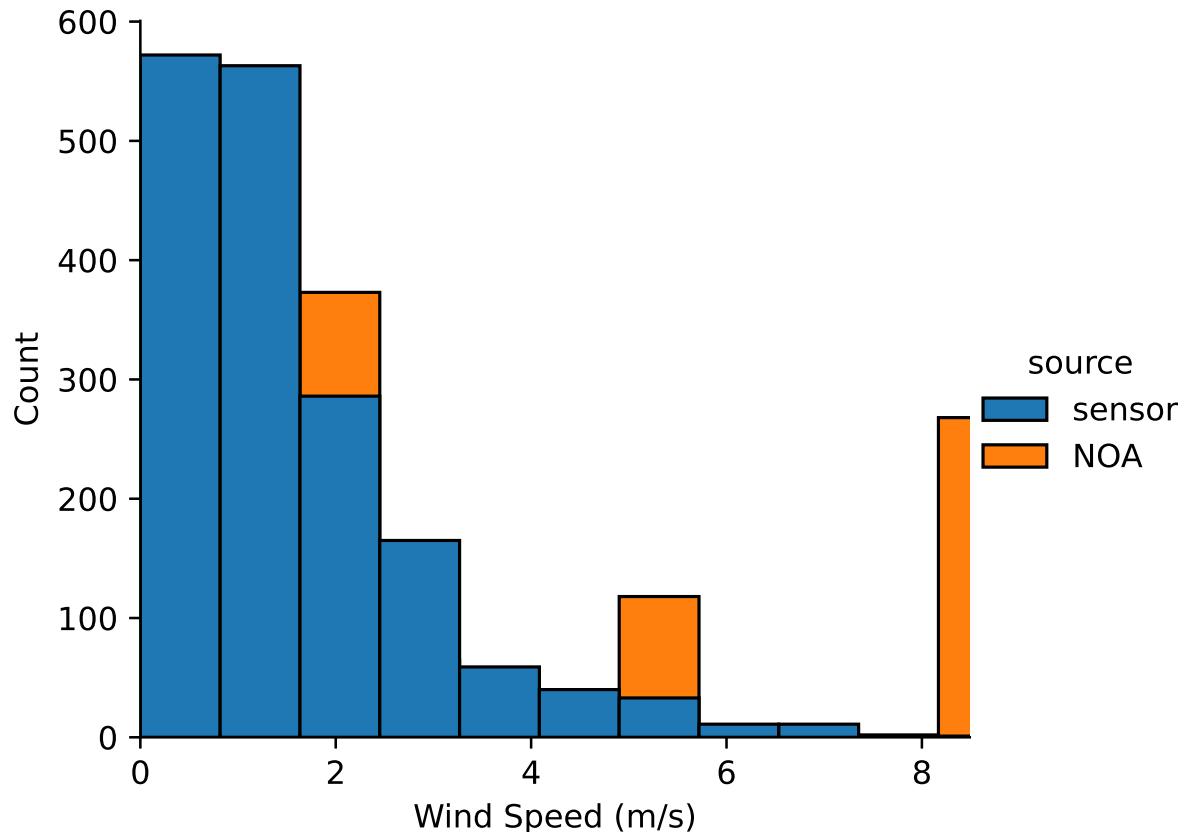


Figure 17: Wind Speed Sensor VS NOA Distributions comparison

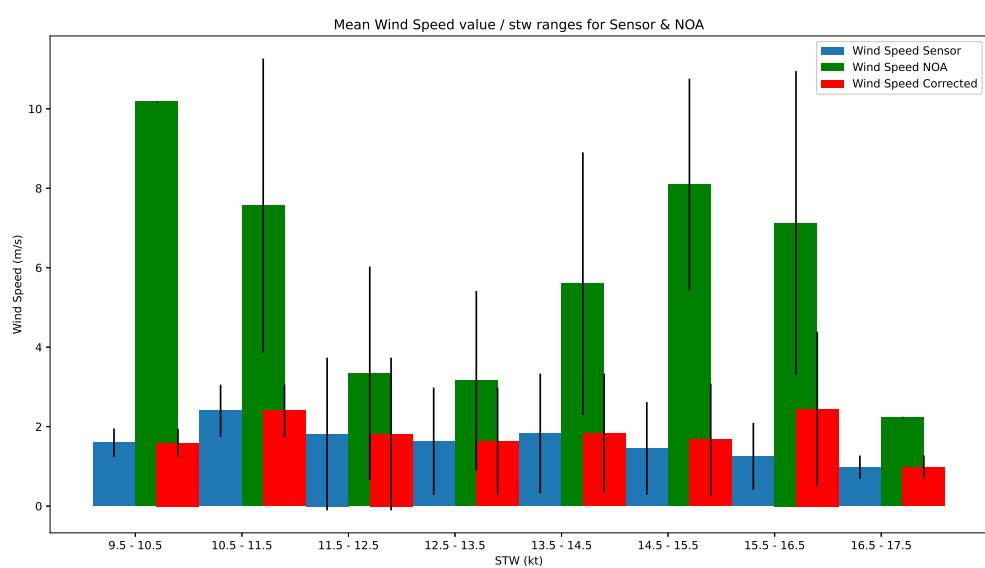


Figure 18: Initial / Weather Features Comparison per Speed Range

Routing Optimization Info :

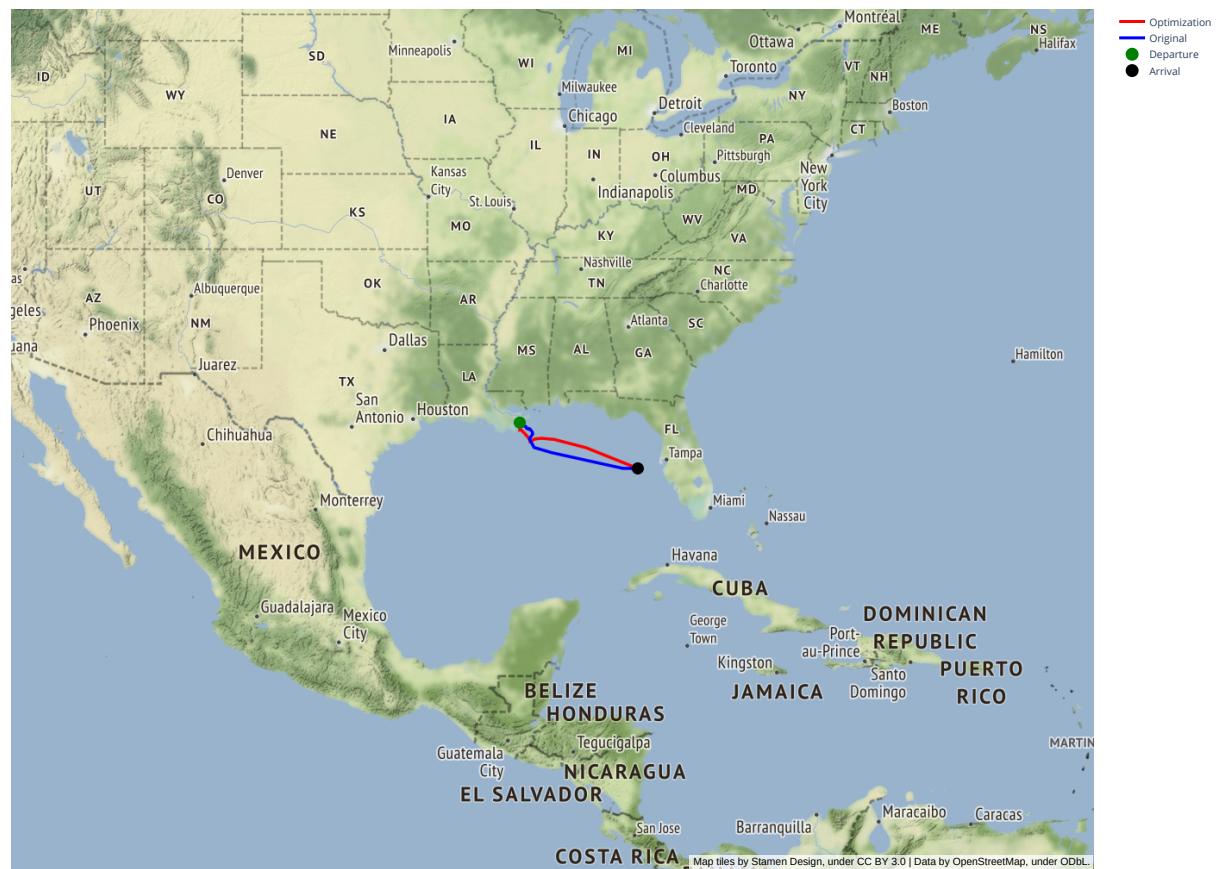


Figure 19: Initial / Optimized Route, TAMPA - TANGER MED

Voyage	Date	Latitude	Longitude
Departure	2019-09-18 21:00:00	27.0° 54.0' N	83.0° 34.0' E
Arrival	2019-09-20 01:00:00	35.0° 39.0' S	8.0° 34.0' E
BASIC COMPARISON	Optimization(RET A = True)	Our Estimation	Optimization(RET A = False)
Distance (nm)	367.73	462.87	367.61
Time (hours)	25.93	28.00	26.08
Avg Speed (kt)	14.20	16.53	14.32
Total FOC (MT)	56.67	745.52	57.19

Weather comparison optimization / initial:

- **RestrictETA = True**

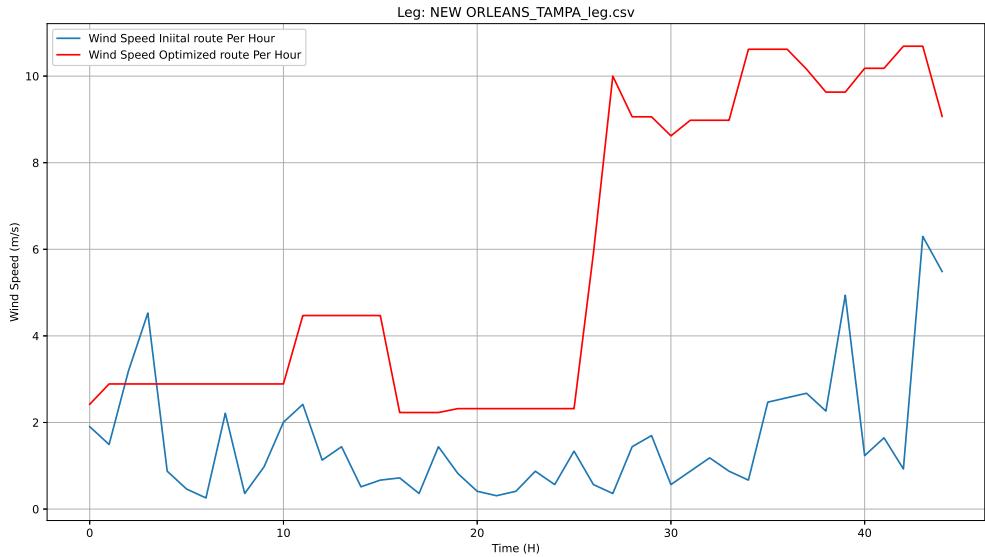


Figure 20: Wind Speed comparison Initial / Optimized Route, TAMPA - TANGER MED

- **RestrictETA = False**

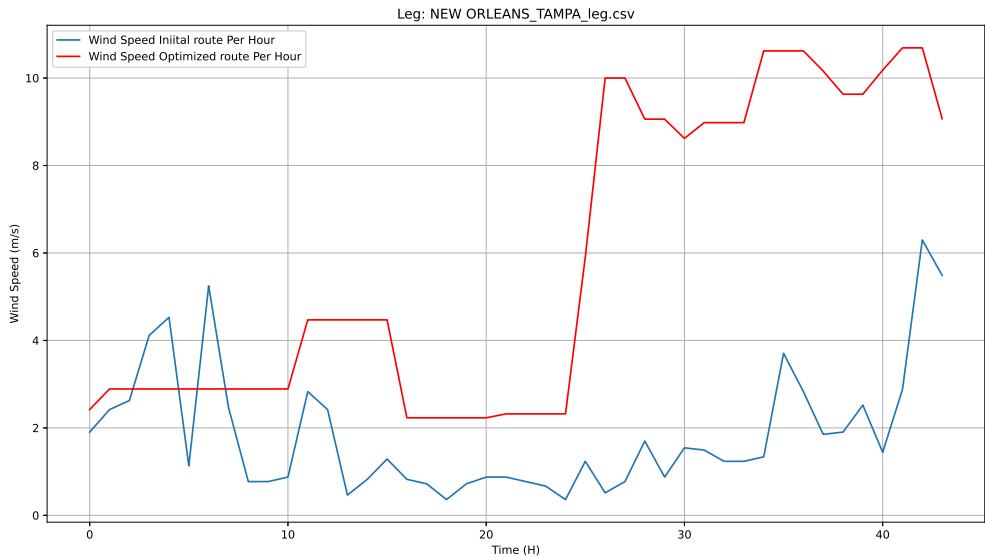


Figure 21: Wind Speed comparison Initial / Optimized Route, TAMPA - TANGER MED

Leg 4 # Basic INFO:

- Total Actual FOC : **384.81 MT**
 - Total Predicted FOC (Neural Net): **390.20 MT**
 - Total Predicted FOC (Neural DT): **371.78 MT**
 - FOC Perc Diff (Neural Net): **1.39 %**
 - FOC Perc Diff (Neural DT): **3.44 %**
- Departure Port : **TANGER MED / 2019-09-20 23:12:00**
- Arrival Port : **SUEZ / 2019-10-03 02:26:00**
- Total Sailing Time: **291 hours**
- Distance Travelled: **3,771.40 n mi**
- Draft: **11.7 m**

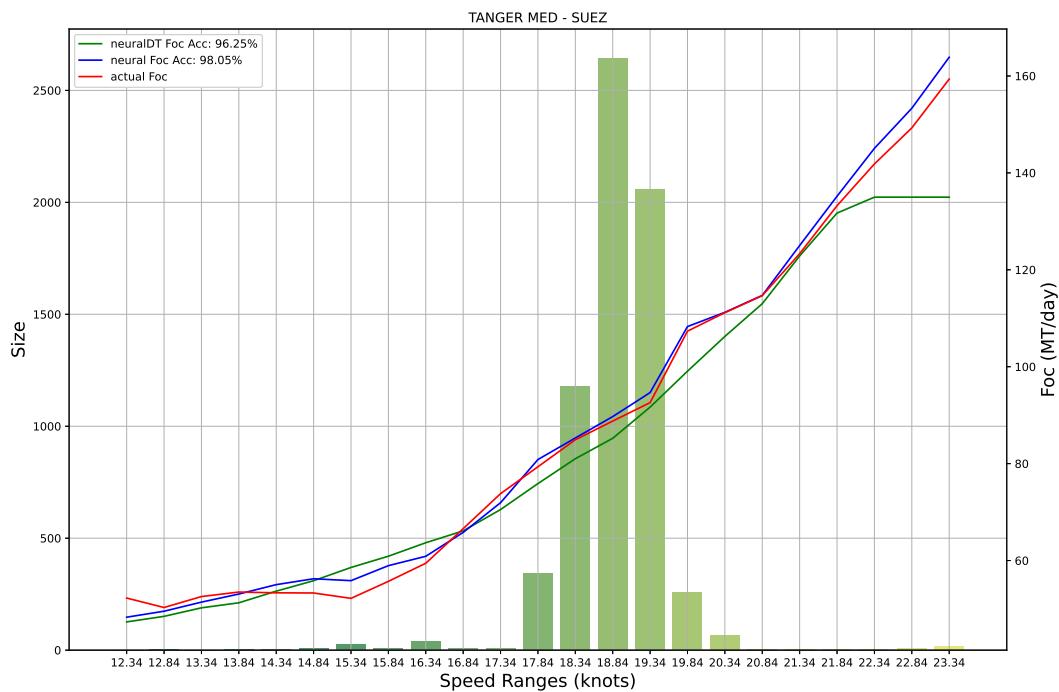


Figure 22: FOC Actual vs Predicted / Speed Ranges, TANGER MED - SUEZ

Weather Comparison - Sensor / Weather Service (NOA)

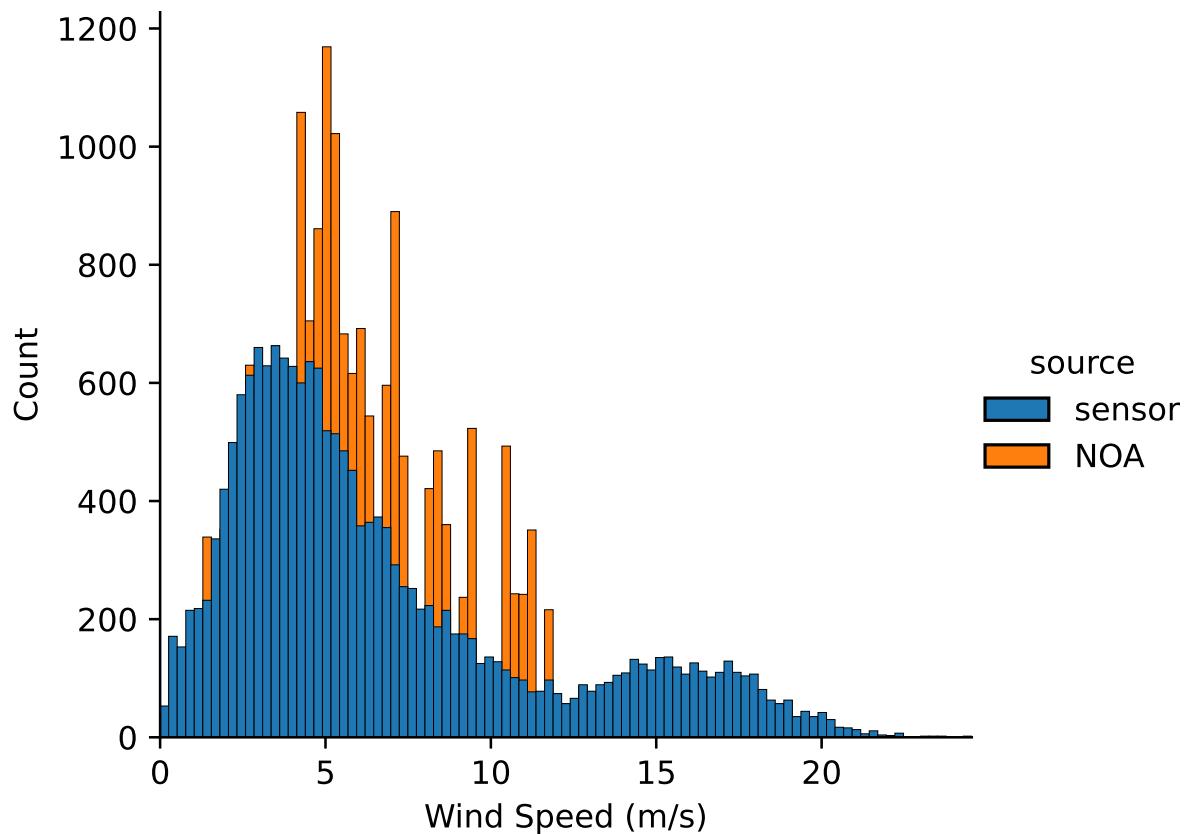


Figure 23: Wind Speed Sensor VS NOA Distributions comparison

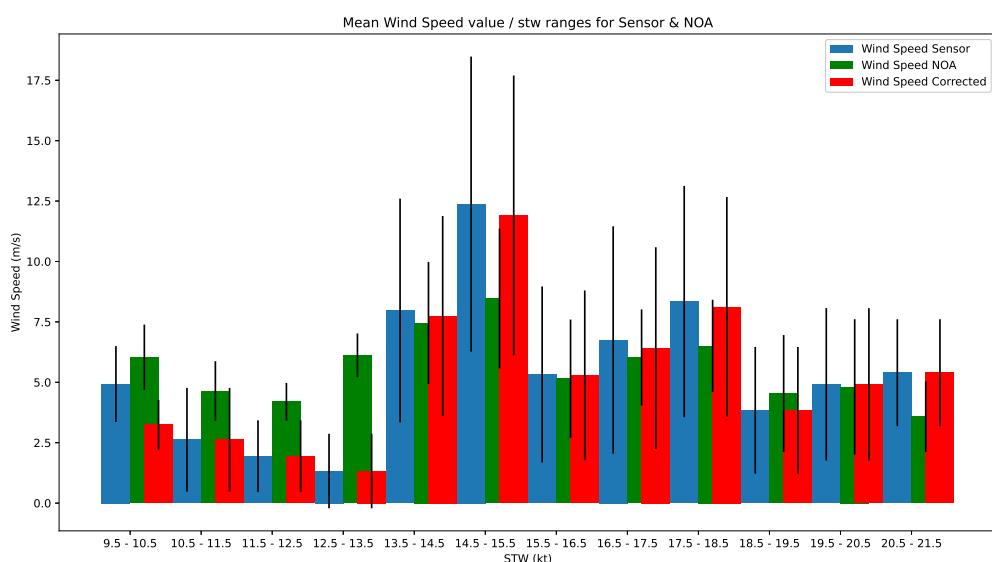


Figure 24: Initial / Weather Features Comparison per Speed Range

Routing Optimization Info :

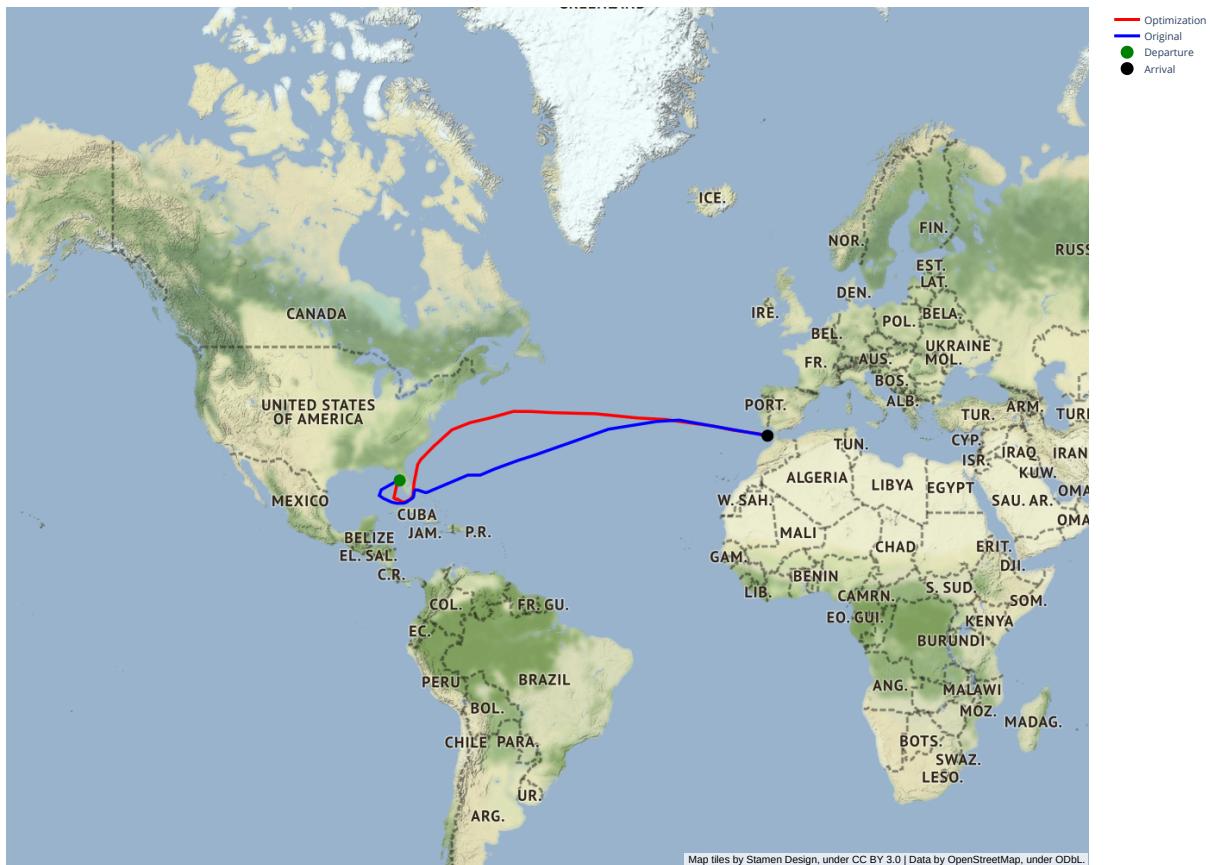


Figure 25: Initial / Optimized Route, TANGER MED - SUEZ

Voyage	Date	Latitude	Longitude
Departure	2019-09-20 23:12:00	36.0° 1.0' N	6.0° 50.0' E
Arrival	2019-10-03 02:26:00	31.0° 24.0' S	32.0° 19.0' E
BASIC COMPARISON	Optimization(RET A = True)	Our Estimation	Optimization(RET A = False)
Distance (nm)	4,303.96	5,504.59	4,391.02
Time (hours)	284.75	291.23	275.47
Avg Speed (kt)	14.99	18.90	15.81
Total FOC (MT)	601.57	390.20	631.68

Weather comparison optimization / initial:

