

Danaos Management Consultants

"CMA CGM MELISANDE"

Friday 15th October, 2021

Vessel Basic Info:

IMO: 9473028

Vessel Type: Container

Min Draft: 10.0 m

Max Draft: 13.0 m

Max Speed: Sea speed Ballast 20.9. Laden 20.7

1 Model Performance Overview

Table 1: Neural Network model accuracy based on the weather observed by the sensors

Neural Net	Info per leg				
	Total Act FOC (MT)	Total Pred FOC (MT)	FOC Perc Diff	Mean STW (kt)	Mean Draft (m)
SUEZ - SINGAPORE	914.65	921.23	0.72 %	13.55	11.82
SINGAPORE - VUNG TAU	150.93	151.25	0.21 %	20.26	10.30
VUNG TAU - HONG KONG	245.21	251.45	2.51 %	17.59	11.01
SHEKOU - NINGBO	100.64	102.99	2.31 %	12.21	10.25
SHANGHAI - PUSAN	75.31	75.13	0.24 %	17.17	12.65
PUSAN - PANAMA	2,221.28	2,241.73	0.92 %	17.48	12.76
PANAMA - HOUSTON	50.09	49.23	1.73 %	13.89	12.43
HOUSTON - MOBILE	67.38	68.37	1.46 %	13.40	12.06
MOBILE - NEW ORLEANS	29.83	32.32	8.01 %	11.79	12.25
NEW ORLEANS - TAMPA	86.68	92.02	5.98 %	16.61	12.36
TAMPA - MIAMI	111.26	111.13	0.12 %	19.14	11.82
MIAMI - SUEZ	671.54	671.27	0.04 %	16.97	11.57
Total	4,724.80	4,768.12	0.91 %	15.8 (Avg)	11.8 (Avg)

Overall Accuracy

- Total records: **68,725 instances**
- Total Sailing Time: **1,186 hours**
- Total Distance Travelled: **18,057.10 n mi**

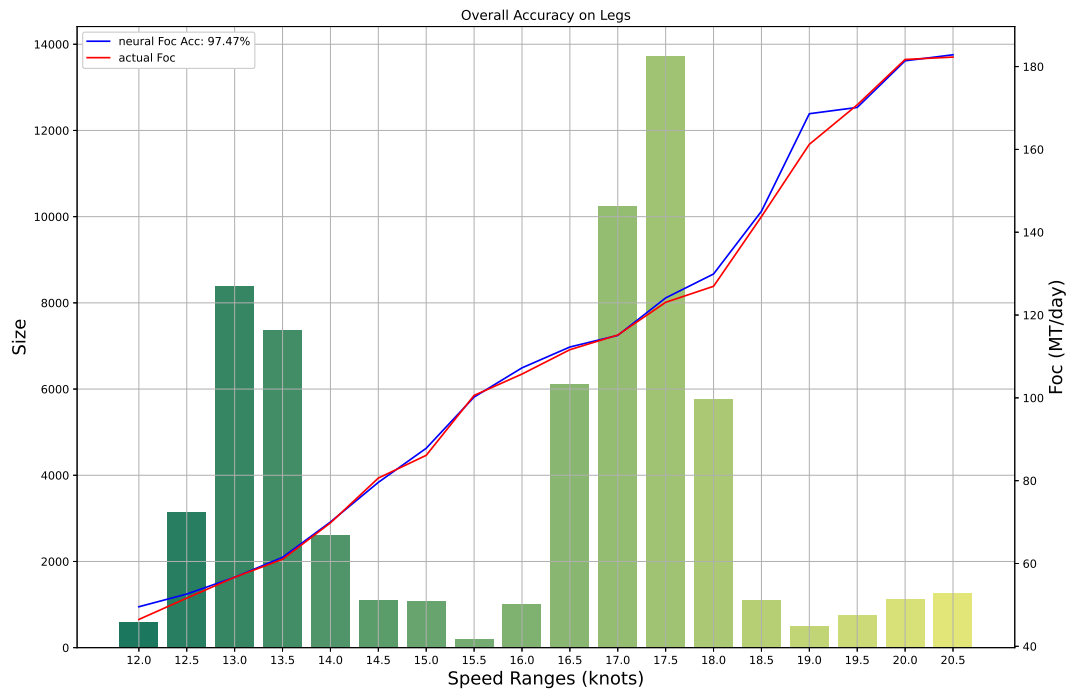


Figure 1: FOC Actual vs Predicted / Speed Ranges, Overall on Legs

2 SUEZ - SINGAPORE

- Total Actual FOC : **914.65 MT**
 - Total Predicted FOC (Neural Net): **921.23 MT**
 - FOC Perc Diff (Neural Net): **0.72 %**
- Departure Port : **SUEZ / 2019-10-18 16:00:00**
- Arrival Port : **SINGAPORE / 2019-11-02 10:37:00**
- Total Sailing Time: **355 hours**
- Distance Travelled: **4,386.96 n mi**
- Draft: **11.8 m**

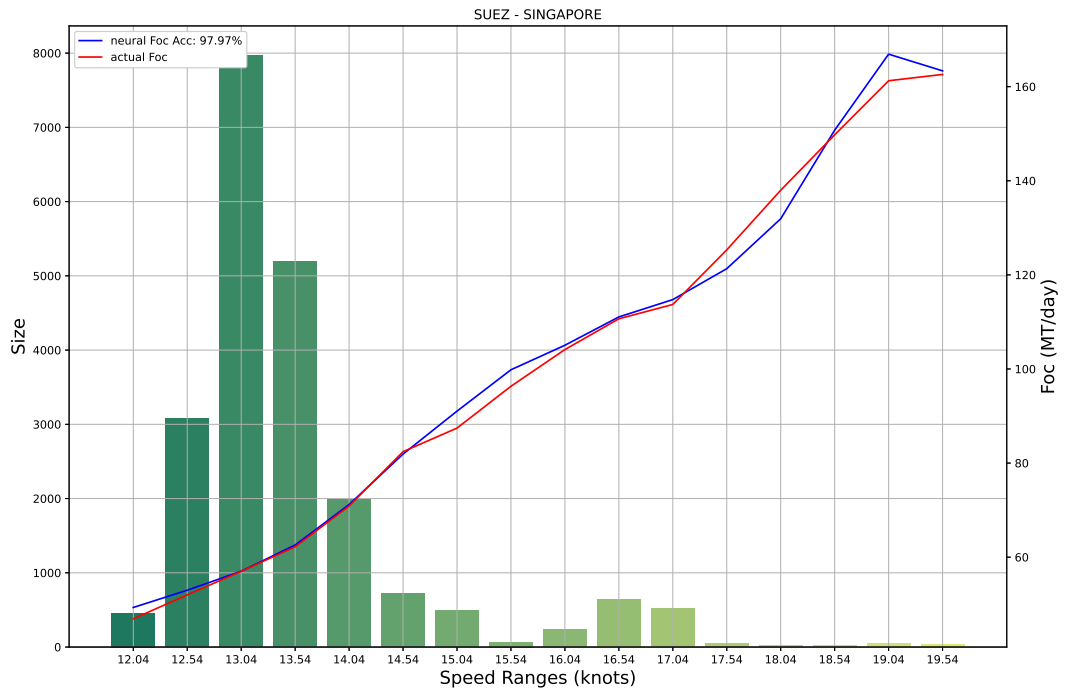


Figure 2: FOC Actual vs Predicted / Speed Ranges, SUEZ - SINGAPORE

Weather Comparison - Sensor / Weather Service (NOA)