- **RestrictETA = True**

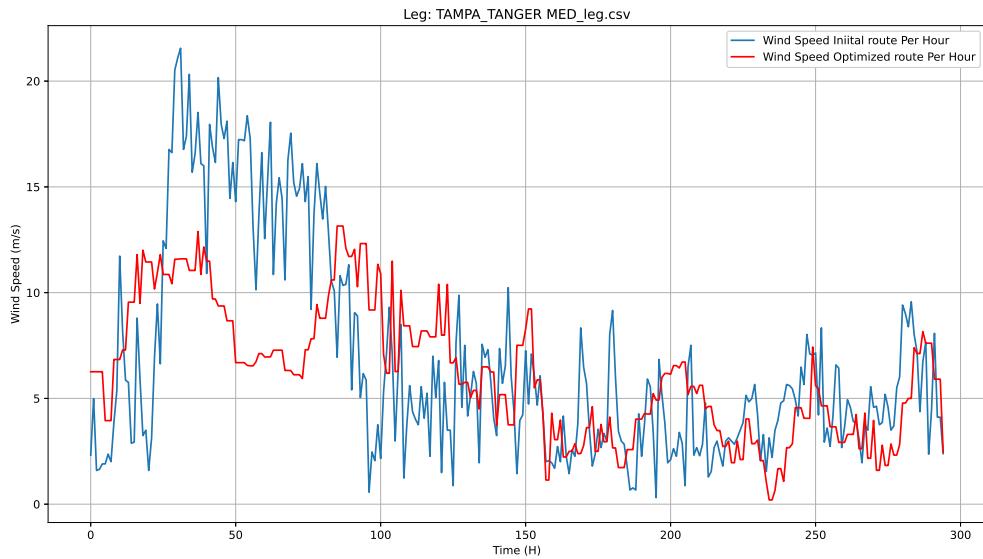


Figure 26: Wind Speed comparison Initial / Optimized Route, TANGER MED - SUEZ

- **RestrictETA = False**

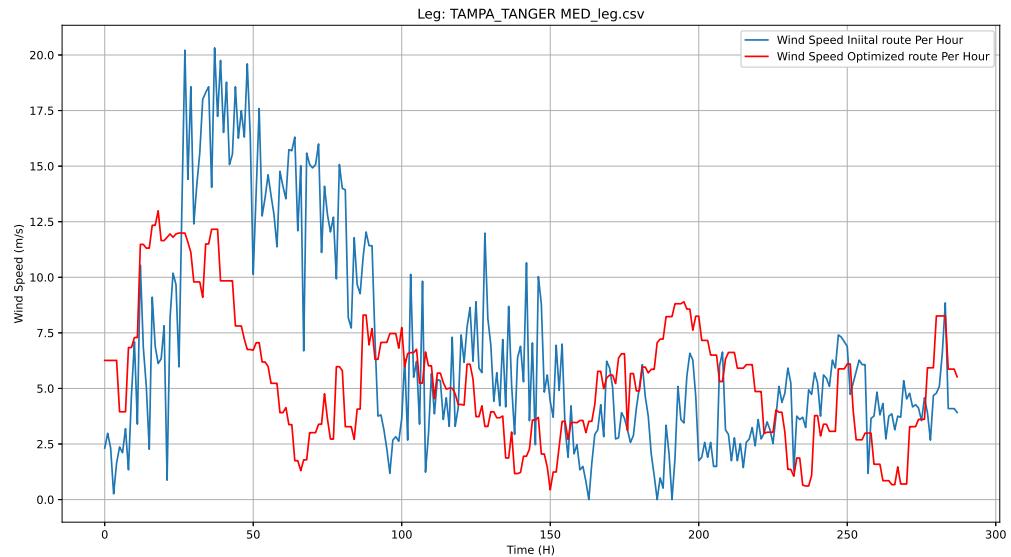


Figure 27: Wind Speed comparison Initial / Optimized Route, TANGER MED - SUEZ

Leg 5 # Basic INFO:

- Total Actual FOC : **1,015.73 MT**
 - Total Predicted FOC (Neural Net): **1,026.19 MT**
 - Total Predicted FOC (Neural DT): **1,000.46 MT**
 - FOC Perc Diff (Neural Net): **1.02 %**
 - FOC Perc Diff (Neural DT): **1.51 %**
- Departure Port : **SUEZ / 2019-10-09 08:30:00**
- Arrival Port : **SINGAPORE / 2019-10-13 20:13:00**
- Total Sailing Time: **108 hours**
- Distance Travelled: **1,884.40 n mi**
- Draft: **11.7 m**

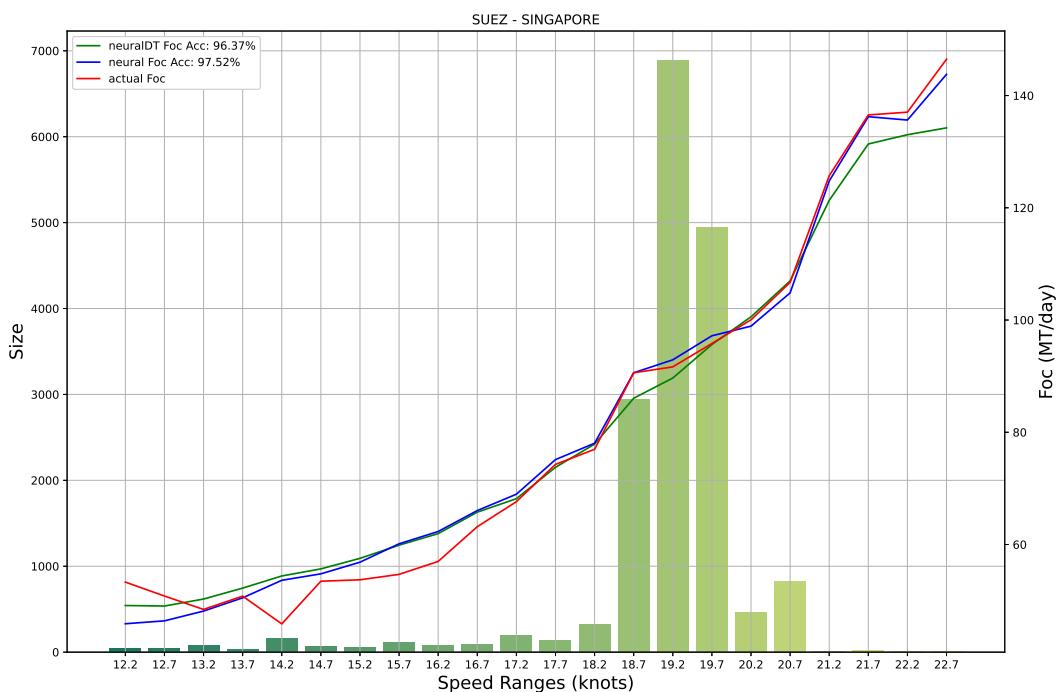


Figure 28: FOC Actual vs Predicted / Speed Ranges, SUEZ - SINGAPORE

Weather Comparison - Sensor / Weather Service (NOA)

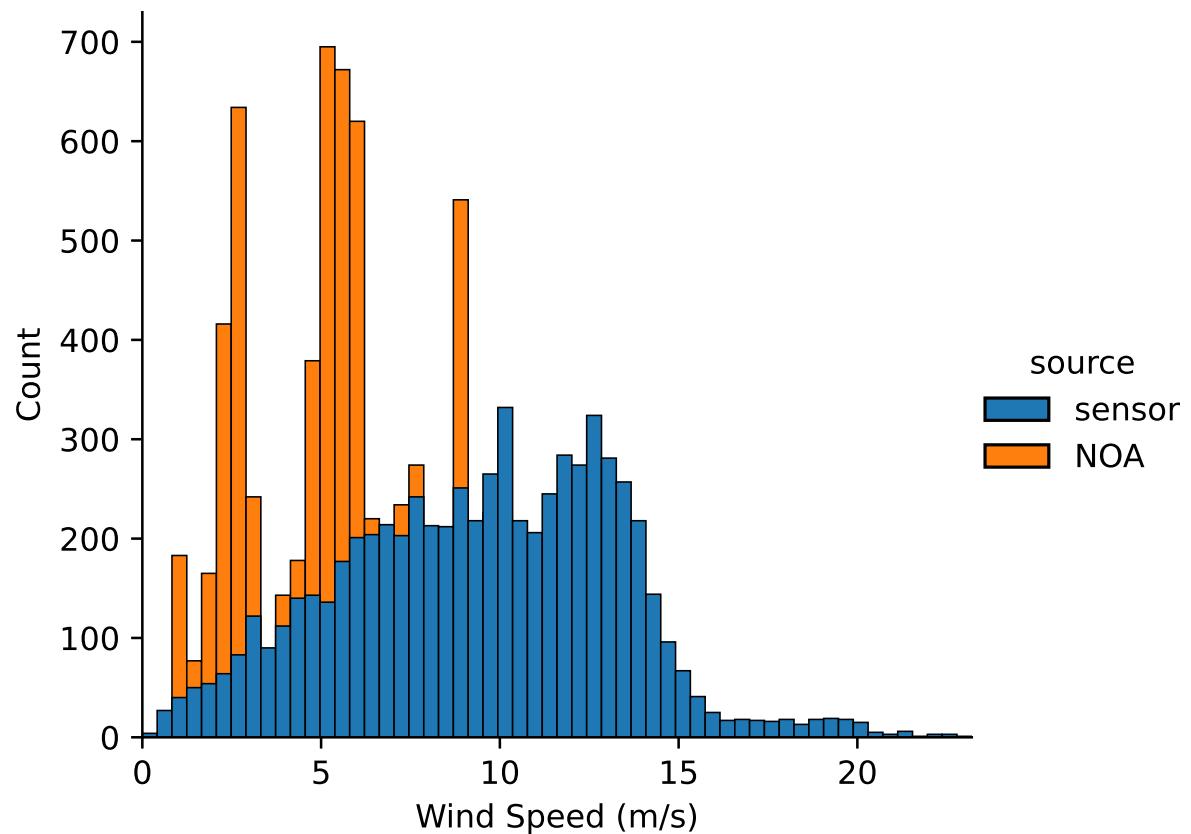


Figure 29: Wind Speed Sensor VS NOA Distributions comparison

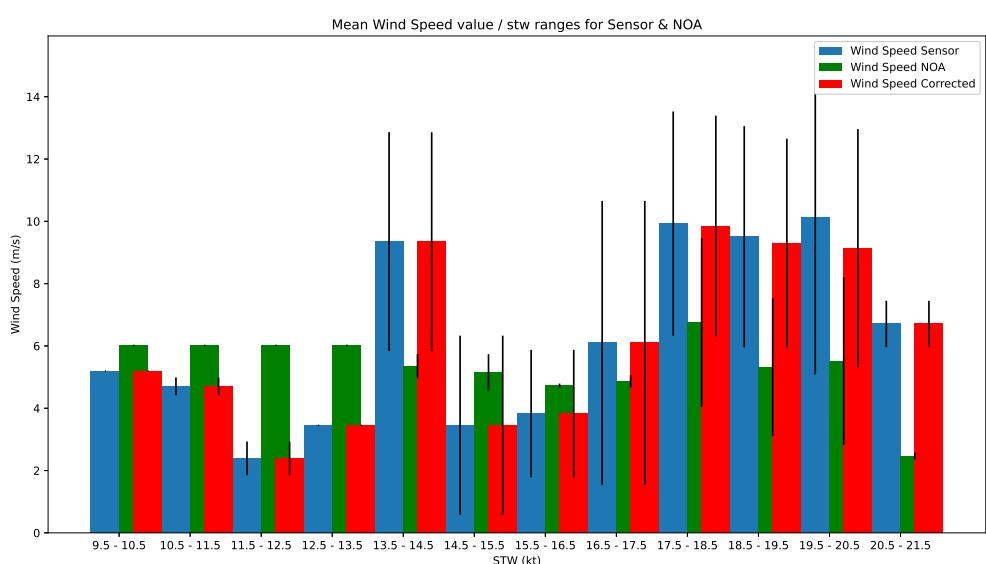


Figure 30: Initial / Weather Features Comparison per Speed Range

Routing Optimization Info :

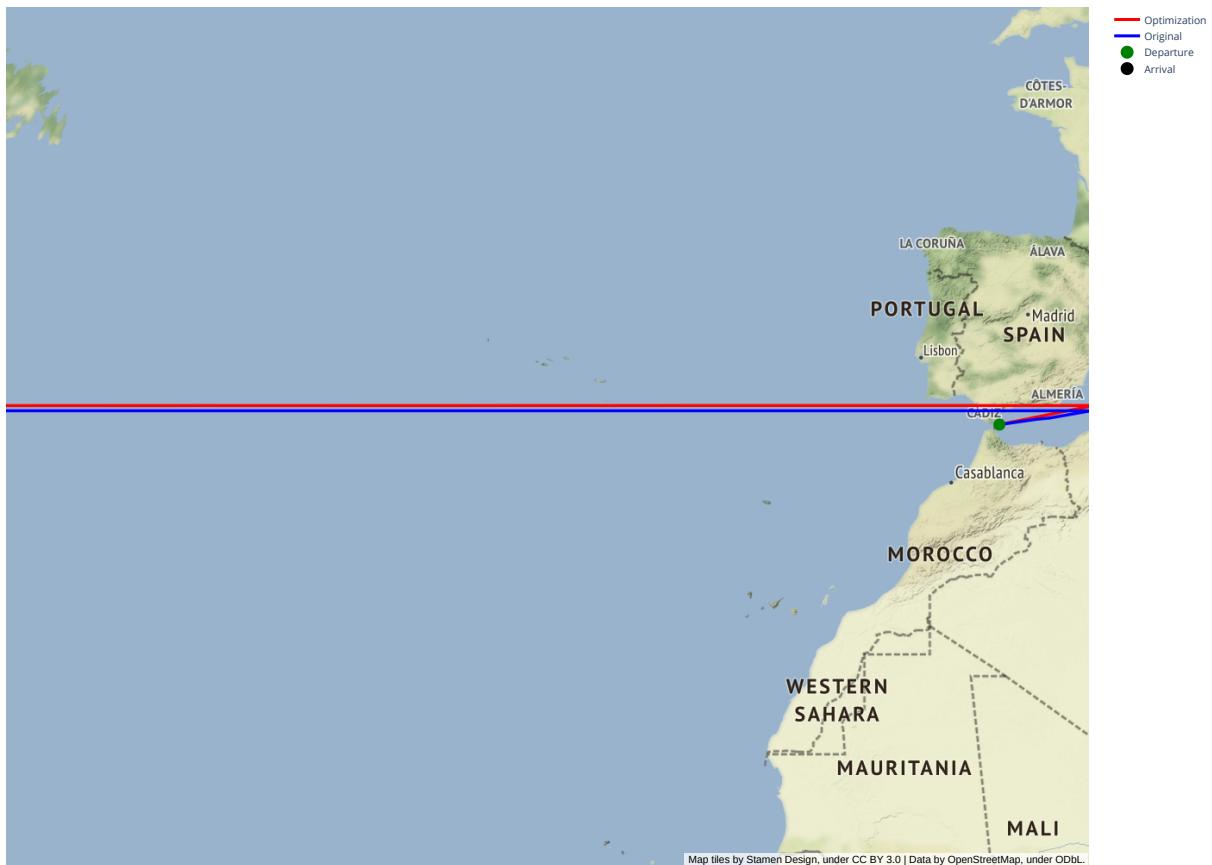


Figure 31: Initial / Optimized Route, SUEZ - SINGAPORE

Voyage	Date	Latitude	Longitude
Departure	2019-10-09 08:30:00	29.0° 16.0' N	32.0° 40.0' E
Arrival	2019-10-13 20:13:00	1.0° 15.0' S	103.0° 46.0' E
BASIC COMPARISON	Optimization(RET A = True)	Our Estimation	Optimization(RET A = False)
Distance (nm)	1,886.95	2,055.83	1,886.22
Time (hours)	106.80	107.72	104.45
Avg Speed (kt)	17.67	19.08	18.06
Total FOC (MT)	320.32	1,026.19	336.32

Weather comparison optimization / initial:

- **RestrictETA = True**

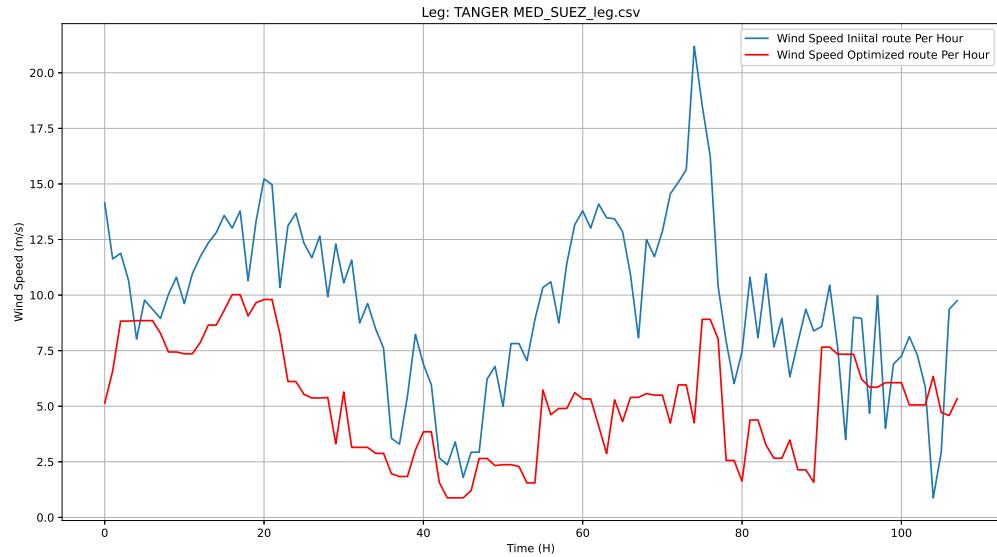


Figure 32: Wind Speed comparison Initial / Optimized Route, SUEZ - SINGAPORE

- **RestrictETA = False**

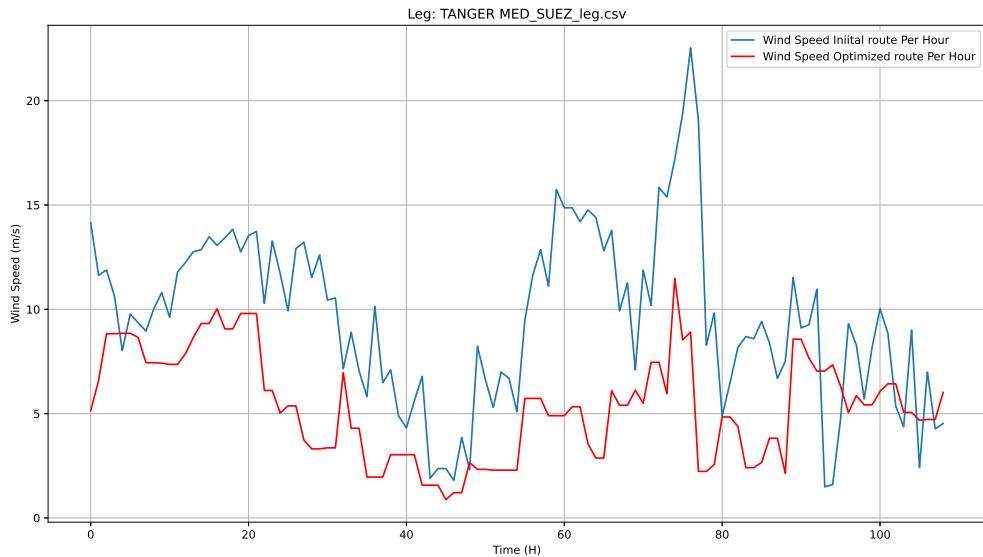


Figure 33: Wind Speed comparison Initial / Optimized Route, SUEZ - SINGAPORE

Leg 6 # Basic INFO:

- Total Actual FOC : **77.82 MT**
 - Total Predicted FOC (Neural Net): **78.85 MT**
 - Total Predicted FOC (Neural DT): **78.75 MT**
 - FOC Perc Diff (Neural Net): **1.31 %**
 - FOC Perc Diff (Neural DT): **1.19 %**
- Departure Port : **SINGAPORE / 2019-10-14 15:30:00**
- Arrival Port : **VUNG TAU / 2019-10-26 06:06:00**
- Total Sailing Time: **279 hours**
- Distance Travelled: **4,382.31 n mi**
- Draft: **10.2 m**

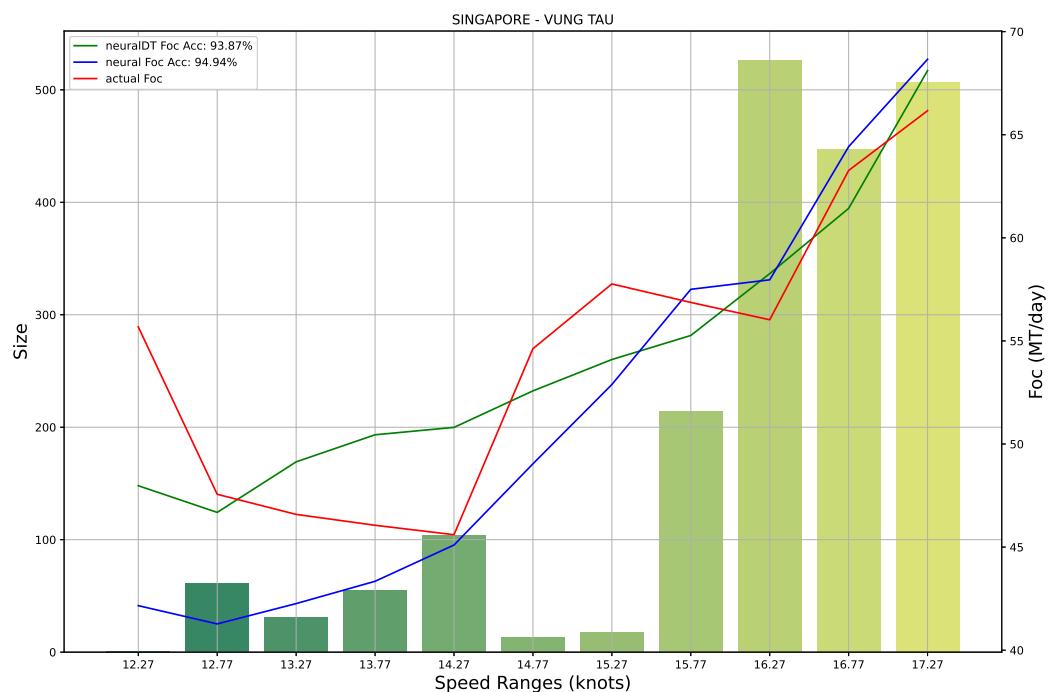


Figure 34: FOC Actual vs Predicted / Speed Ranges, SINGAPORE - VUNG TAU

Weather Comparison - Sensor / Weather Service (NOA)

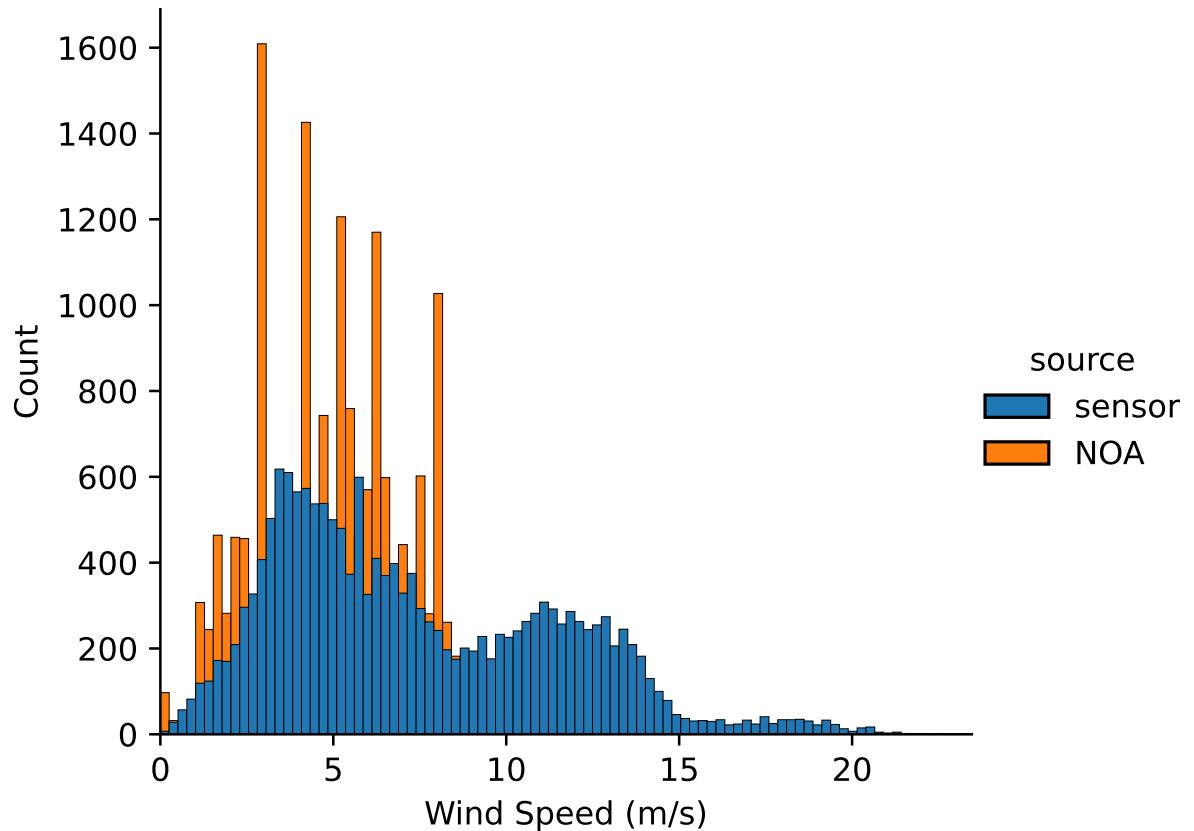


Figure 35: Wind Speed Sensor VS NOA Distributions comparison

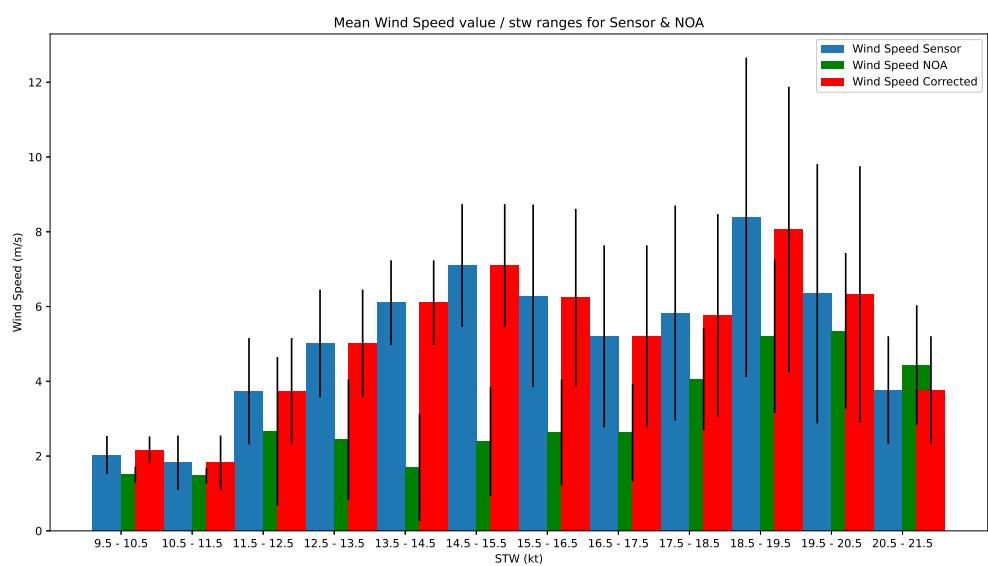


Figure 36: Initial / Weather Features Comparison per Speed Range

Routing Optimization Info :