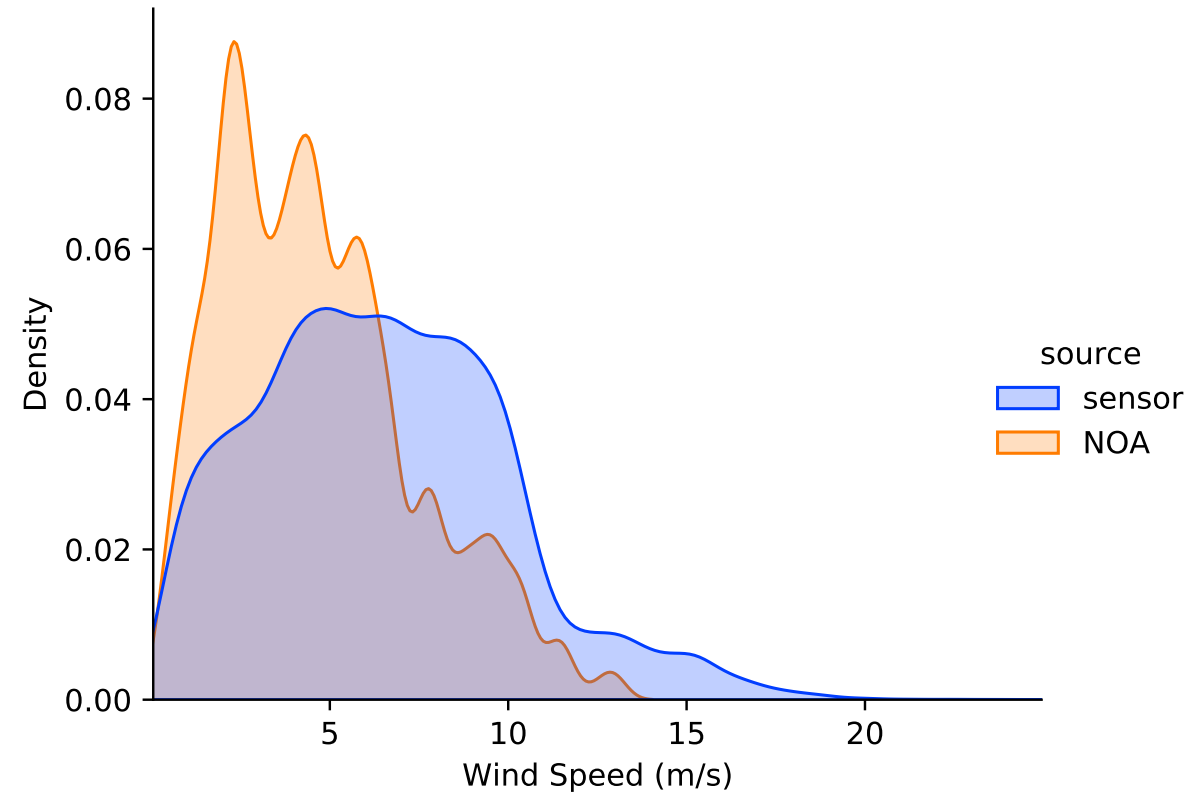


Figure 3: Wind Speed Sensor VS NOA Distributions comparison

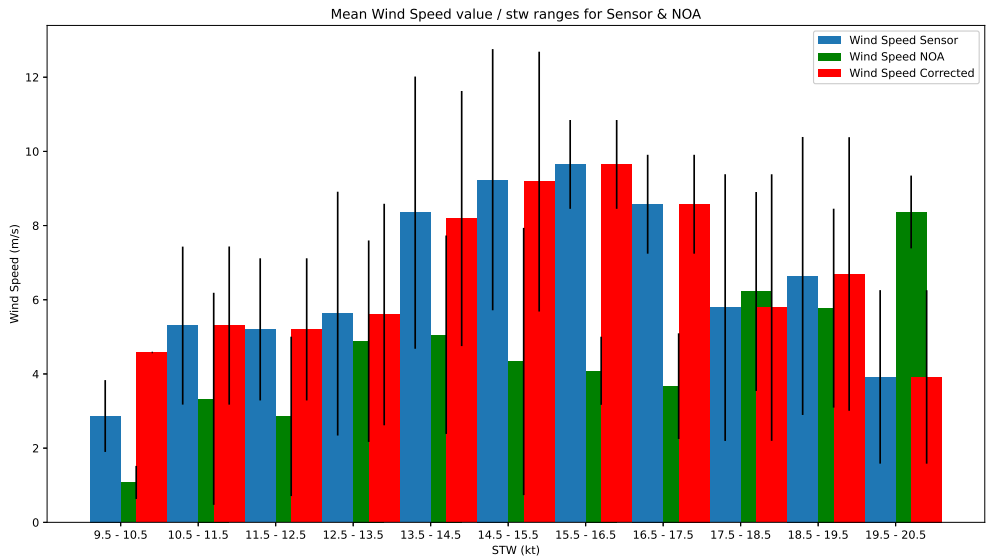


Figure 4: Initial / Weather Features Comparison per Speed Range

Routing Optimization Info : SUEZ - SINGAPORE

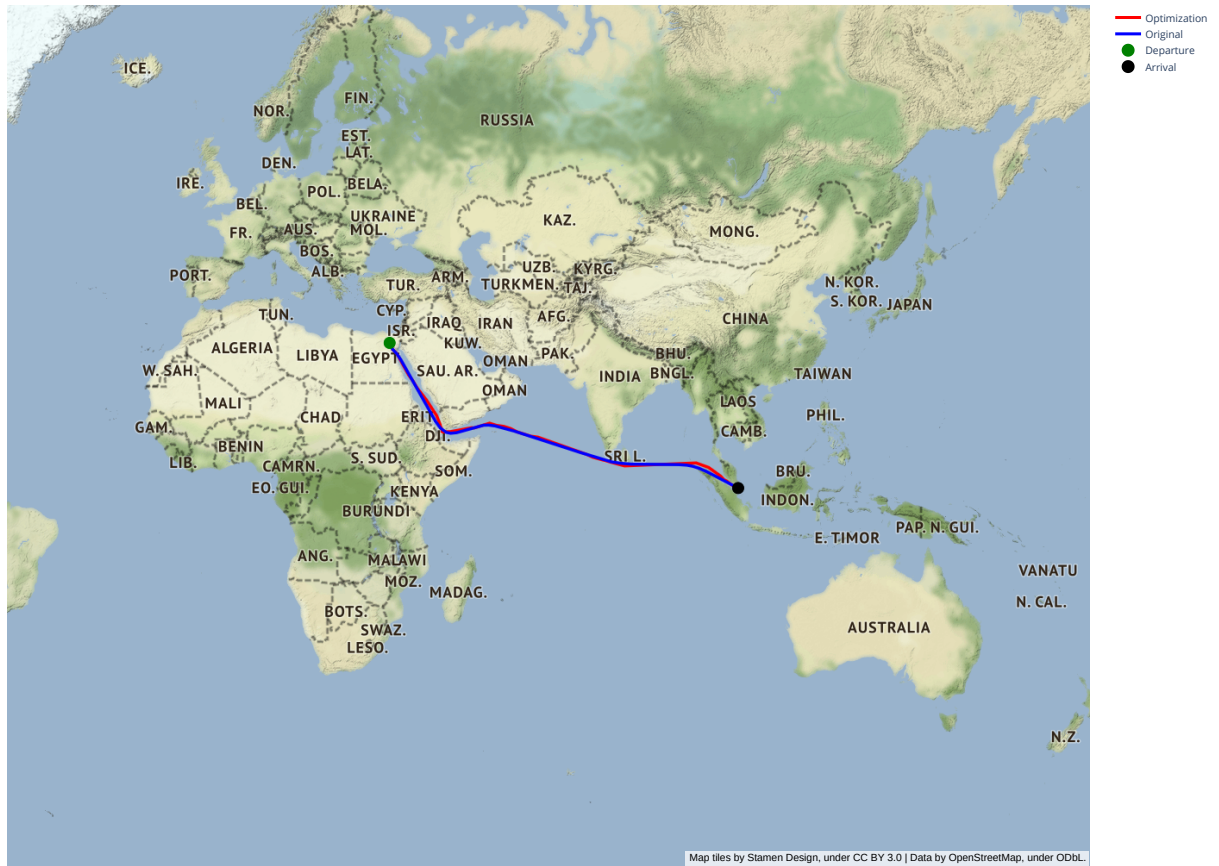


Figure 5: Initial / Optimized Route, SUEZ - SINGAPORE

Voyage	Date	Latitude	Longitude
Departure	2019-10-18 16:00:00	29.0° 24.0' N	32.0° 36.0' E
Arrival	2019-11-02 10:37:00	1.0° 15.0' S	103.0° 46.0' E
BASIC COMPARISON	Actual route estimation	Optimized route estimation	
Distance (nm)	5,036.43	4,958.77	
Time (hours)	354.62	348.75	
Avg Speed (kt)	14.20	14.29	
Total FOC (MT)	1,051.24	1,043.31	