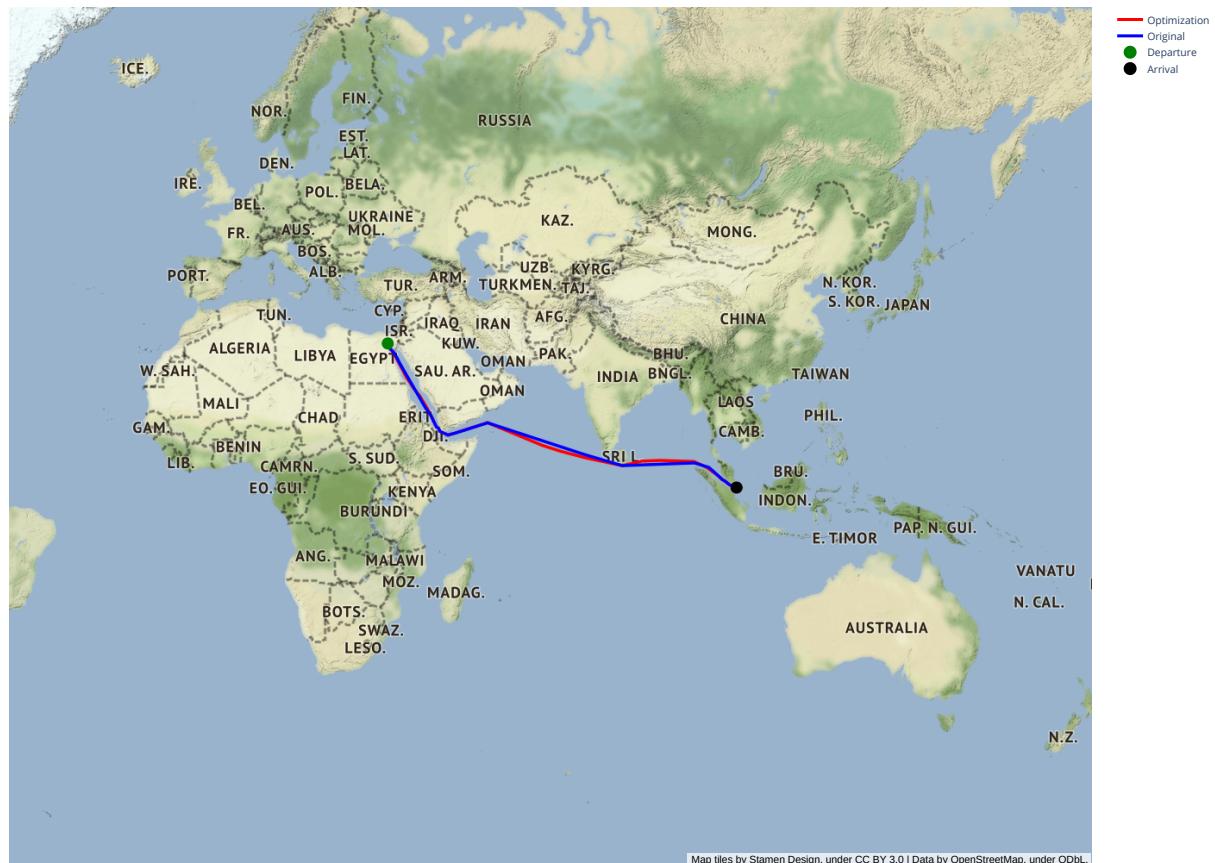


Figure 37: Initial / Optimized Route, SINGAPORE - VUNG TAU

Voyage	Date	Latitude	Longitude
Departure	2019-10-14 15:30:00	2.0° 44.0' N	105.0° 6.0' E
Arrival	2019-10-26 06:06:00	10.0° 30.0' S	107.0° 0.0' E
BASIC COMPARISON	Optimization(RET A = True)	Our Estimation	Optimization(RET A = False)
Distance (nm)	4,947.53	4,538.22	4,954.30
Time (hours)	276.17	278.60	270.57
Avg Speed (kt)	17.90	16.29	18.31
Total FOC (MT)	854.61	78.85	887.63

Weather comparison optimization / initial:

- **RestrictETA = True**

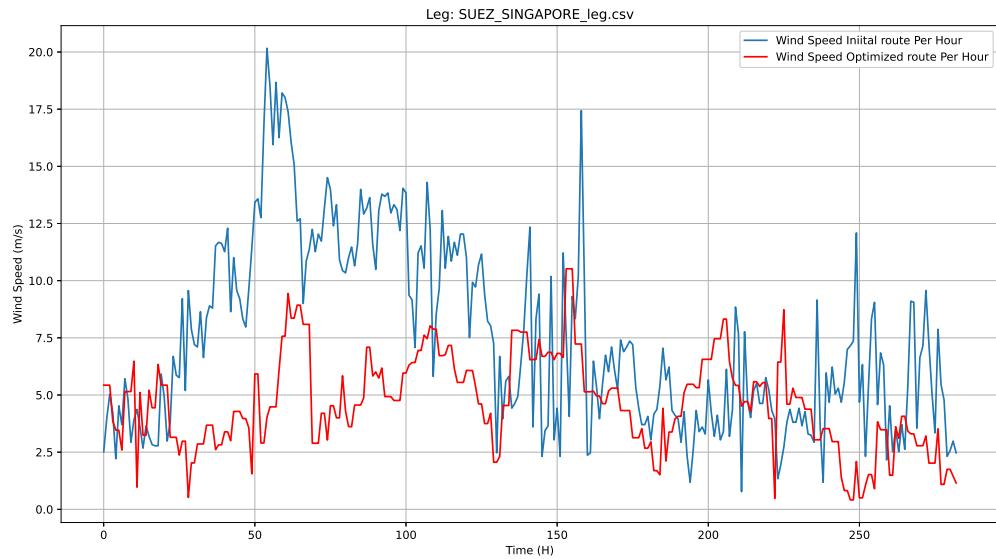


Figure 38: Wind Speed comparison Initial / Optimized Route, SINGAPORE - VUNG TAU

- **RestrictETA = False**

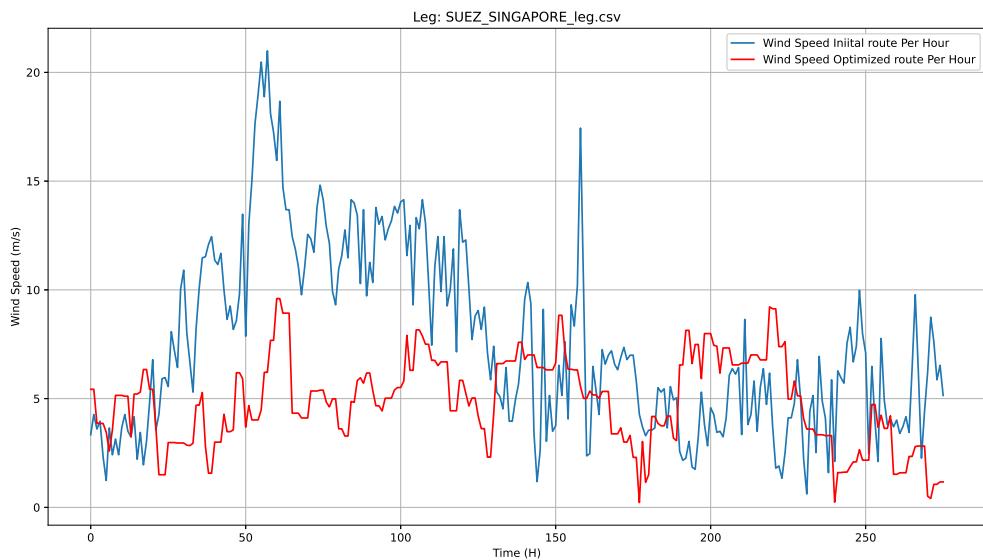


Figure 39: Wind Speed comparison Initial / Optimized Route, SINGAPORE - VUNG TAU

Leg 7 # Basic INFO:

- Total Actual FOC : **188.01 MT**
 - Total Predicted FOC (Neural Net): **185.73 MT**
 - Total Predicted FOC (Neural DT): **172.78 MT**
 - FOC Perc Diff (Neural Net): **1.22 %**
 - FOC Perc Diff (Neural DT): **8.44 %**
- Departure Port : **VUNG TAU / 2019-10-27 16:00:00**
- Arrival Port : **HONG KONG / 2019-10-29 02:09:00**
- Total Sailing Time: **34 hours**
- Distance Travelled: **477.57 n mi**
- Draft: **10.9 m**

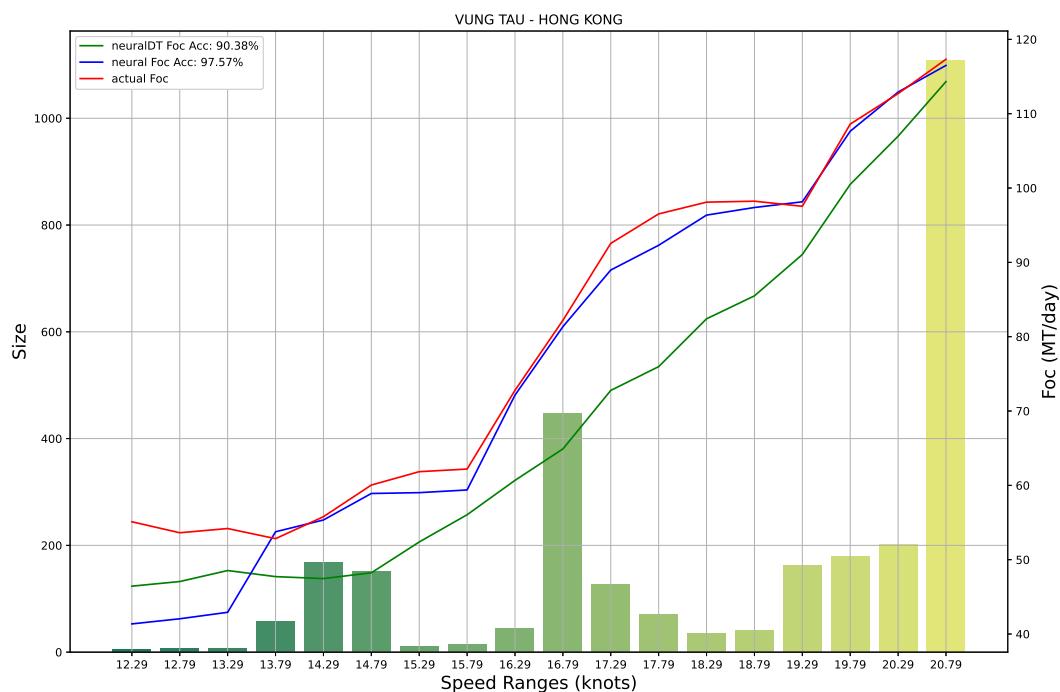


Figure 40: FOC Actual vs Predicted / Speed Ranges, VUNG TAU - HONG KONG

Weather Comparison - Sensor / Weather Service (NOA)

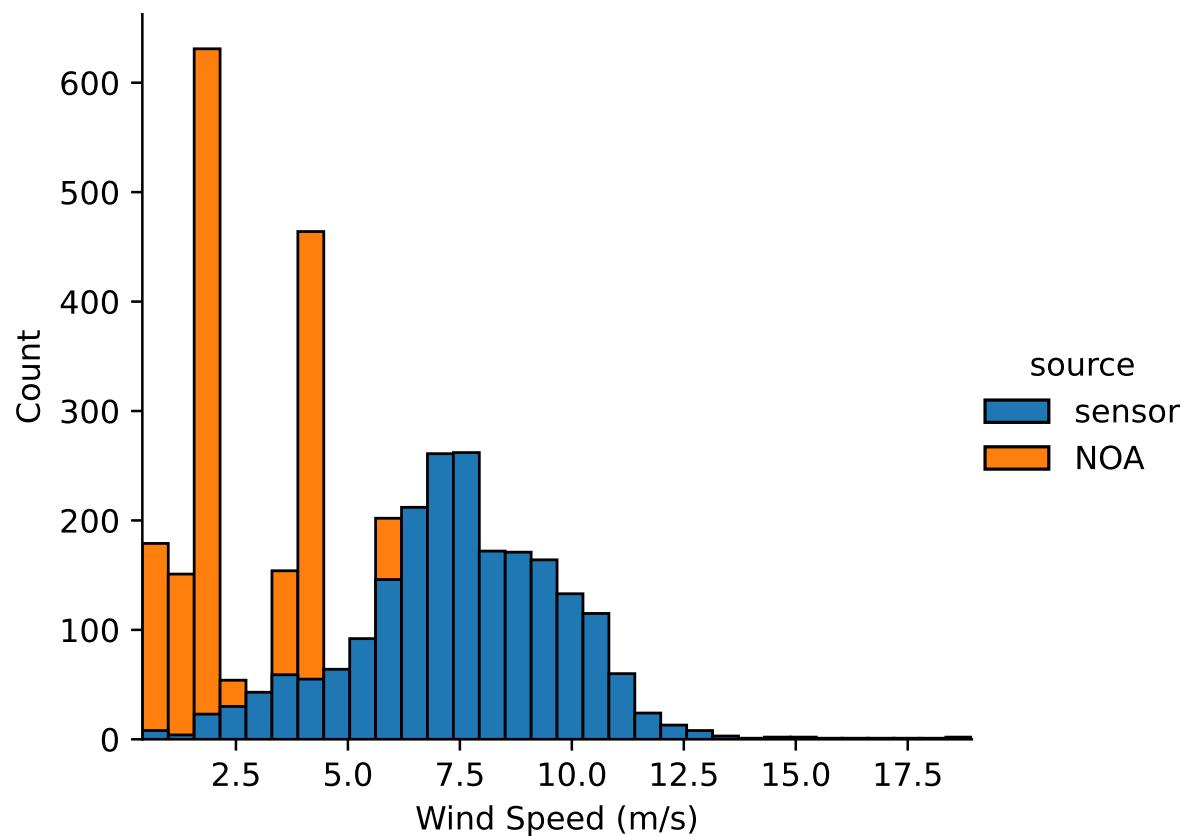


Figure 41: Wind Speed Sensor VS NOA Distributions comparison

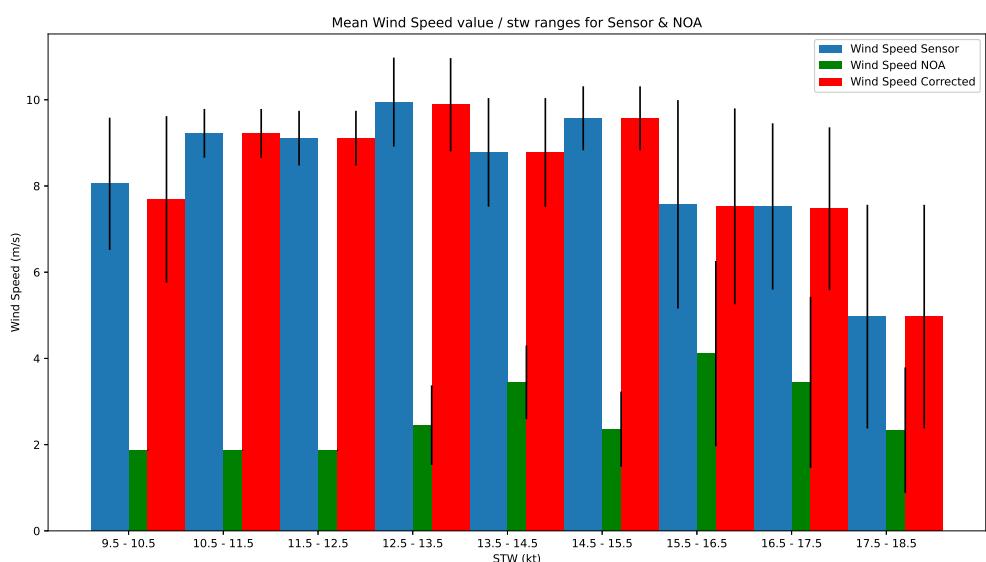


Figure 42: Initial / Weather Features Comparison per Speed Range

Routing Optimization Info :

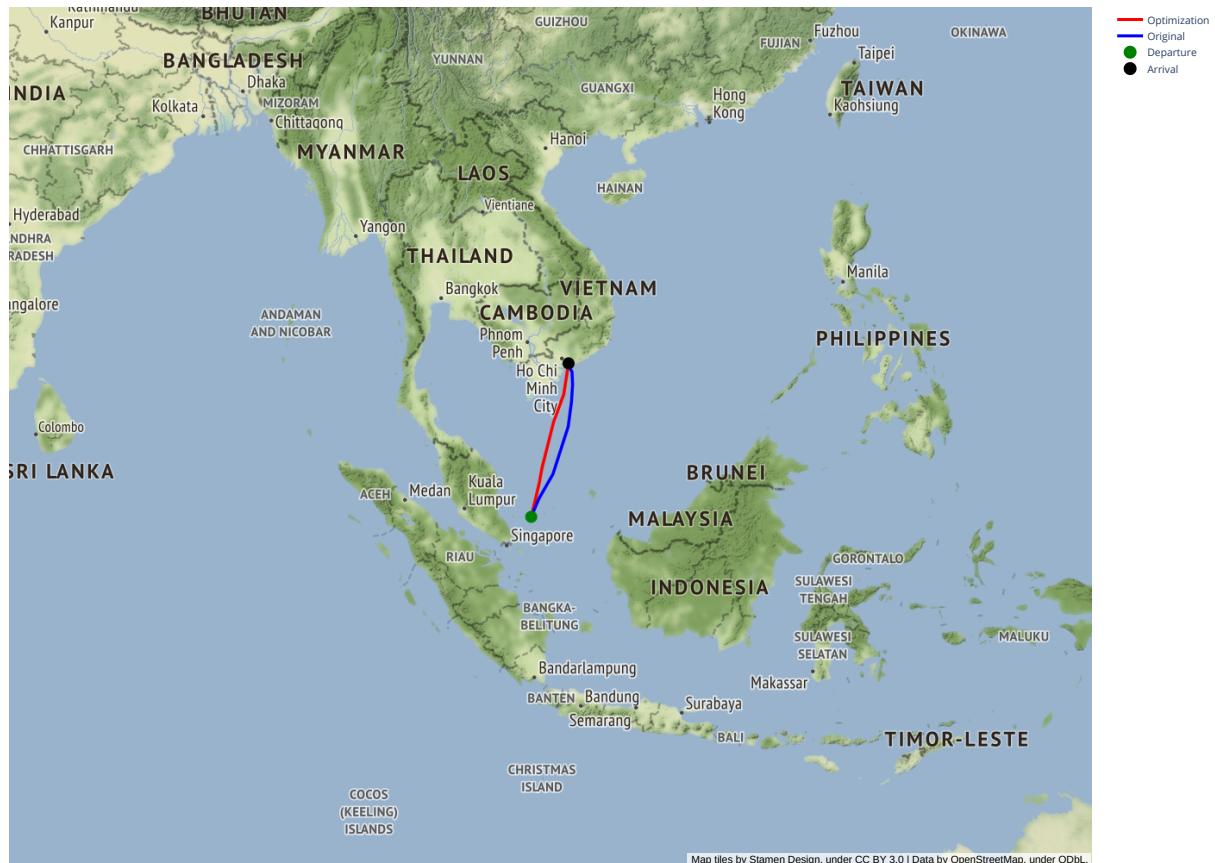


Figure 43: Initial / Optimized Route, VUNG TAU - HONG KONG

Voyage	Date	Latitude	Longitude
Departure	2019-10-27 16:00:00	10.0° 23.0' N	109.0° 14.0' E
Arrival	2019-10-29 02:09:00	22.0° 18.0' S	114.0° 5.0' E
BASIC COMPARISON	Optimization(RET A = True)	Our Estimation	Optimization(RET A = False)
Distance (nm)	464.63	642.89	462.79
Time (hours)	32.62	34.15	29.67
Avg Speed (kt)	14.20	18.83	15.53
Total FOC (MT)	67.99	185.73	68.96

Weather comparison optimization / initial:

- **RestrictETA = True**

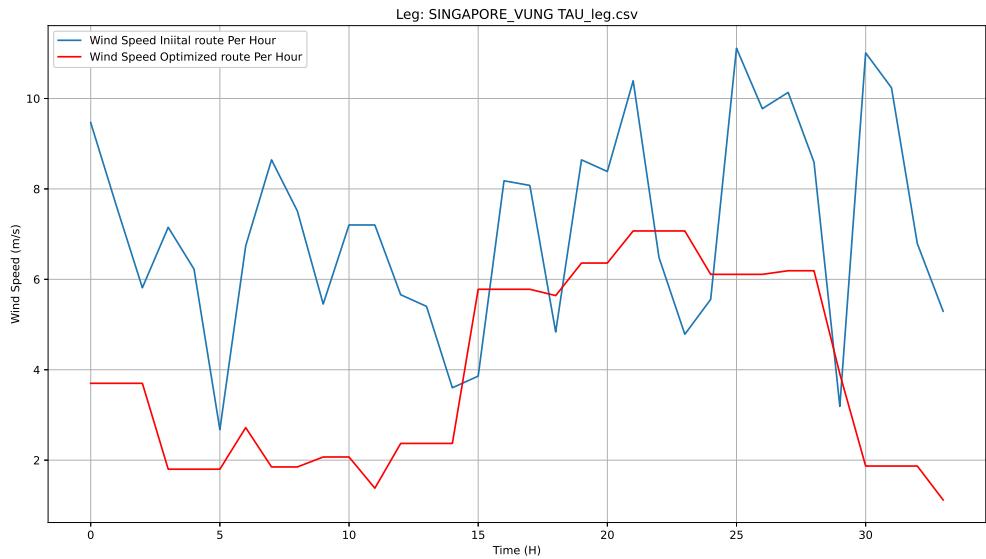


Figure 44: Wind Speed comparison Initial / Optimized Route, VUNG TAU - HONG KONG

- **RestrictETA = False**

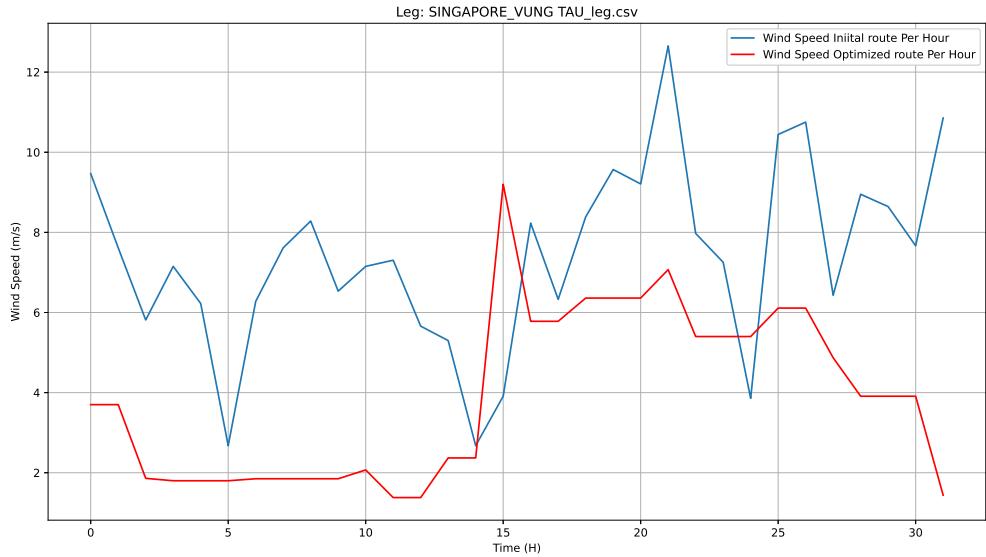


Figure 45: Wind Speed comparison Initial / Optimized Route, VUNG TAU - HONG KONG

Leg 8 # Basic INFO:

- Total Actual FOC : **119.35 MT**
 - Total Predicted FOC (Neural Net): **120.30 MT**
 - Total Predicted FOC (Neural DT): **115.89 MT**
 - FOC Perc Diff (Neural Net): **0.79 %**
 - FOC Perc Diff (Neural DT): **2.94 %**
- Departure Port : **SHEKOU / 2019-10-29 22:12:00**
- Arrival Port : **NINGBO / 2019-10-31 22:30:00**
- Total Sailing Time: **48 hours**
- Distance Travelled: **764.79 n mi**
- Draft: **10.3 m**

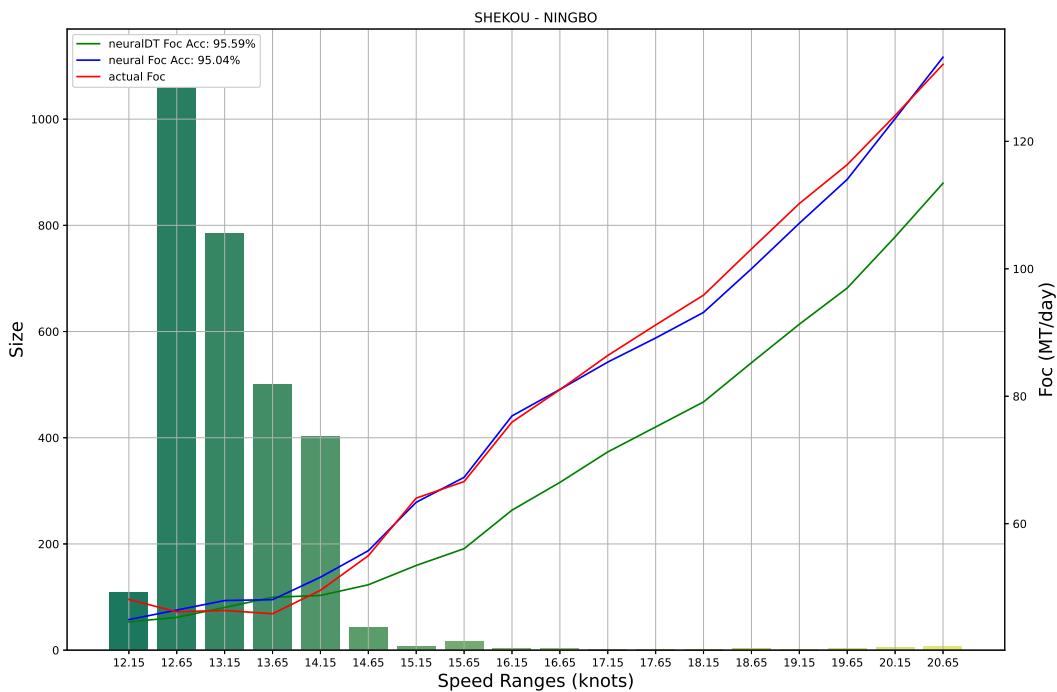


Figure 46: FOC Actual vs Predicted / Speed Ranges, SHEKOU - NINGBO

Weather Comparison - Sensor / Weather Service (NOA)

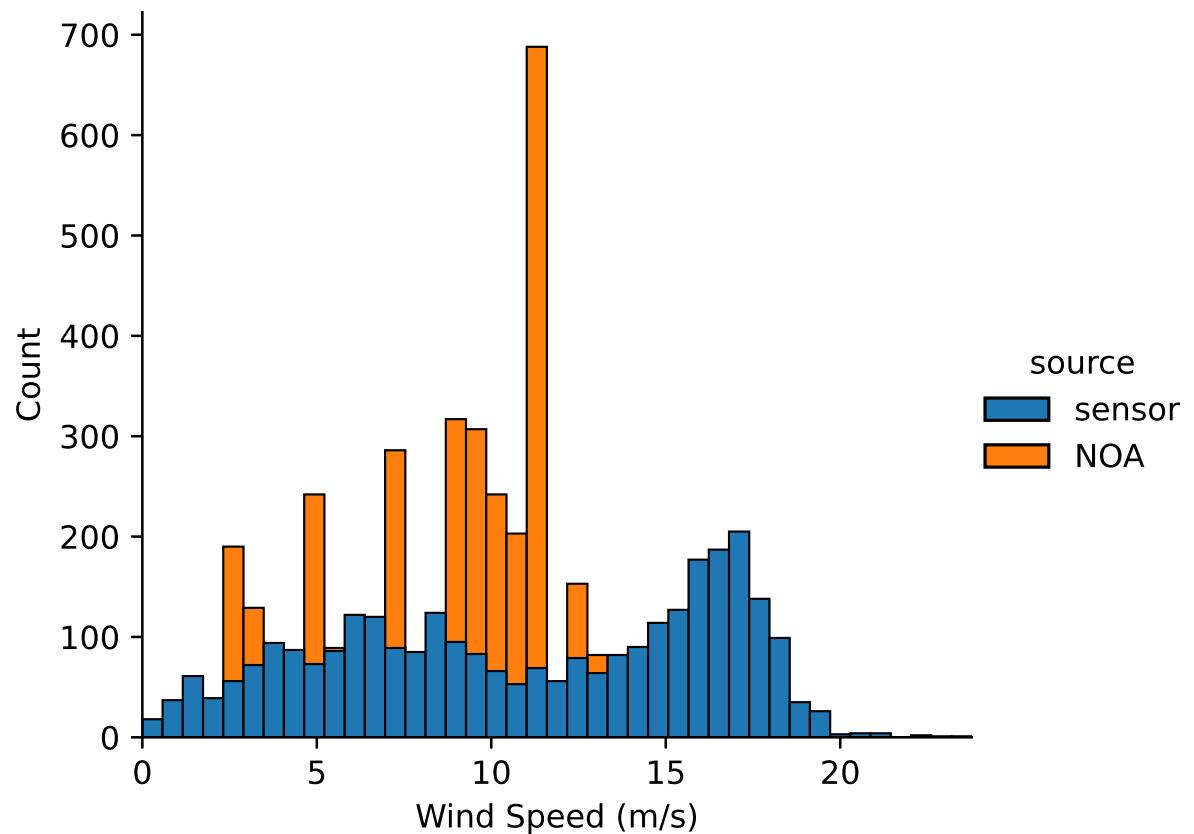


Figure 47: Wind Speed Sensor VS NOA Distributions comparison

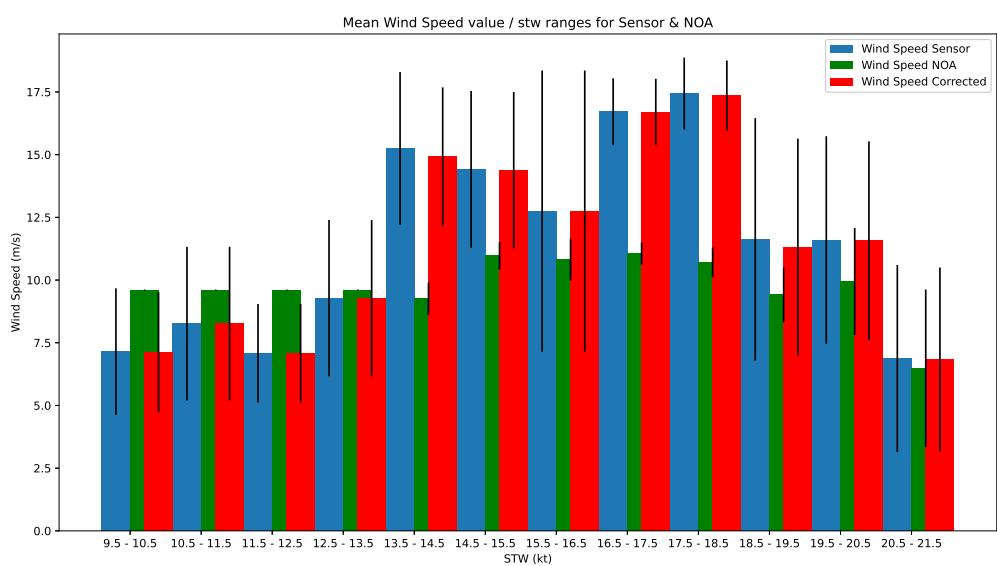


Figure 48: Initial / Weather Features Comparison per Speed Range

Routing Optimization Info :

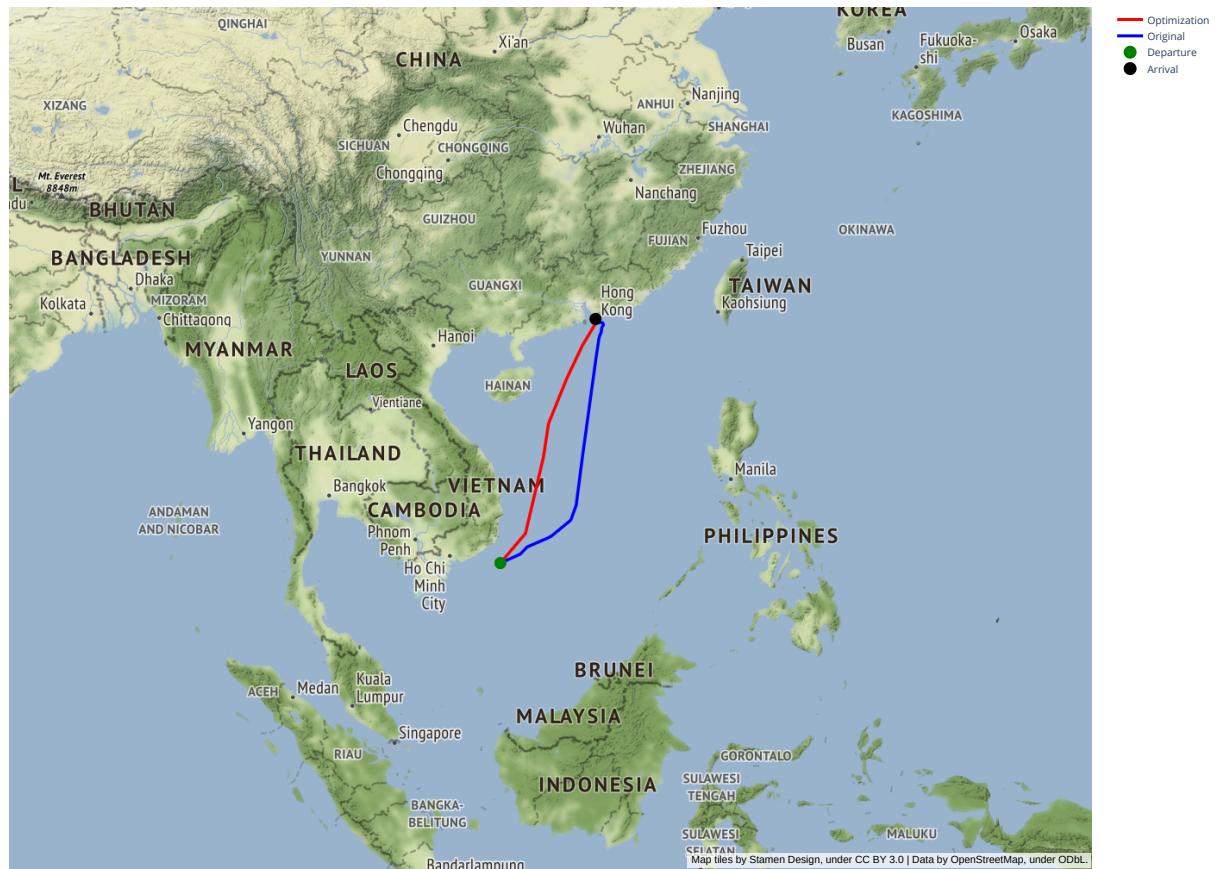


Figure 49: Initial / Optimized Route, SHEKOU - NINGBO

Voyage	Date	Latitude	Longitude
Departure	2019-10-29 22:12:00	22.0° 23.0' N	115.0° 56.0' E
Arrival	2019-10-31 22:30:00	29.0° 46.0' S	122.0° 0.0' E
BASIC COMPARISON	Optimization(RET A = True)	Our Estimation	Optimization(RET A = False)
Distance (nm)	758.96	640.08	762.84
Time (hours)	46.95	48.30	44.25
Avg Speed (kt)	16.13	13.25	17.29
Total FOC (MT)	109.21	120.30	124.86

Weather comparison optimization / initial:

- **RestrictETA = True**

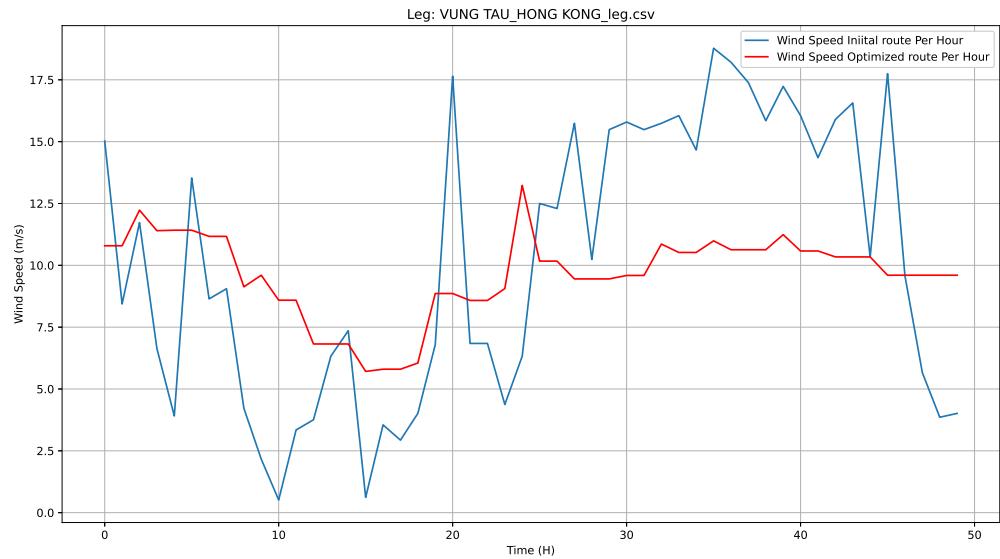


Figure 50: Wind Speed comparison Initial / Optimized Route, SHEKOU - NINGBO

- **RestrictETA = False**

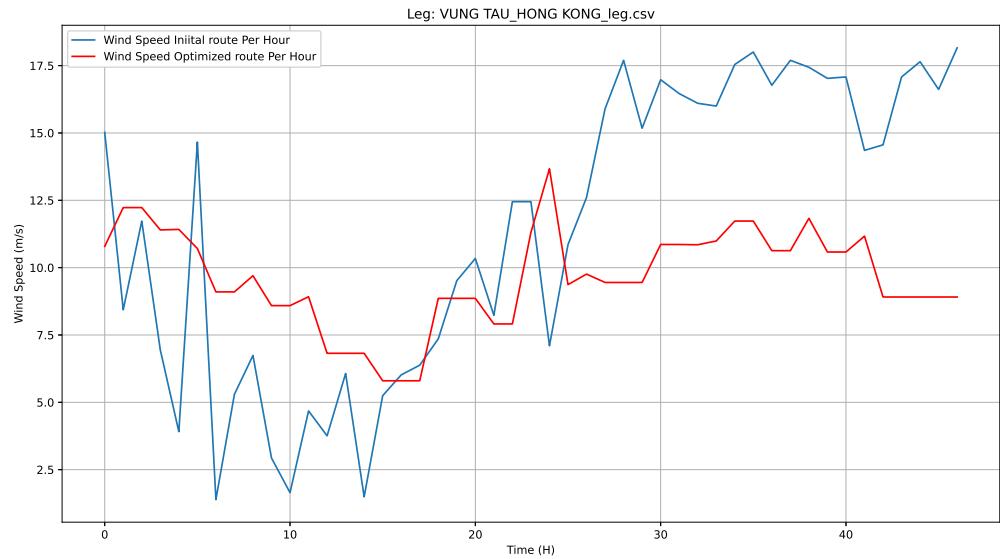


Figure 51: Wind Speed comparison Initial / Optimized Route, SHEKOU - NINGBO

Leg 9 # Basic INFO:

- Total Actual FOC : **77.57 MT**
 - Total Predicted FOC (Neural Net): **76.24 MT**
 - Total Predicted FOC (Neural DT): **69.07 MT**
 - FOC Perc Diff (Neural Net): **1.73 %**
 - FOC Perc Diff (Neural DT): **11.59 %**
- Departure Port : **SHANGHAI / 2019-11-02 18:42:00**
- Arrival Port : **PUSAN / 2019-11-05 07:01:00**
- Total Sailing Time: **60 hours**
- Distance Travelled: **549.92 n mi**
- Draft: **11.2 m**

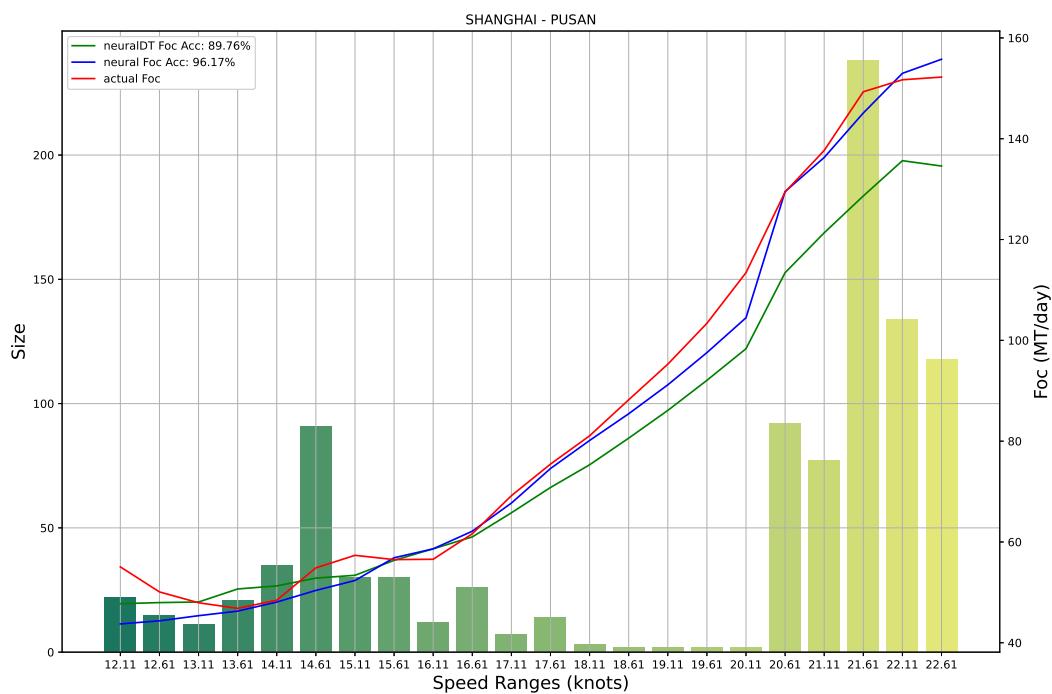


Figure 52: FOC Actual vs Predicted / Speed Ranges, SHANGHAI - PUSAN

Weather Comparison - Sensor / Weather Service (NOA)

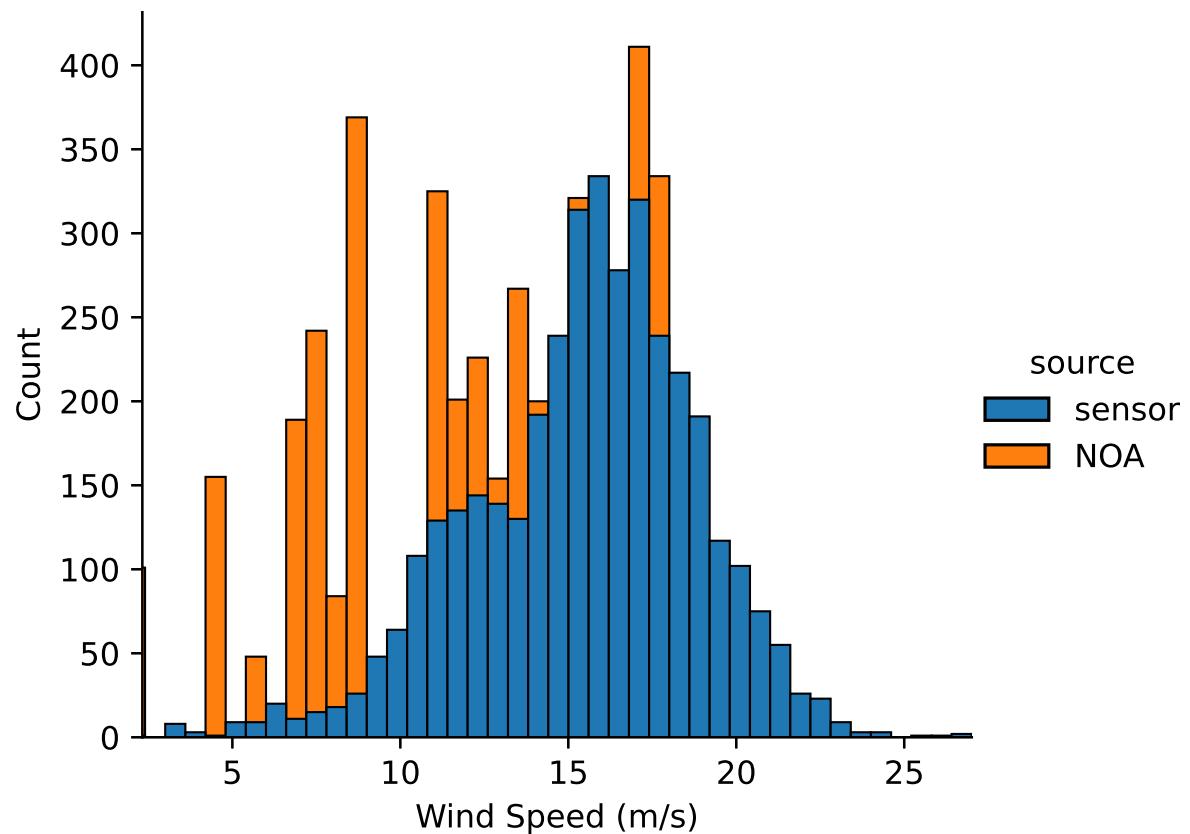


Figure 53: Wind Speed Sensor VS NOA Distributions comparison

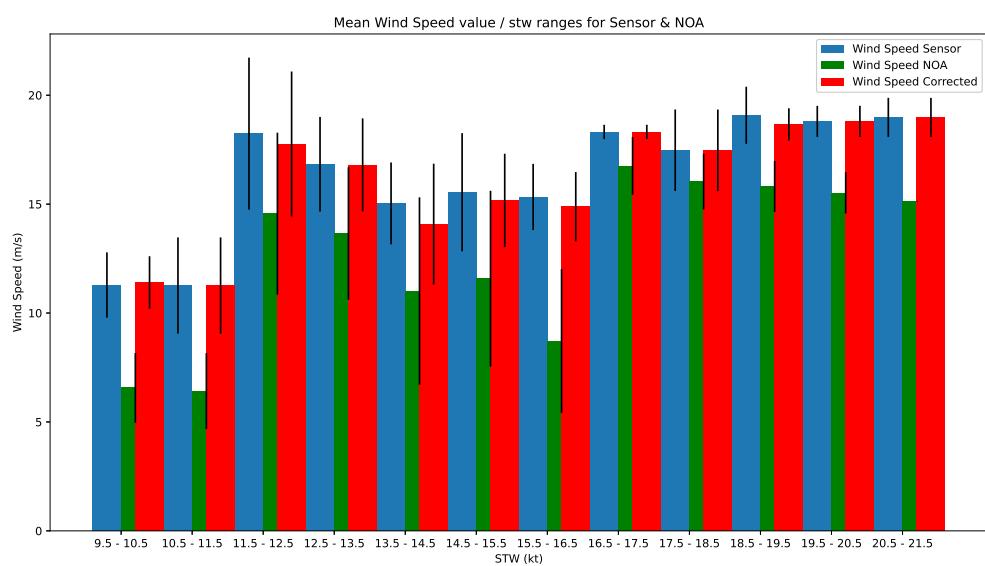


Figure 54: Initial / Weather Features Comparison per Speed Range

Routing Optimization Info :

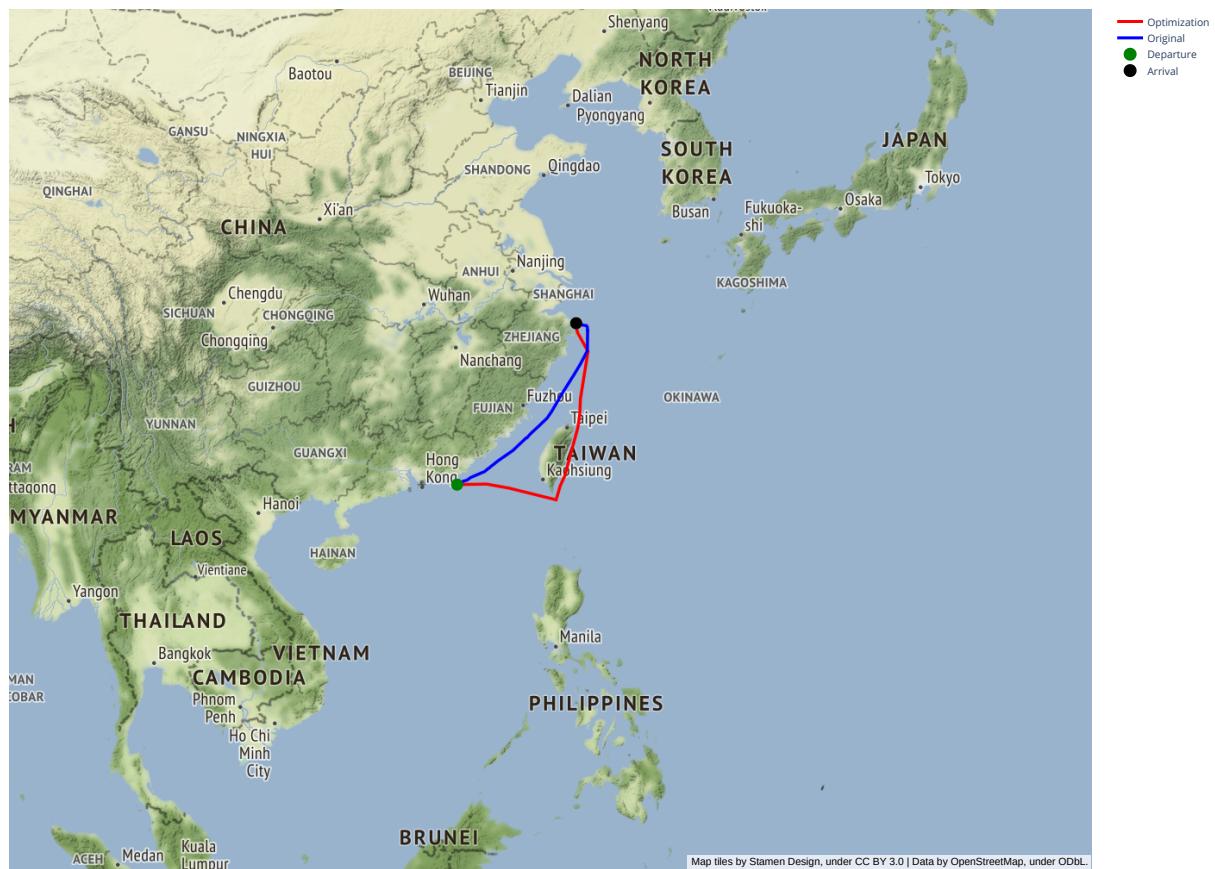


Figure 55: Initial / Optimized Route, SHANGHAI - PUSAN

Voyage	Date	Latitude	Longitude
Departure	2019-11-02 18:42:00	31.0° 35.0' N	124.0° 44.0' E
Arrival	2019-11-05 07:01:00	35.0° 4.0' S	128.0° 48.0' E
<hr/>			
BASIC COMPARISON	Optimization(RET A = True)	Our Estimation	Optimization(RET A = False)
Distance (nm)	783.71	1,173.08	777.32
Time (hours)	56.15	60.32	62.10
Avg Speed (kt)	13.95	19.45	12.51
Total FOC (MT)	110.89	76.24	114.05

Weather comparison optimization / initial:

- **RestrictETA = True**

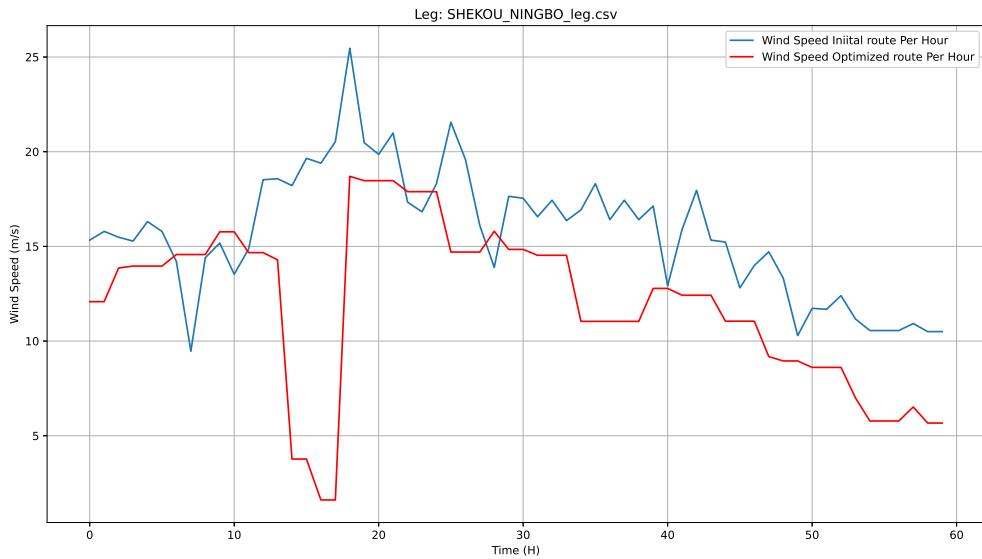


Figure 56: Wind Speed comparison Initial / Optimized Route, SHANGHAI - PUSAN

- **RestrictETA = False**

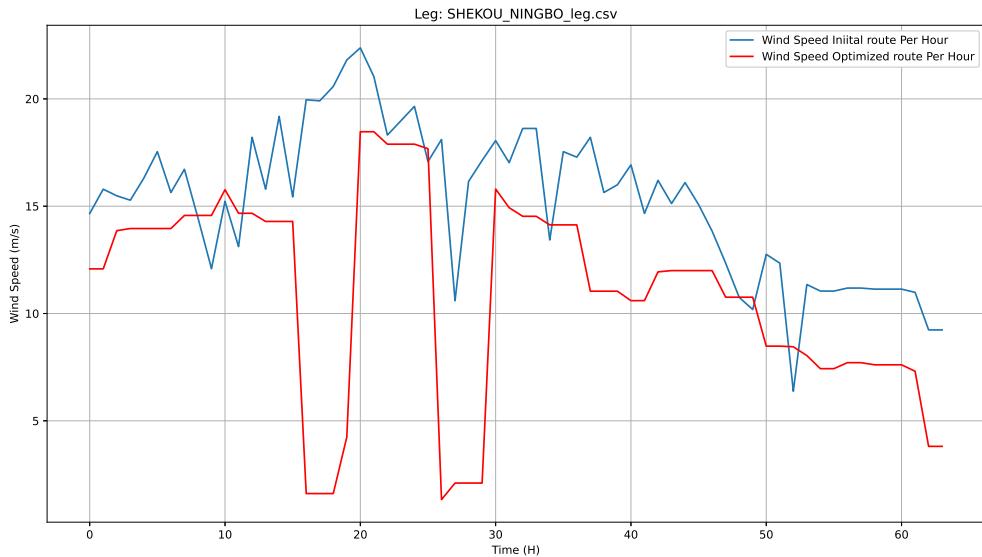


Figure 57: Wind Speed comparison Initial / Optimized Route, SHANGHAI - PUSAN

Leg 10 # Basic INFO:

- Total Actual FOC : **348.23 MT**
 - Total Predicted FOC (Neural Net): **348.10 MT**
 - Total Predicted FOC (Neural DT): **331.37 MT**
 - FOC Perc Diff (Neural Net): **0.04 %**
 - FOC Perc Diff (Neural DT): **4.96 %**
- Departure Port : **PANAMA / 2019-11-08 00:18:00**
- Arrival Port : **HOUSTON / 2019-11-08 18:12:00**
- Total Sailing Time: **18 hours**
- Distance Travelled: **292.16 n mi**
- Draft: **13.2 m**

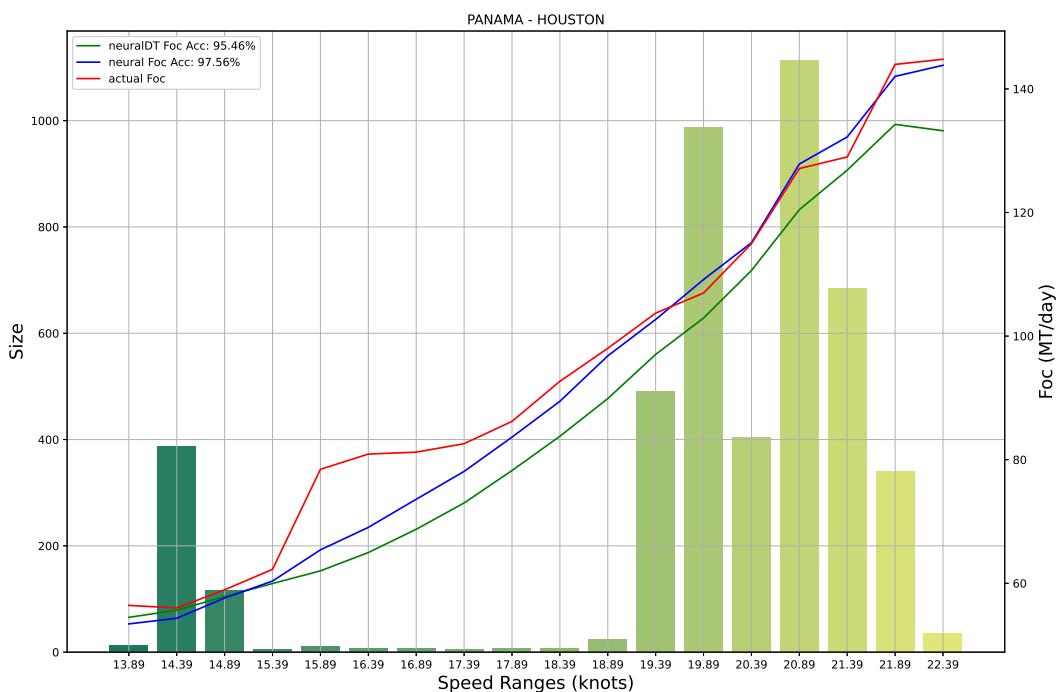


Figure 58: FOC Actual vs Predicted / Speed Ranges, PANAMA - HOUSTON

Weather Comparison - Sensor / Weather Service (NOA)

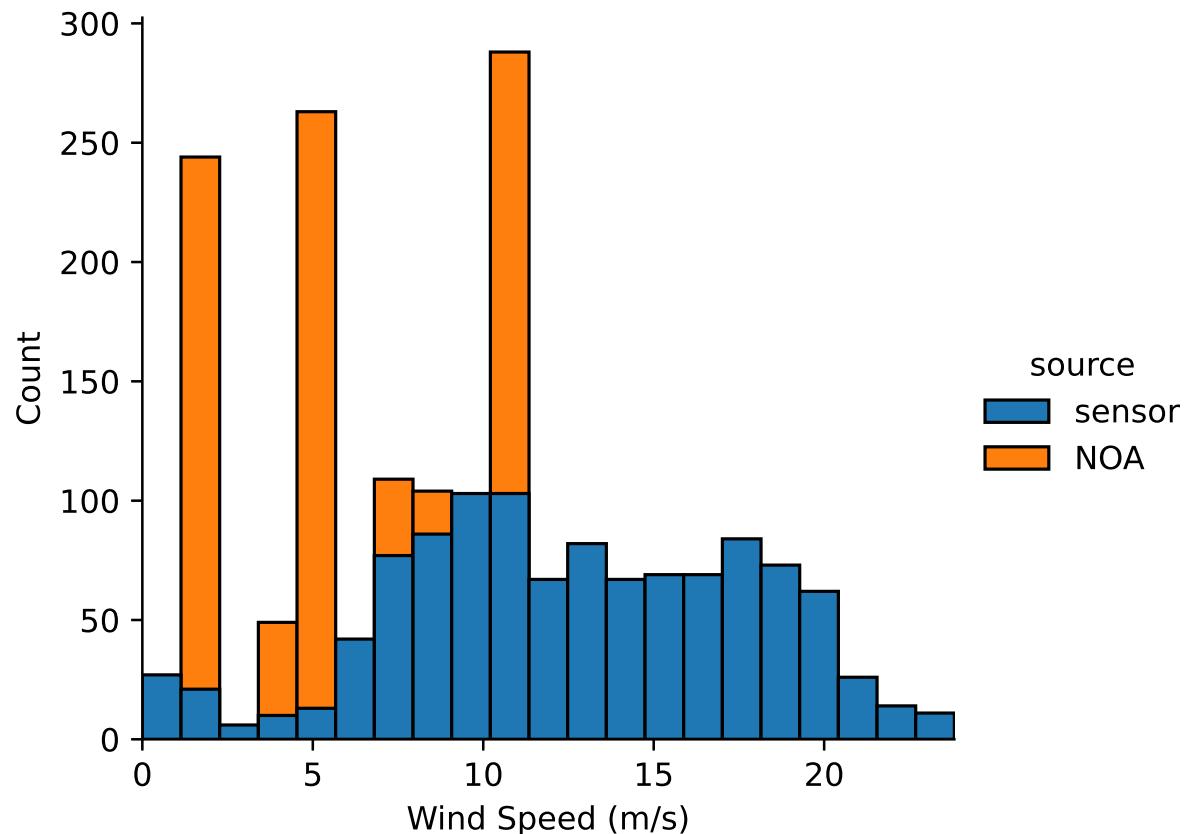


Figure 59: Wind Speed Sensor VS NOA Distributions comparison

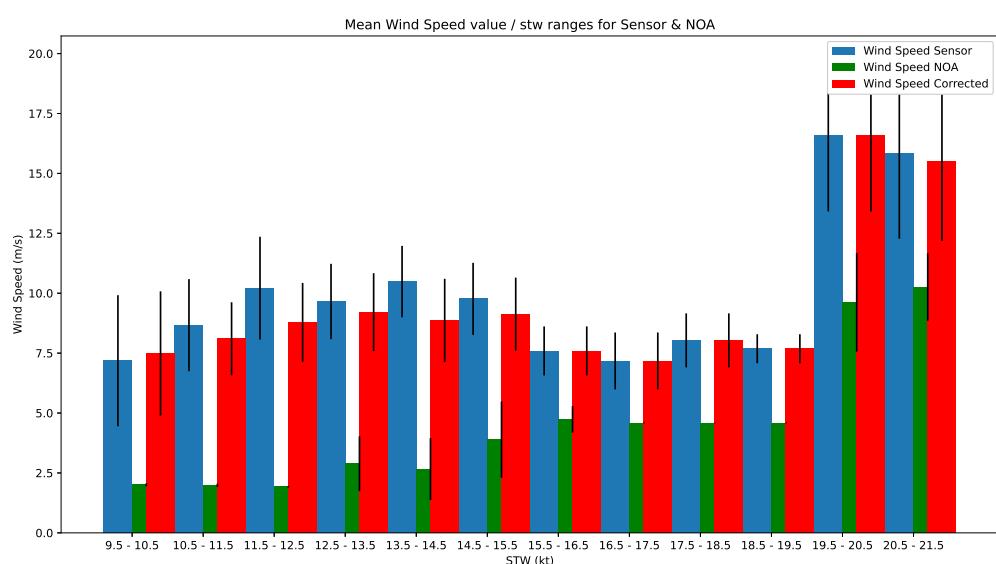


Figure 60: Initial / Weather Features Comparison per Speed Range

Routing Optimization Info :

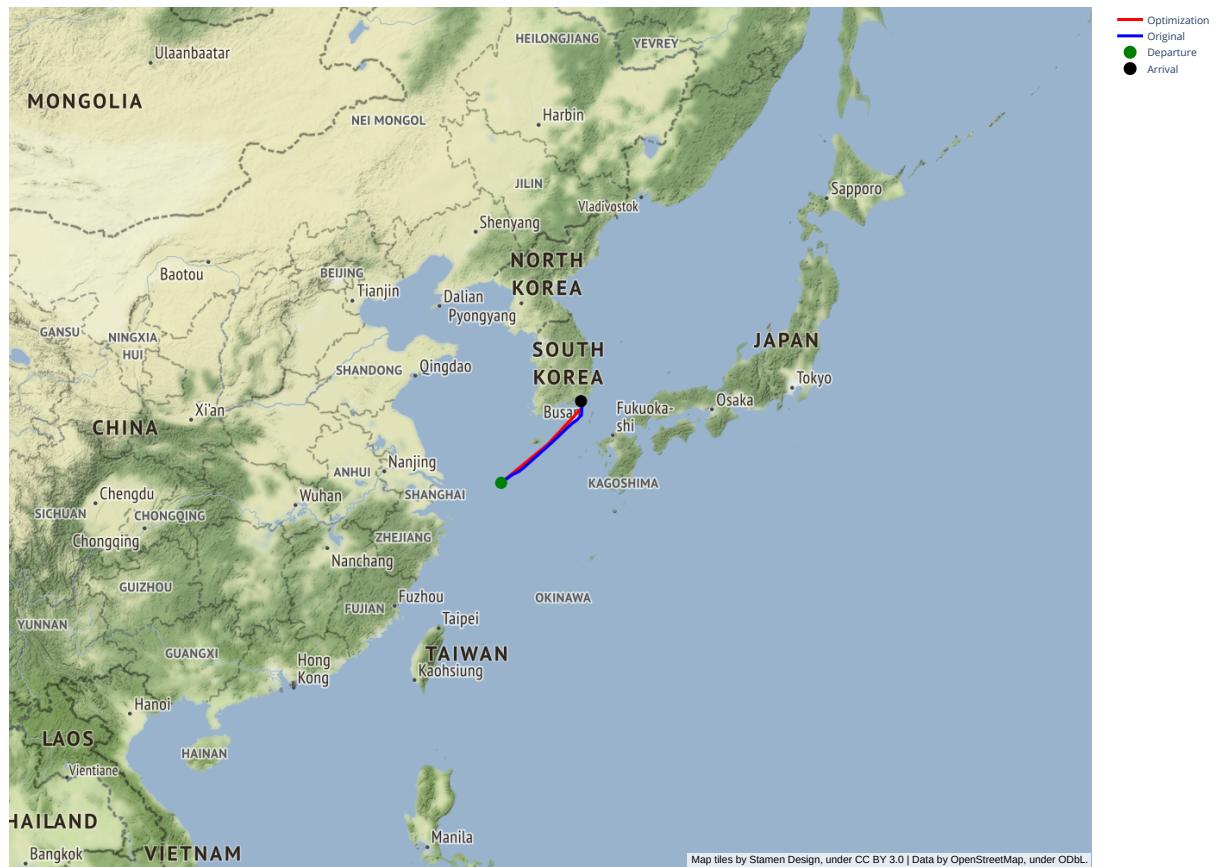


Figure 61: Initial / Optimized Route, PANAMA - HOUSTON

Voyage	Date	Latitude	Longitude
Departure	2019-11-08 00:18:00	9.0° 12.0' N	80.0° 4.0' E
Arrival	2019-11-08 18:12:00	27.0° 39.0' S	95.0° 38.0' E
BASIC COMPARISON	Optimization(RET A = True)	Our Estimation	Optimization(RET A = False)
Distance (nm)	285.81	356.24	287.17
Time (hours)	16.77	17.90	18.02
Avg Speed (kt)	16.54	19.90	15.57
Total FOC (MT)	50.83	348.10	47.81

Weather comparison optimization / initial:

- **RestrictETA = True**

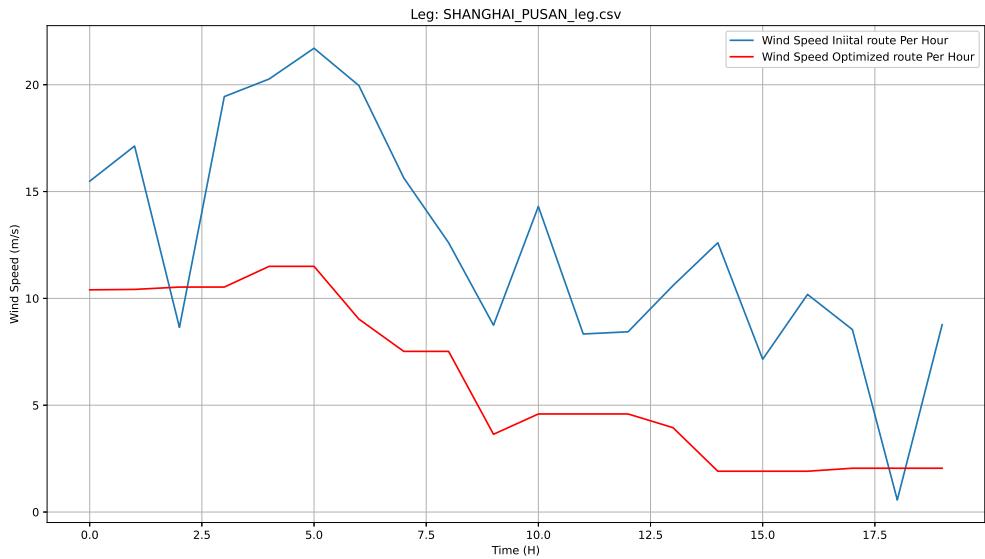


Figure 62: Wind Speed comparison Initial / Optimized Route, PANAMA - HOUSTON

- **RestrictETA = False**

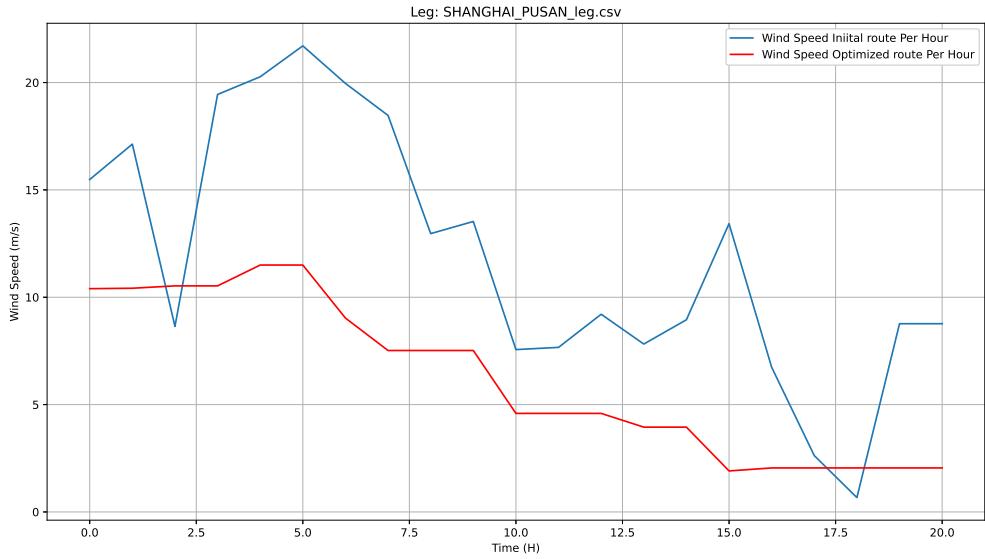


Figure 63: Wind Speed comparison Initial / Optimized Route, PANAMA - HOUSTON

Leg 11 # Basic INFO:

- Total Actual FOC : **49.38 MT**
 - Total Predicted FOC (Neural Net): **46.54 MT**
 - Total Predicted FOC (Neural DT): **47.61 MT**
 - FOC Perc Diff (Neural Net): **5.92 %**
 - FOC Perc Diff (Neural DT): **3.65 %**
- Departure Port : **MOBILE / 2019-11-29 18:48:00**
- Arrival Port : **NEW ORLEANS / 2019-12-03 06:00:00**
- Total Sailing Time: **83 hours**
- Distance Travelled: **1,372.74 n mi**
- Draft: **11.4 m**

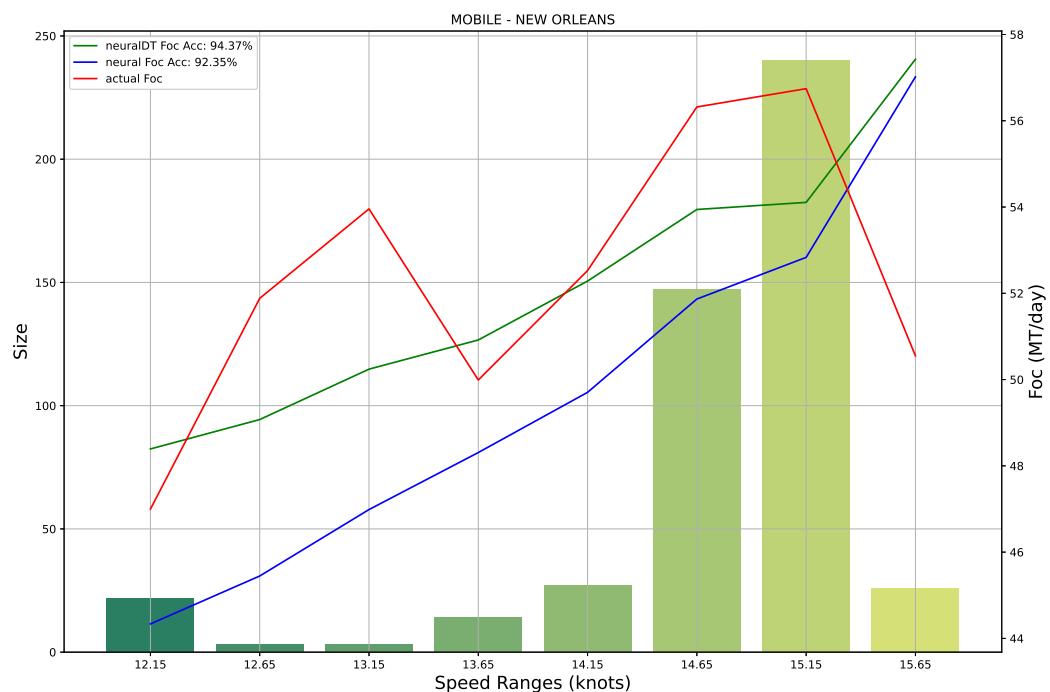


Figure 64: FOC Actual vs Predicted / Speed Ranges, MOBILE - NEW ORLEANS

Weather Comparison - Sensor / Weather Service (NOA)