Table 2: Estimation based on Weather Service data (NOA)

Weather comparison optimization / initial:

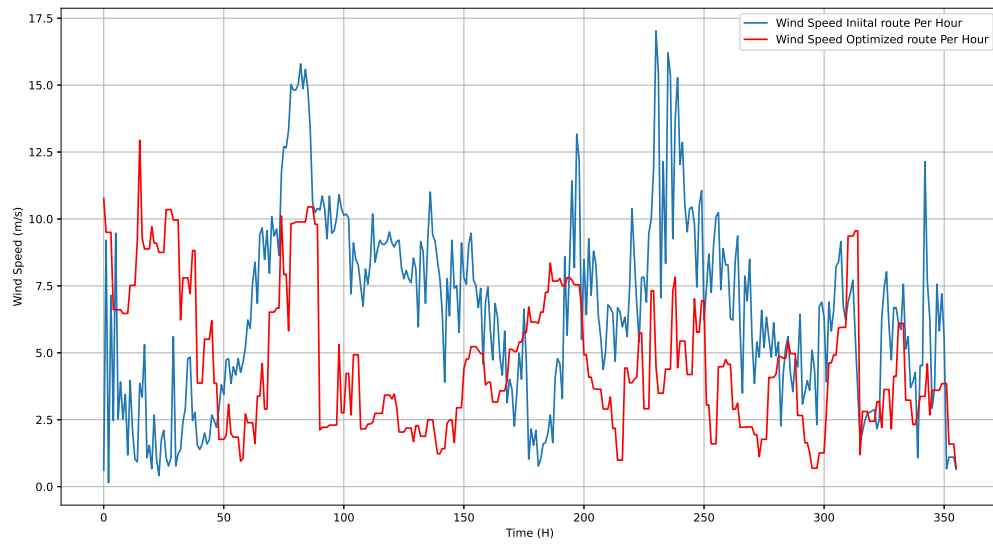


Figure 6: Wind Speed comparison Initial / Optimized Route, SUEZ - SINGAPORE

3 SHEKOU - NINGBO

- Total Actual FOC : **100.64 MT**
 - Total Predicted FOC (Neural Net): **102.99 MT**
 - FOC Perc Diff (Neural Net): **2.31 %**
- Departure Port : **SHEKOU / 2019-11-09 20:00:00**
- Arrival Port : **NINGBO / 2019-11-11 20:54:00**
- Total Sailing Time: **49 hours**
- Distance Travelled: **569.42 n mi**
- Draft: **10.2 m**