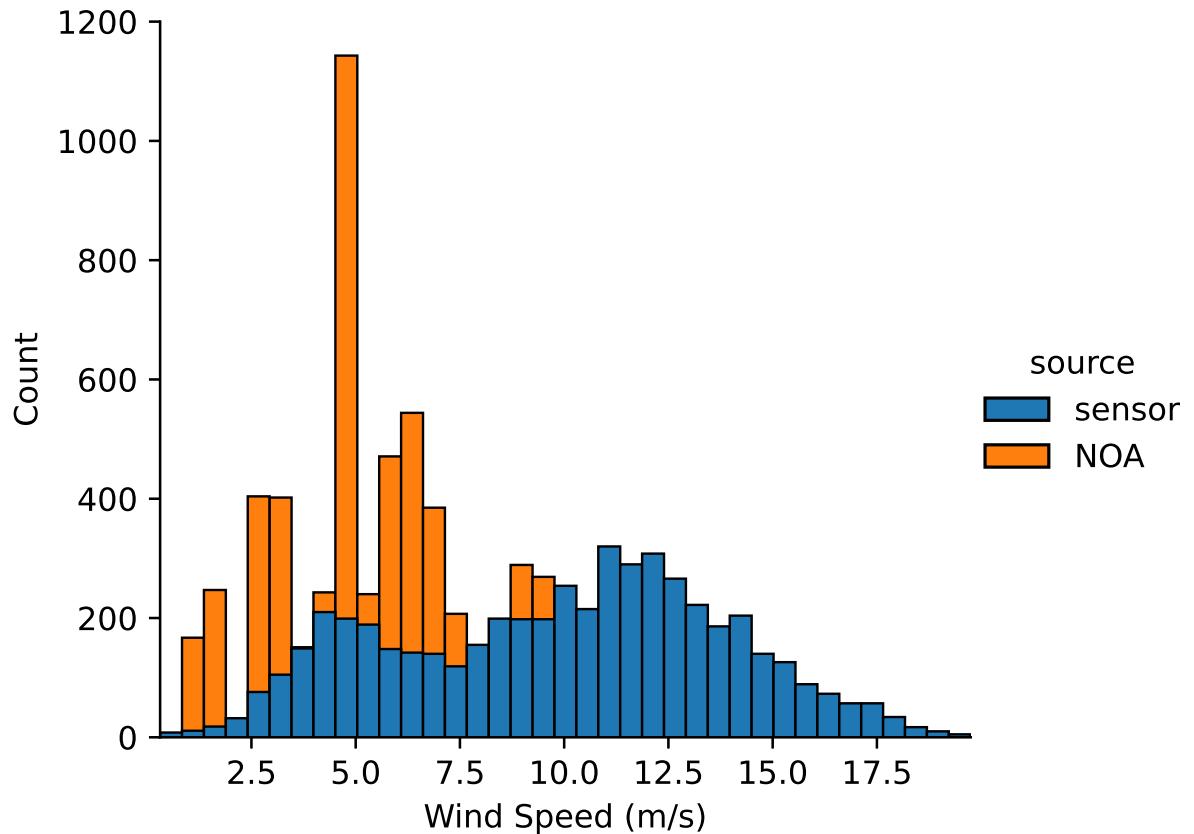


Figure 65: Wind Speed Sensor VS NOA Distributions comparison

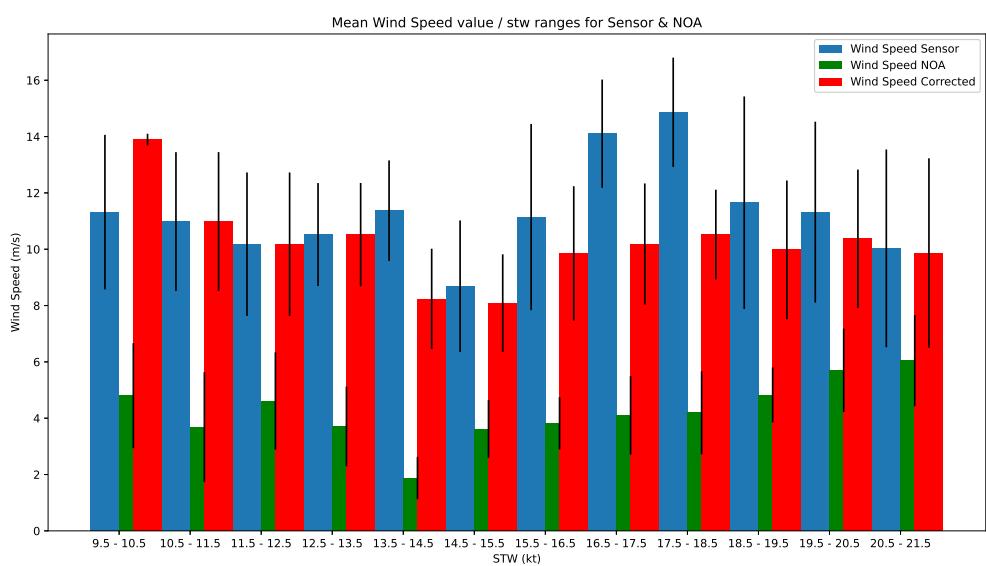


Figure 66: Initial / Weather Features Comparison per Speed Range

Routing Optimization Info :



Figure 67: Initial / Optimized Route, MOBILE - NEW ORLEANS

Voyage	Date	Latitude	Longitude
Departure	2019-11-29 18:48:00	30.0° 39.0' N	89.0° 58.0' E
Arrival	2019-12-03 06:00:00	28.0° 59.0' S	88.0° 6.0' E
BASIC COMPARISON	Optimization(RET A = True)	Our Estimation	Optimization(RET A = False)
Distance (nm)	1,477.54	1,224.99	1,476.31
Time (hours)	81.47	83.20	80.35
Avg Speed (kt)	17.84	14.72	18.06
Total FOC (MT)	269.75	46.54	277.80

Weather comparison optimization / initial:

- **RestrictETA = True**

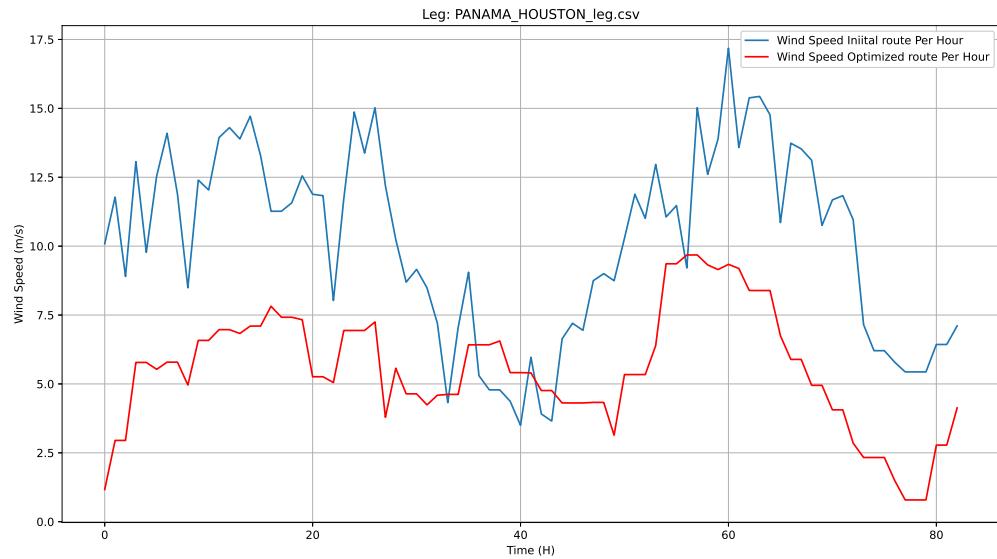


Figure 68: Wind Speed comparison Initial / Optimized Route, MOBILE - NEW ORLEANS

- **RestrictETA = False**

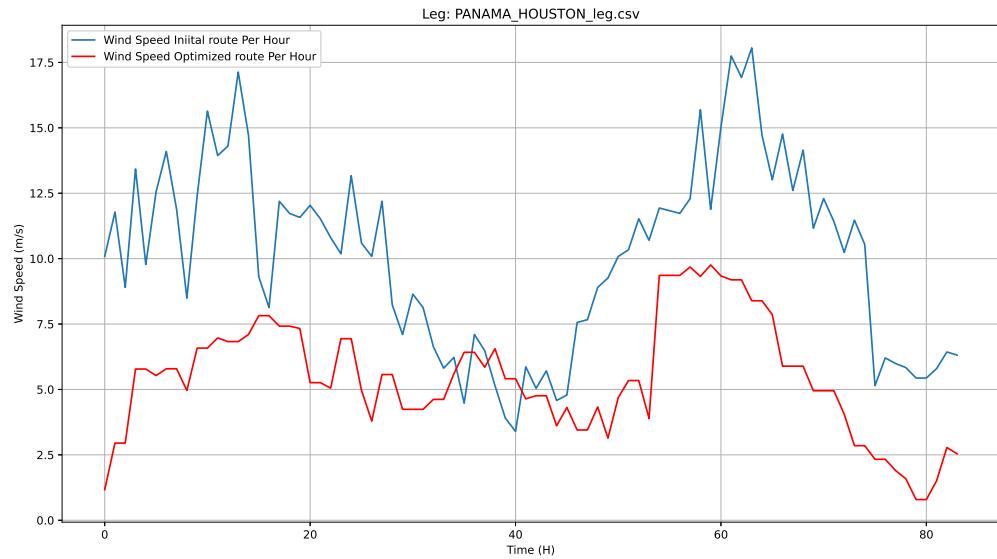


Figure 69: Wind Speed comparison Initial / Optimized Route, MOBILE - NEW ORLEANS

Leg 12 # Basic INFO:

- Total Actual FOC : **61.04 MT**
 - Total Predicted FOC (Neural Net): **56.93 MT**
 - Total Predicted FOC (Neural DT): **60.93 MT**
 - FOC Perc Diff (Neural Net): **6.97 %**
 - FOC Perc Diff (Neural DT): **0.18 %**
- Departure Port : **NEW ORLEANS / 2019-12-07 17:42:00**
- Arrival Port : **TAMPA / 2019-12-08 17:00:00**
- Total Sailing Time: **23 hours**
- Distance Travelled: **100.22 n mi**
- Draft: **11.6 m**

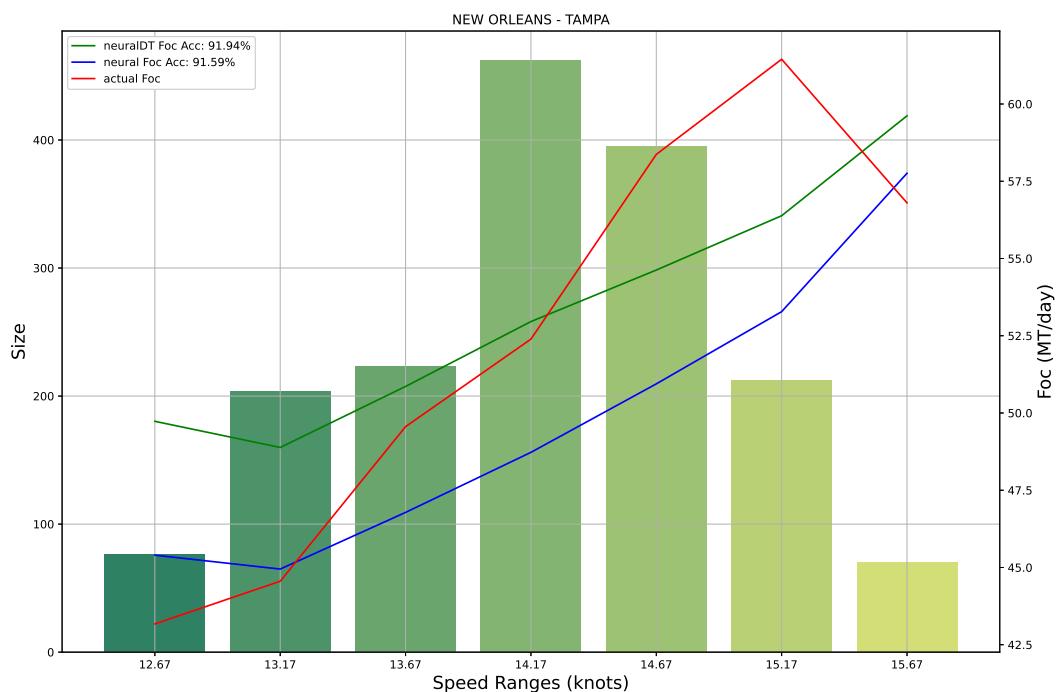


Figure 70: FOC Actual vs Predicted / Speed Ranges, NEW ORLEANS - TAMPA

Weather Comparison - Sensor / Weather Service (NOA)

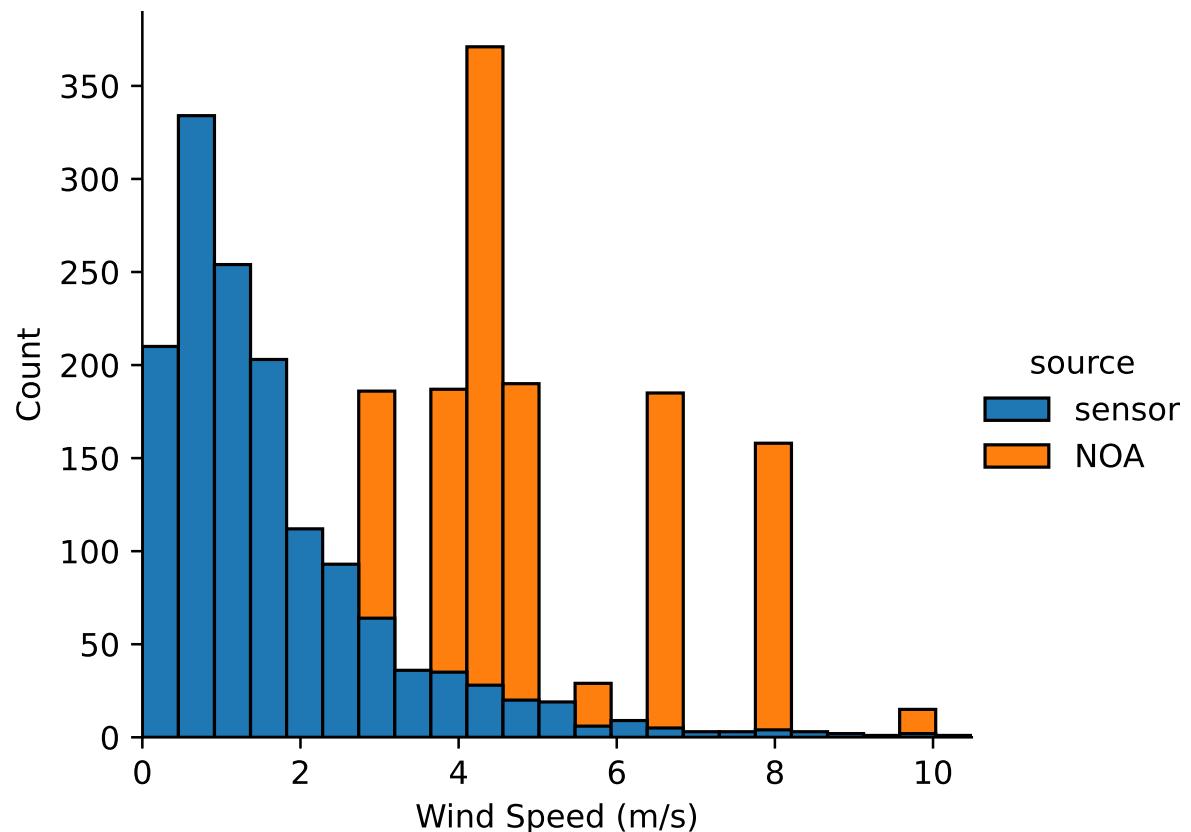


Figure 71: Wind Speed Sensor VS NOA Distributions comparison

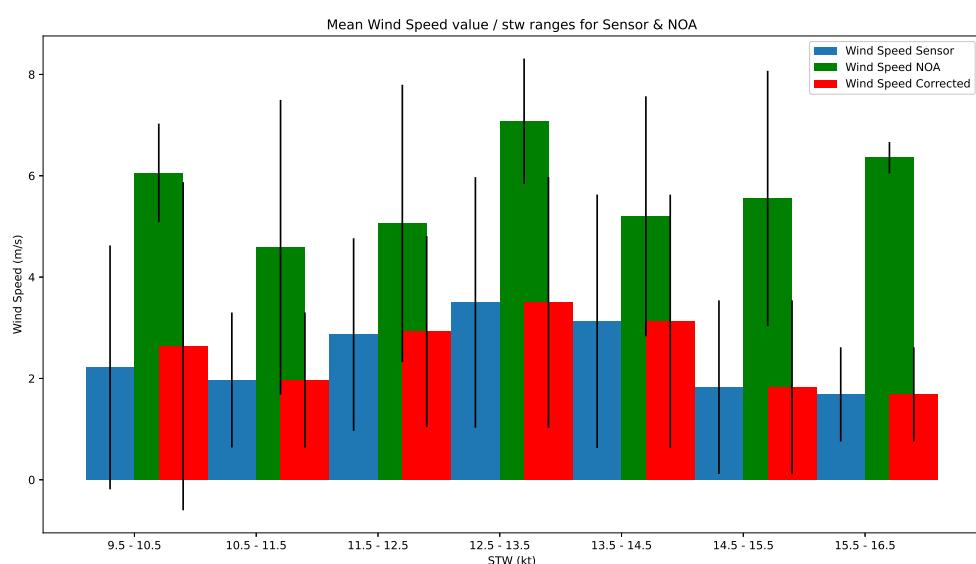


Figure 72: Initial / Weather Features Comparison per Speed Range

Routing Optimization Info :

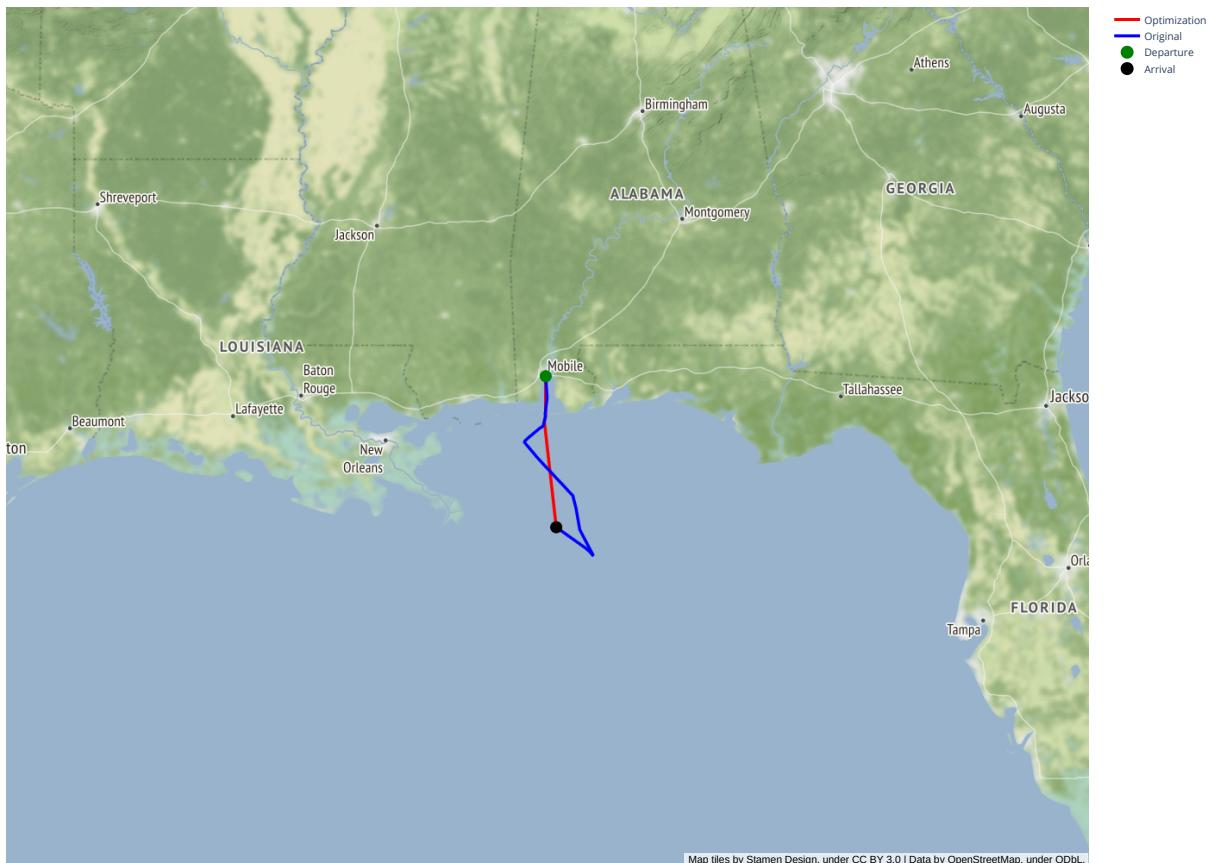


Figure 73: Initial / Optimized Route, NEW ORLEANS - TAMPA

Voyage	Date	Latitude	Longitude
Departure	2019-12-07 17:42:00	29.0° 37.0' N	90.0° 4.0' E
Arrival	2019-12-08 17:00:00	27.0° 34.0' S	84.0° 5.0' E
<hr/>			
BASIC COMPARISON	Optimization(RET A = True)	Our Estimation	Optimization(RET A = False)
Distance (nm)	86.56	332.45	87.16
Time (hours)	6.18	23.30	6.50
Avg Speed (kt)	13.97	14.27	13.37
Total FOC (MT)	13.19	56.93	13.48

Weather comparison optimization / initial:

- **RestrictETA = True**

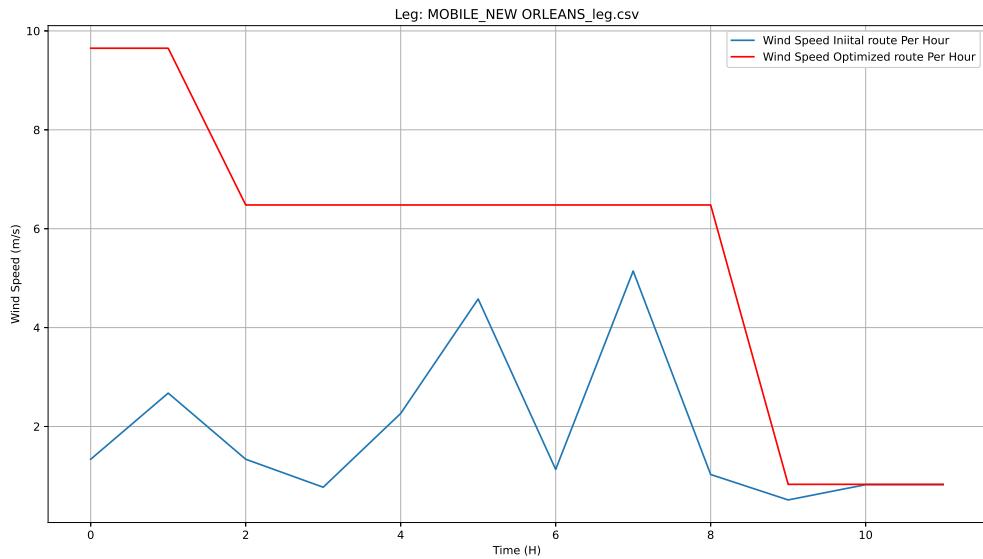


Figure 74: Wind Speed comparison Initial / Optimized Route, NEW ORLEANS - TAMPA

- **RestrictETA = False**

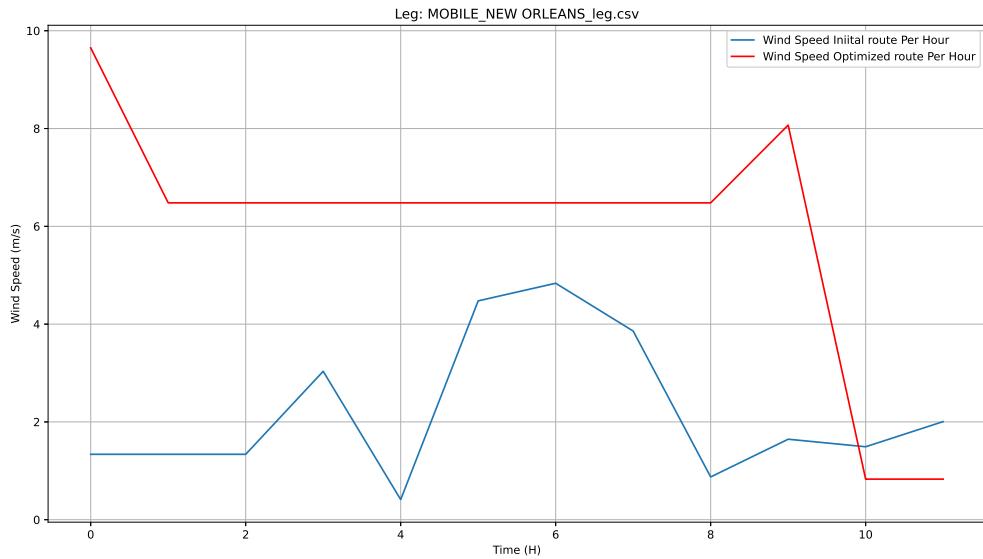


Figure 75: Wind Speed comparison Initial / Optimized Route, NEW ORLEANS - TAMPA

Leg 13 # Basic INFO:

- Total Actual FOC : **85.09 MT**
 - Total Predicted FOC (Neural Net): **81.97 MT**
 - Total Predicted FOC (Neural DT): **77.80 MT**
 - FOC Perc Diff (Neural Net): **3.74 %**
 - FOC Perc Diff (Neural DT): **8.95 %**
- Departure Port : **TAMPA / 2019-12-13 01:47:00**
- Arrival Port : **MIAMI / 2019-12-14 00:06:00**
- Total Sailing Time: **22 hours**
- Distance Travelled: **226.05 n mi**
- Draft: **11.4 m**

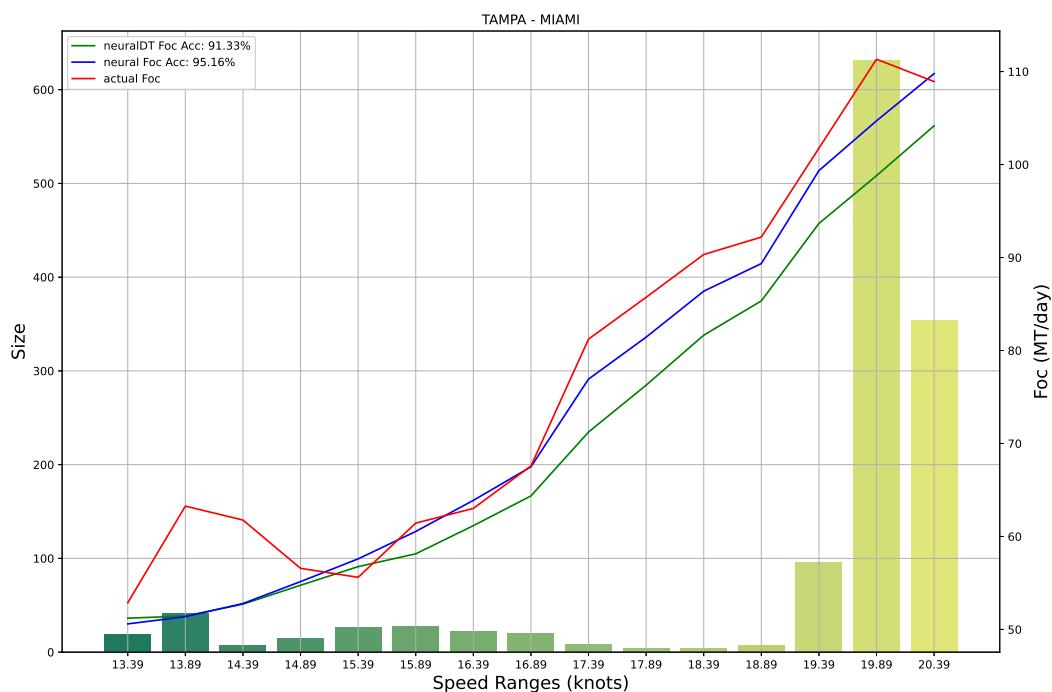


Figure 76: FOC Actual vs Predicted / Speed Ranges, TAMPA - MIAMI

Weather Comparison - Sensor / Weather Service (NOA)

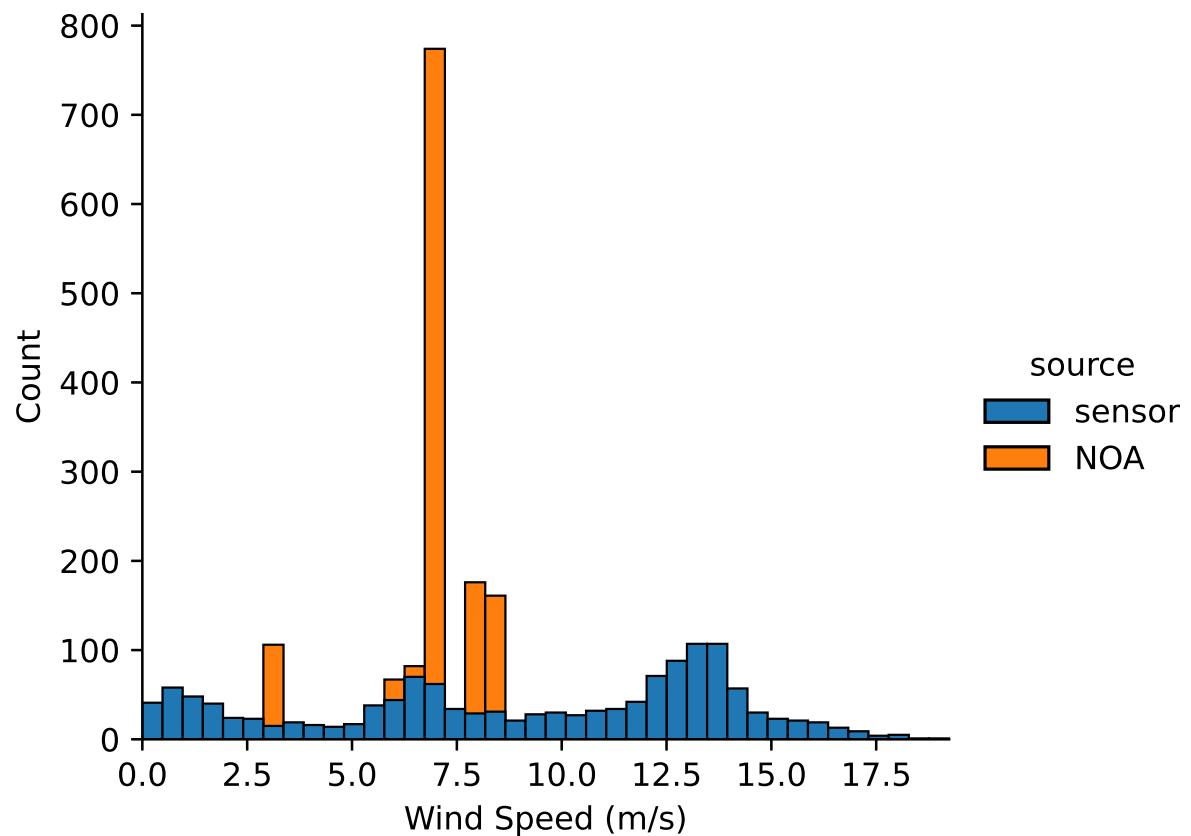


Figure 77: Wind Speed Sensor VS NOA Distributions comparison

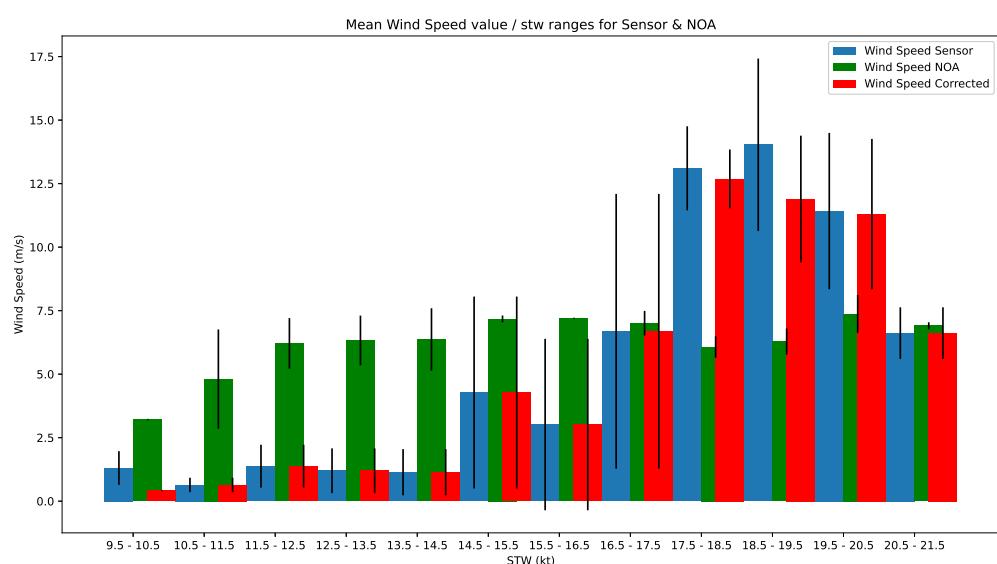


Figure 78: Initial / Weather Features Comparison per Speed Range

Routing Optimization Info :

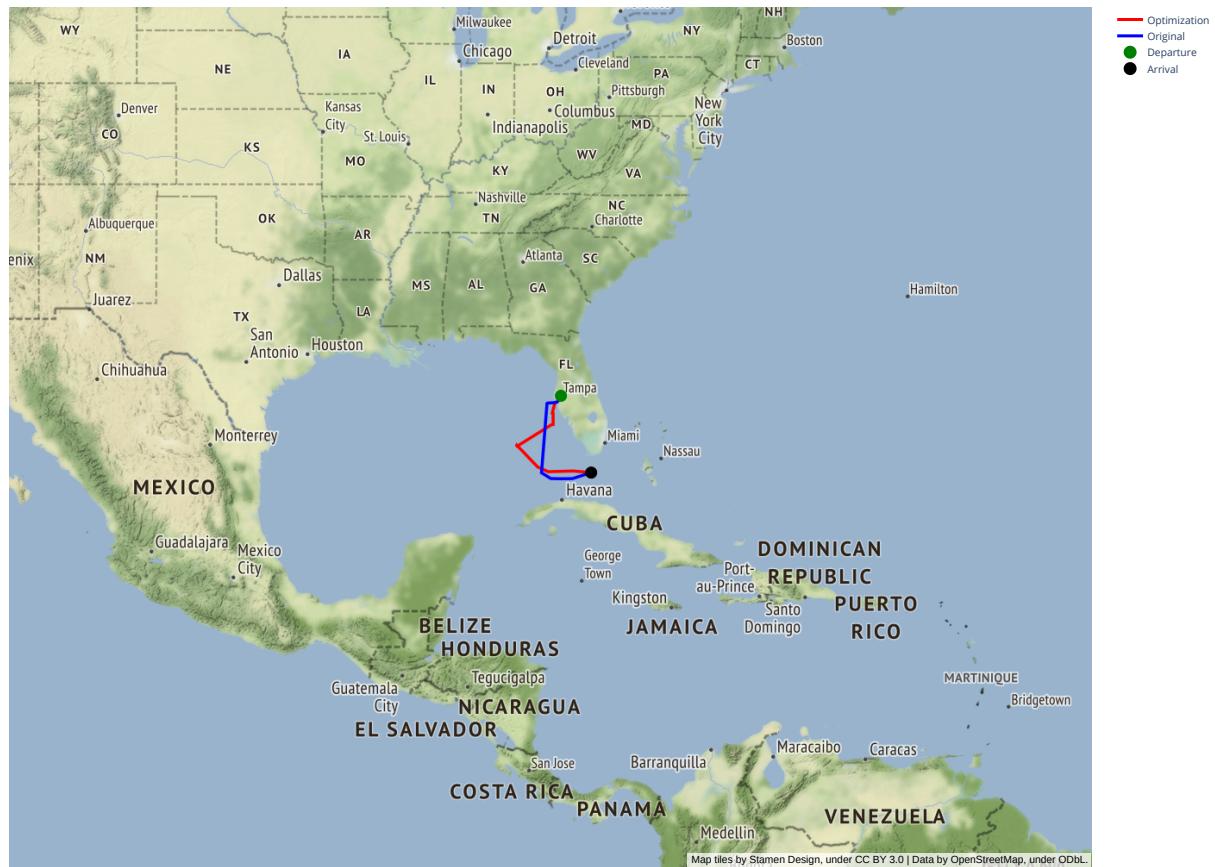


Figure 79: Initial / Optimized Route, TAMPA - MIAMI

Voyage	Date	Latitude	Longitude
Departure	2019-12-13 01:47:00	27.0° 54.0' N	83.0° 34.0' E
Arrival	2019-12-14 00:06:00	24.0° 24.0' S	81.0° 6.0' E
BASIC COMPARISON	Optimization(RET = True)	Our Estimation	Optimization(RET = False)
Distance (nm)	NA	431.34	448.40
Time (hours)	NA	22.32	28.28
Avg Speed (kt)	NA	19.33	14.99
Total FOC (MT)	NA	81.97	72.09

Weather comparison optimization / initial:

- **RestrictETA = True**

NA

Figure 80: Wind Speed comparison Initial / Optimized Route, TAMPA - MIAMI

- **RestrictETA = False**

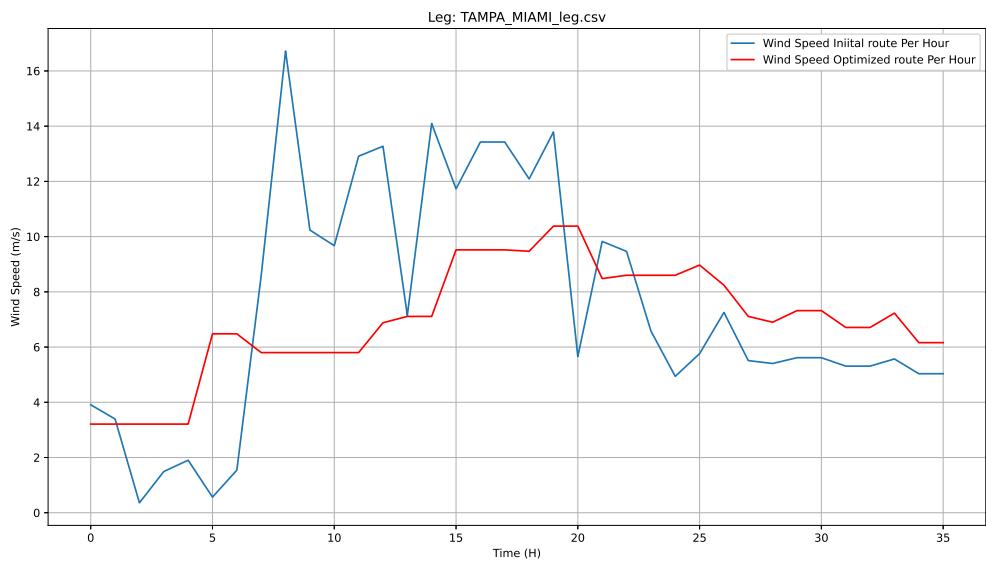


Figure 81: Wind Speed comparison Initial / Optimized Route, TAMPA - MIAMI

Leg 14 # Basic INFO:

- Total Actual FOC : **197.74 MT**
 - Total Predicted FOC (Neural Net): **202.11 MT**
 - Total Predicted FOC (Neural DT): **162.63 MT**
 - FOC Perc Diff (Neural Net): **2.19 %**
 - FOC Perc Diff (Neural DT): **19.49 %**
- Departure Port : **MIAMI / 2019-12-15 11:41:00**
- Arrival Port : **KINGSTON / 2019-12-16 18:00:00**
- Total Sailing Time: **30 hours**
- Distance Travelled: **505.17 n mi**
- Draft: **11.1 m**

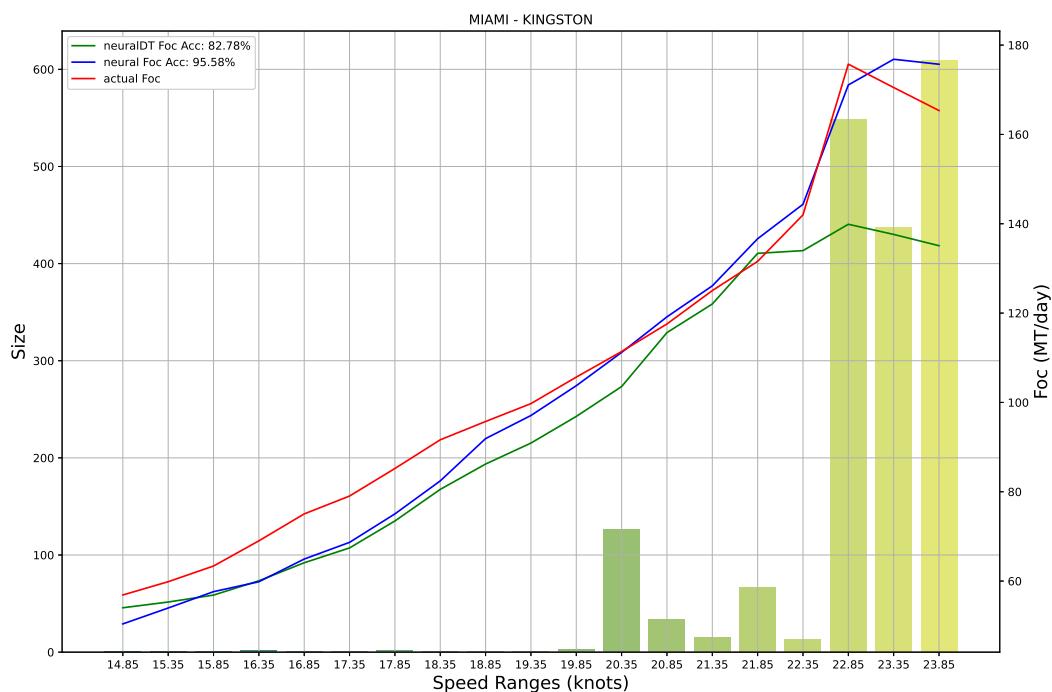


Figure 82: FOC Actual vs Predicted / Speed Ranges, MIAMI - KINGSTON

Weather Comparison - Sensor / Weather Service (NOA)

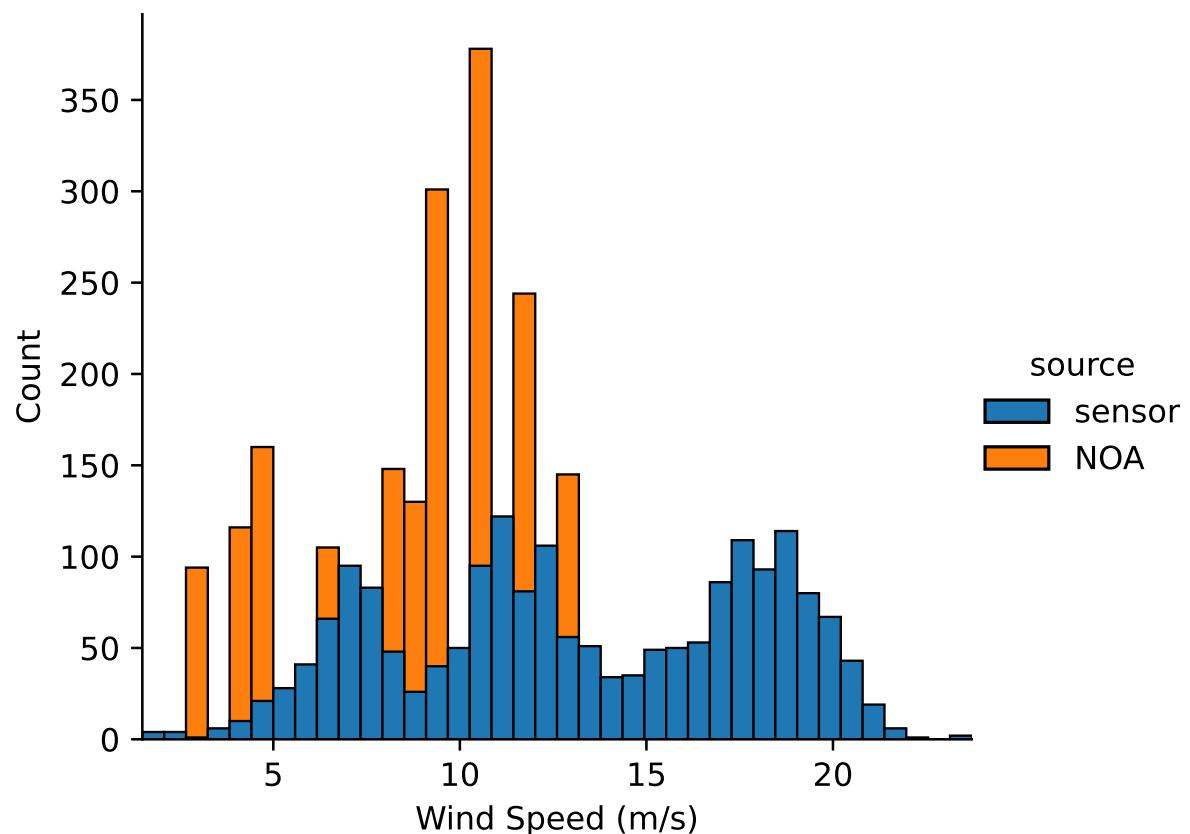


Figure 83: Wind Speed Sensor VS NOA Distributions comparison

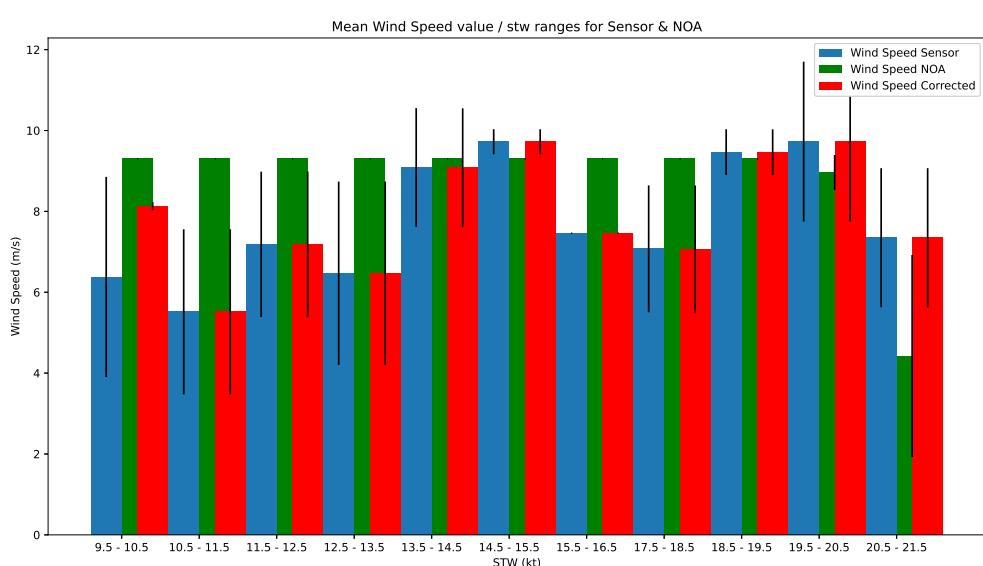


Figure 84: Initial / Weather Features Comparison per Speed Range

Routing Optimization Info :

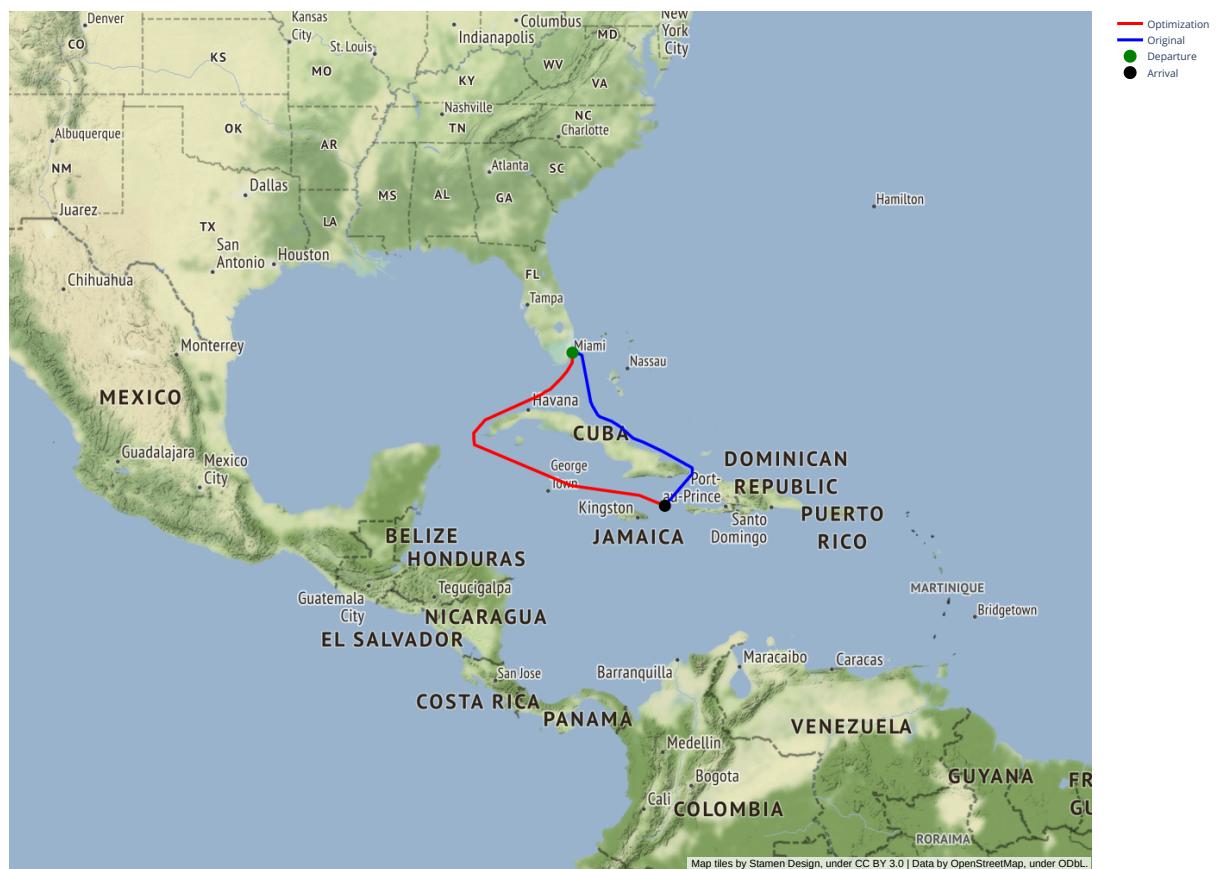


Figure 85: Initial / Optimized Route, MIAMI - KINGSTON

Voyage	Date	Latitude	Longitude
Departure	2019-12-15 11:41:00	25.0° 46.0' N	81.0° 51.0' E
Arrival	2019-12-16 18:00:00	18.0° 32.0' S	76.0° 34.0' E
BASIC COMPARISON	Optimization(RET = True)	Our Estimation	Optimization(RET = False)
Distance (nm)	NA	698.75	988.37
Time (hours)	NA	30.32	44.93
Avg Speed (kt)	NA	23.05	21.64
Total FOC (MT)	NA	202.11	227.97

Weather comparison optimization / initial:

- **RestrictETA = True**

NA

Figure 86: Wind Speed comparison Initial / Optimized Route, MIAMI - KINGSTON

- **RestrictETA = False**

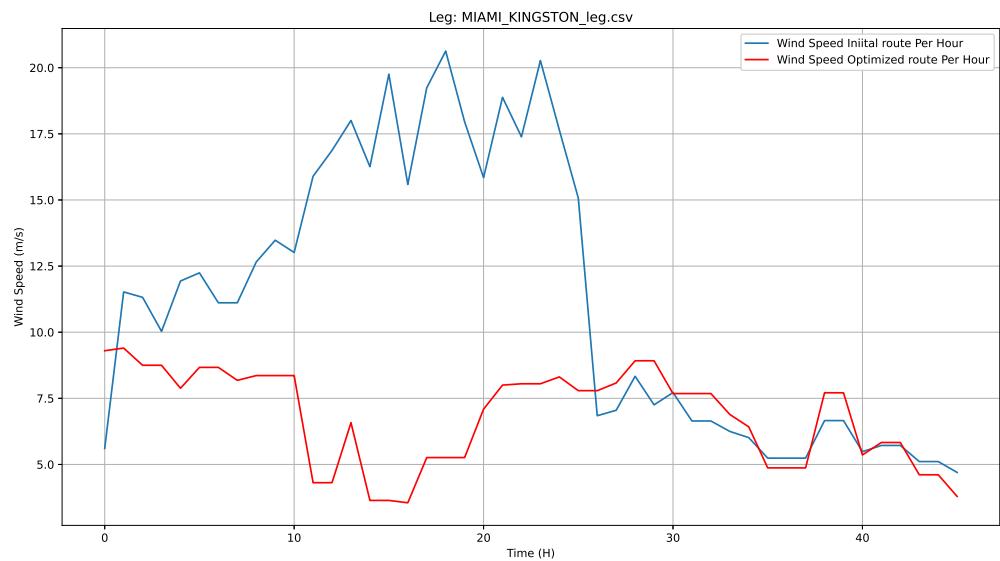


Figure 87: Wind Speed comparison Initial / Optimized Route, MIAMI - KINGSTON

Leg 15 # Basic INFO:

- Total Actual FOC : **1,196.27 MT**
 - Total Predicted FOC (Neural Net): **1,210.07 MT**
 - Total Predicted FOC (Neural DT): **1,127.19 MT**
 - FOC Perc Diff (Neural Net): **1.15 %**
 - FOC Perc Diff (Neural DT): **5.95 %**
- Departure Port : **KINGSTON / 2019-12-18 14:14:00**
- Arrival Port : **NINGBO / 2020-01-01 11:59:00**
- Total Sailing Time: **334 hours**
- Distance Travelled: **5,670.14 n mi**
- Draft: **11.7 m**

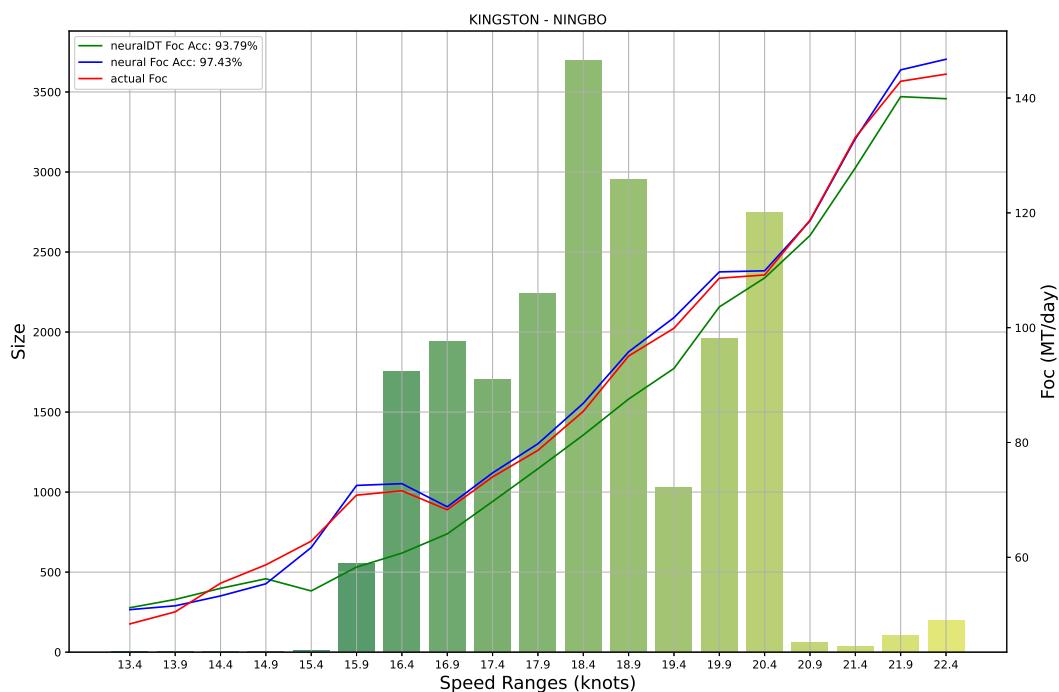


Figure 88: FOC Actual vs Predicted / Speed Ranges, KINGSTON - NINGBO

Weather Comparison - Sensor / Weather Service (NOA)

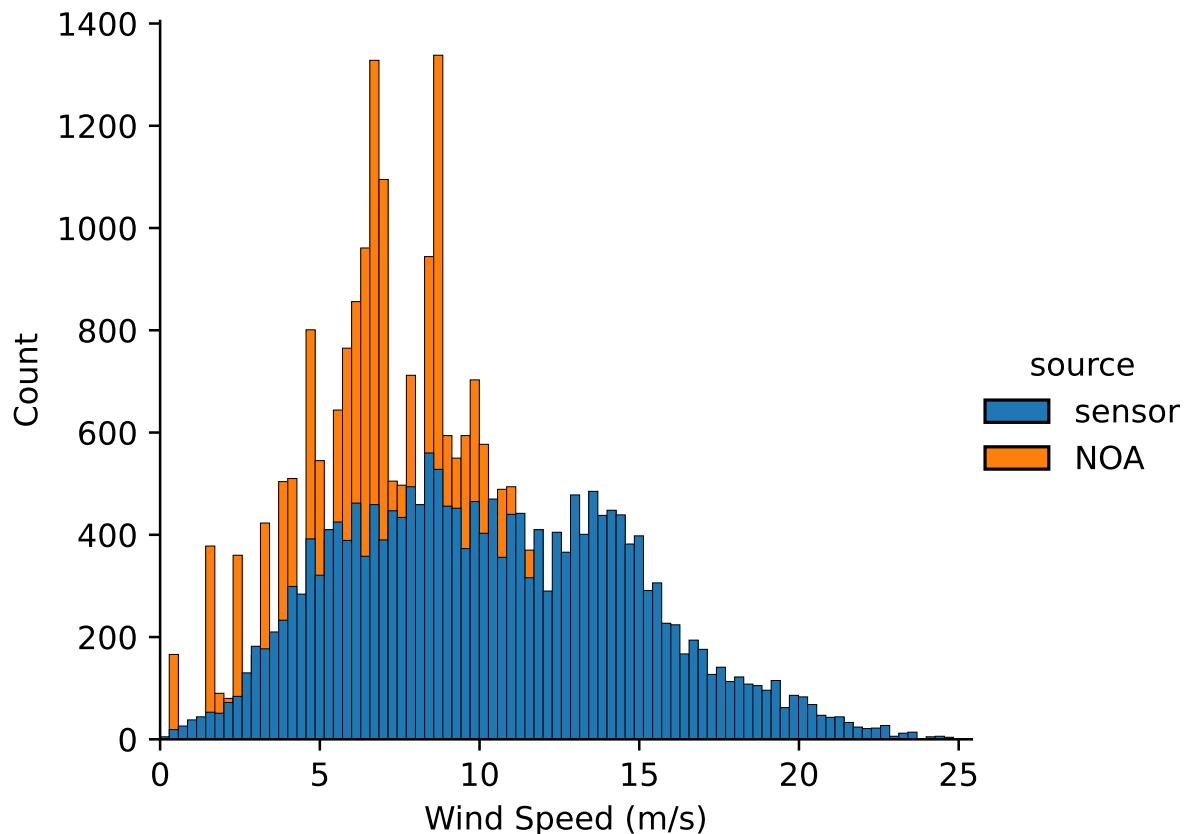


Figure 89: Wind Speed Sensor VS NOA Distributions comparison

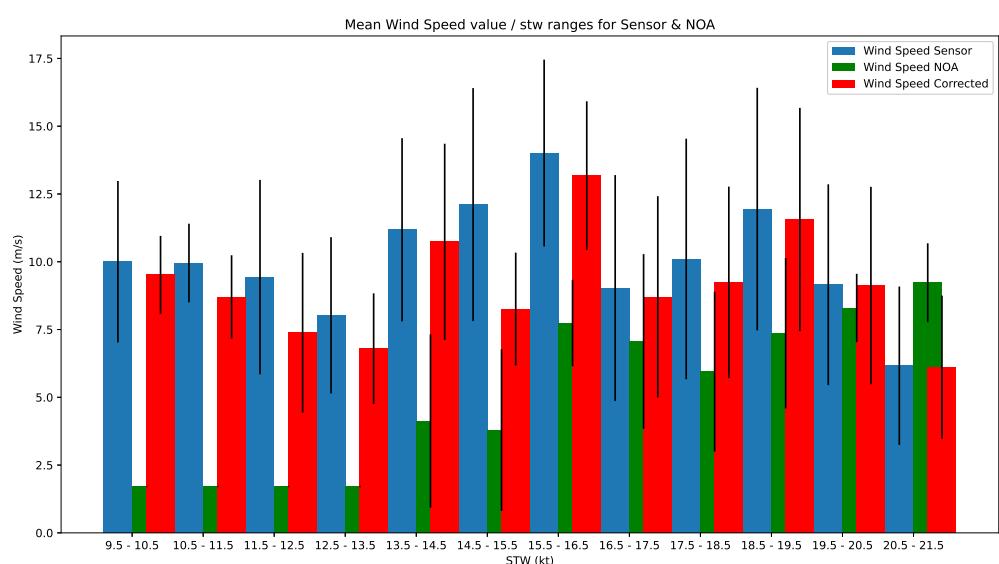


Figure 90: Initial / Weather Features Comparison per Speed Range

Routing Optimization Info :

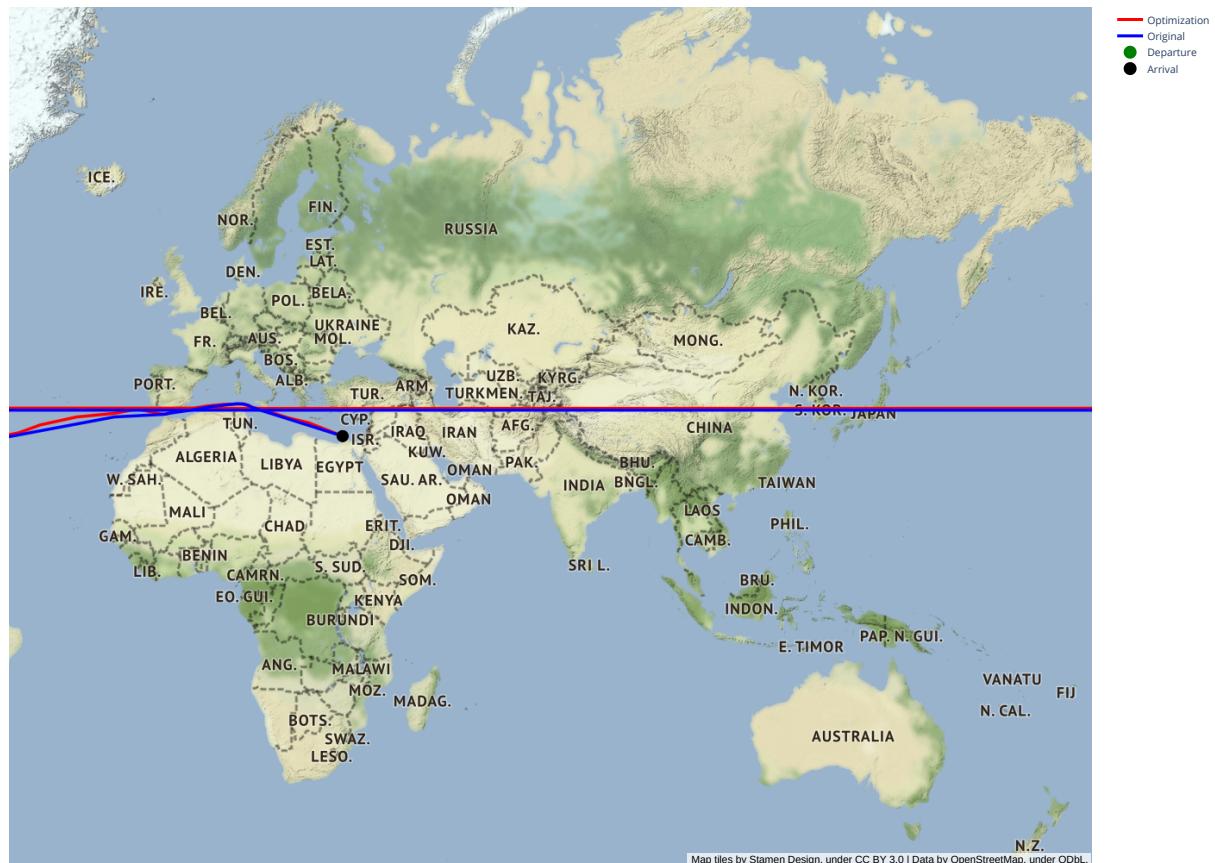


Figure 91: Initial / Optimized Route, KINGSTON - NINGBO

Voyage	Date	Latitude	Longitude
Departure	2019-12-18 14:14:00	17.0° 58.0' N	77.0° 10.0' E
Arrival	2020-01-01 11:59:00	32.0° 11.0' S	30.0° 27.0' E
BASIC COMPARISON	Optimization(RET A = True)	Our Estimation	Optimization(RET A = False)
Distance (nm)	5,733.27	6,165.96	5,741.43
Time (hours)	333.00	333.75	322.92
Avg Speed (kt)	17.18	18.47	17.74
Total FOC (MT)	934.79	1,210.07	995.92

Weather comparison optimization / initial:

- **RestrictETA = True**

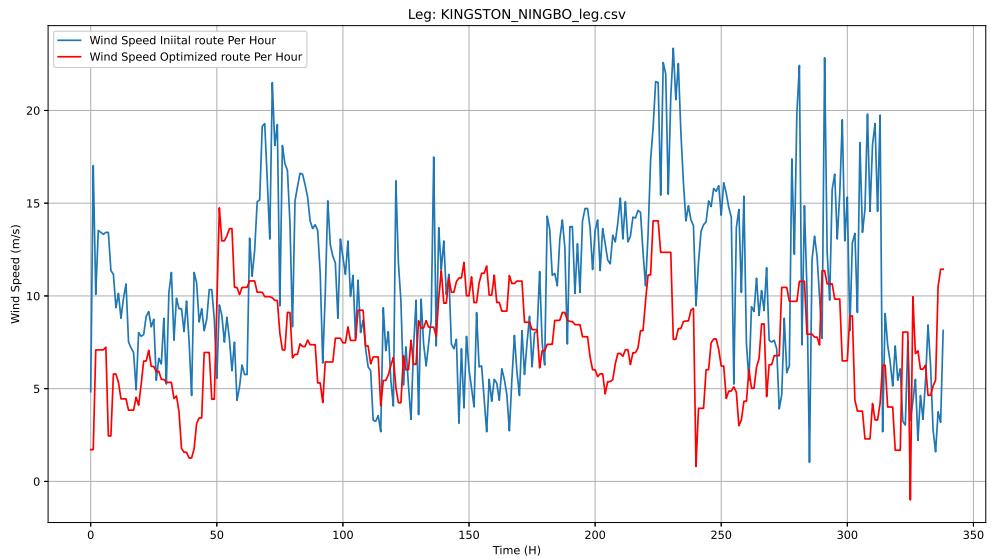


Figure 92: Wind Speed comparison Initial / Optimized Route, KINGSTON - NINGBO

- **RestrictETA = False**

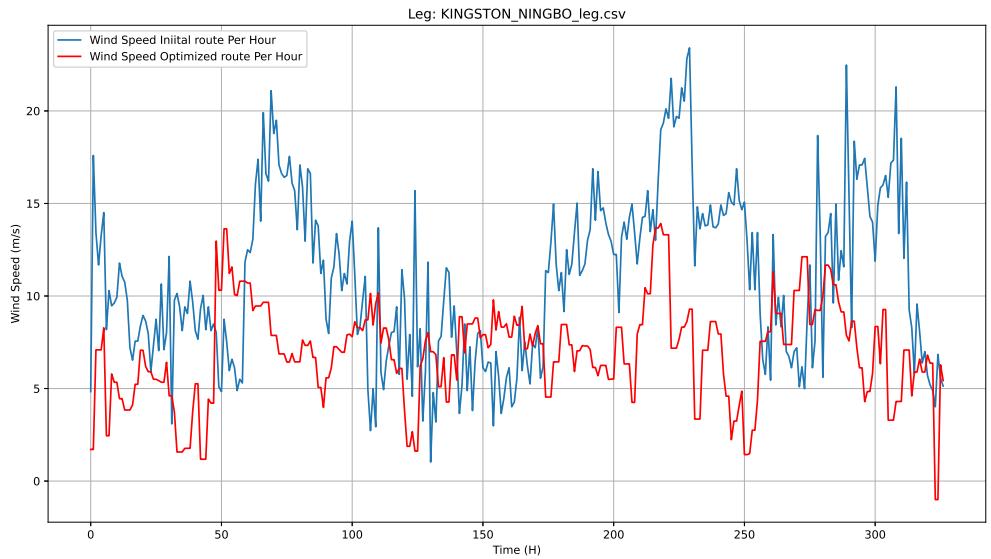


Figure 93: Wind Speed comparison Initial / Optimized Route, KINGSTON - NINGBO

3 Weather Comparison - Sensor / Weather Service (NOA) - Total

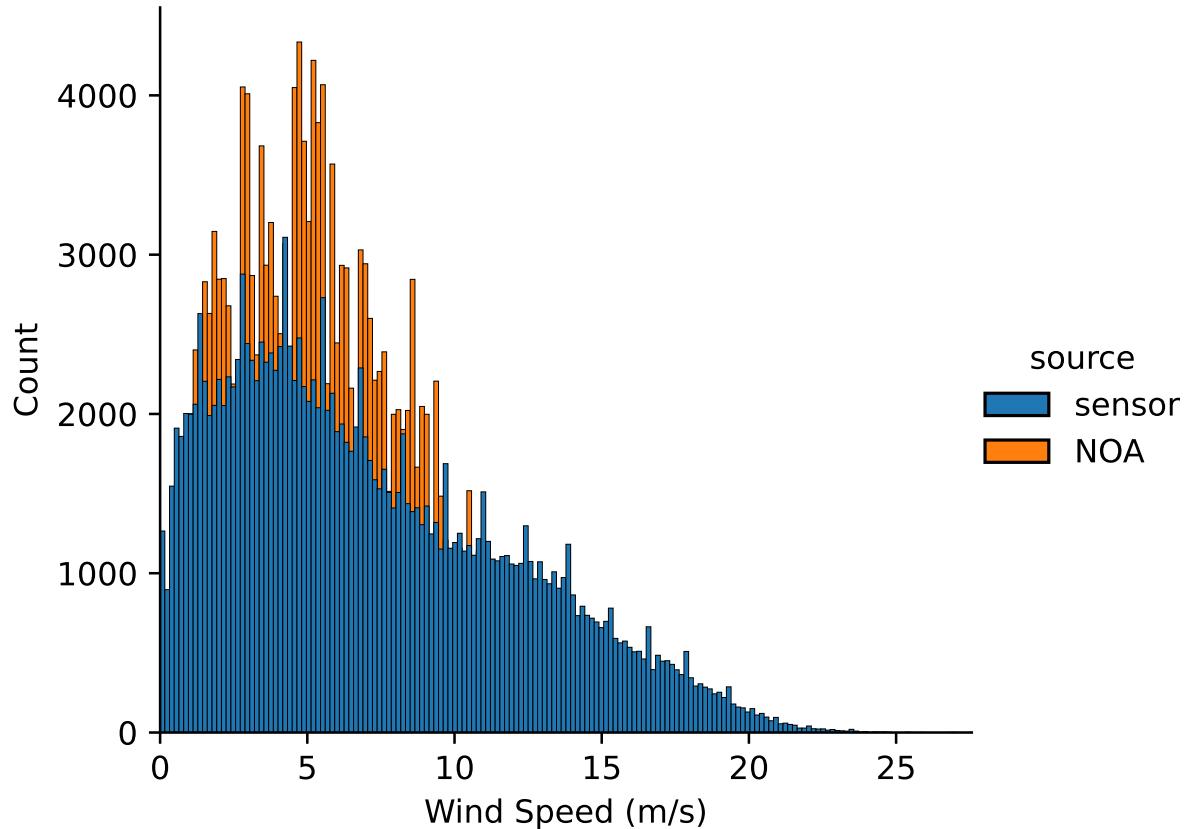


Figure 94: Wind Speed Sensor VS NOA Distributions comparison

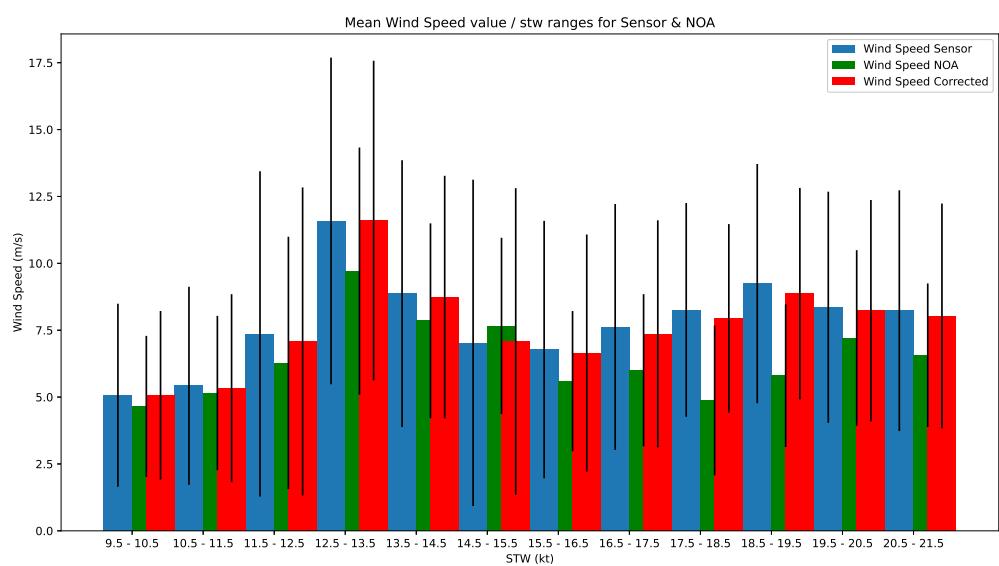


Figure 95: Initial / Weather Features Comparison per Speed Range