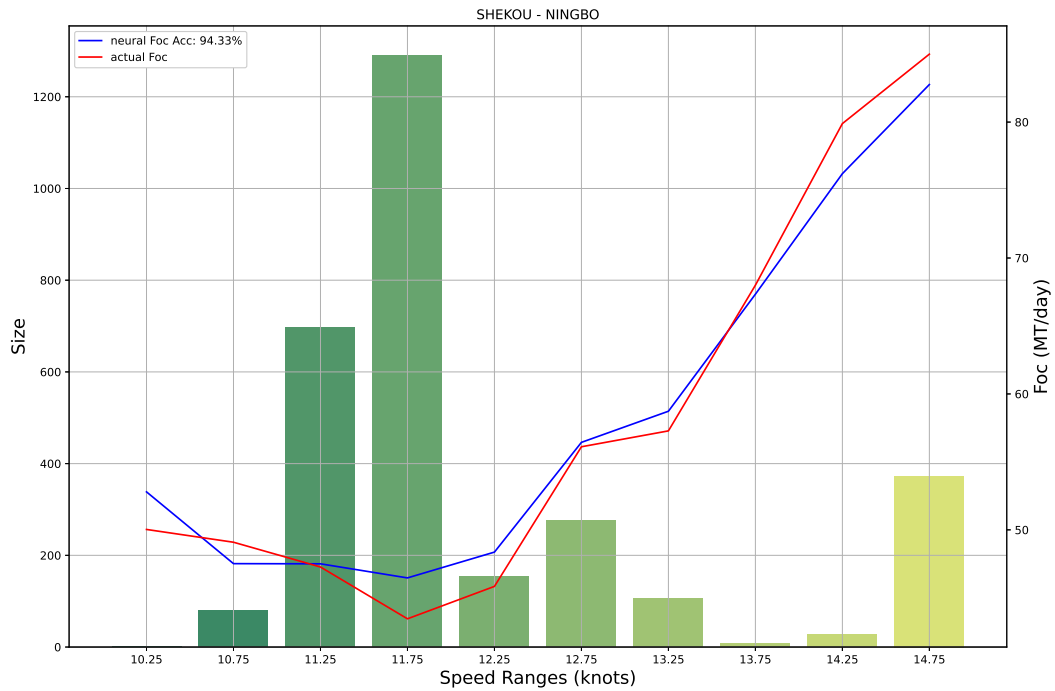


Figure 7: FOC Actual vs Predicted / Speed Ranges, SHEKOU - NINGBO

Weather Comparison - Sensor / Weather Service (NOA)

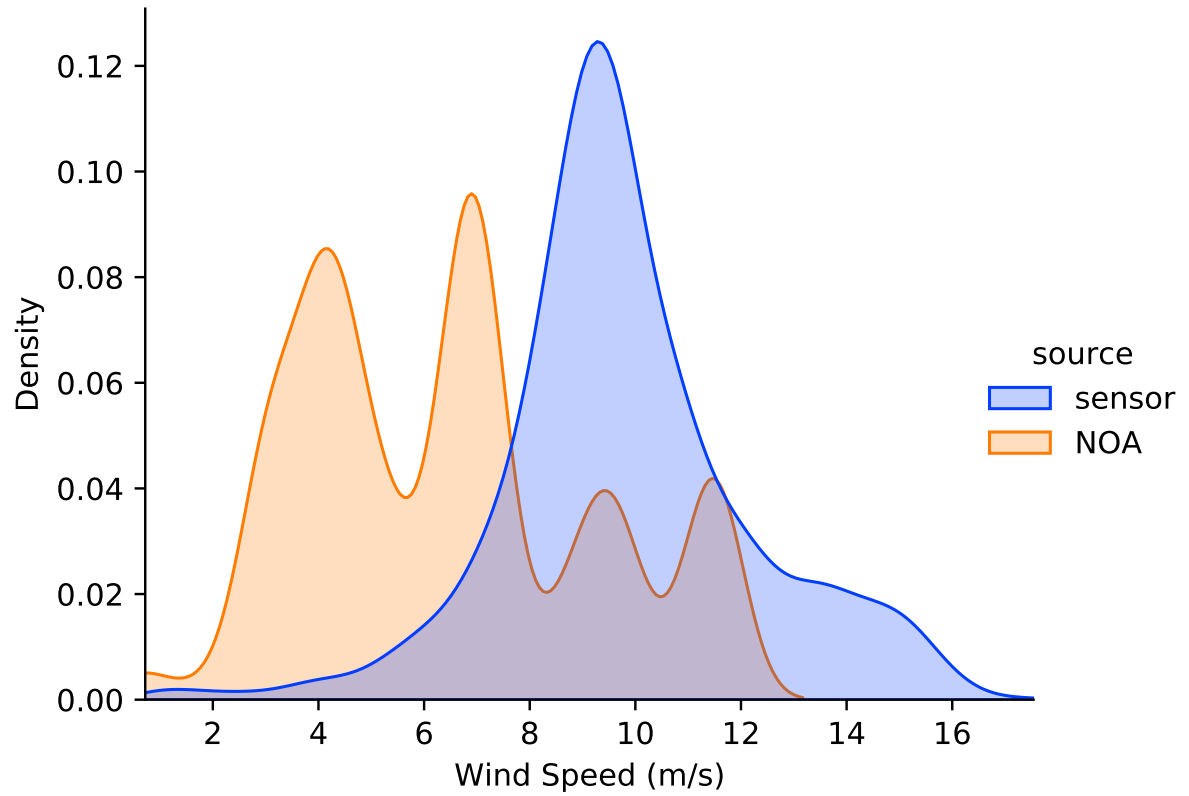


Figure 8: Wind Speed Sensor VS NOA Distributions comparison

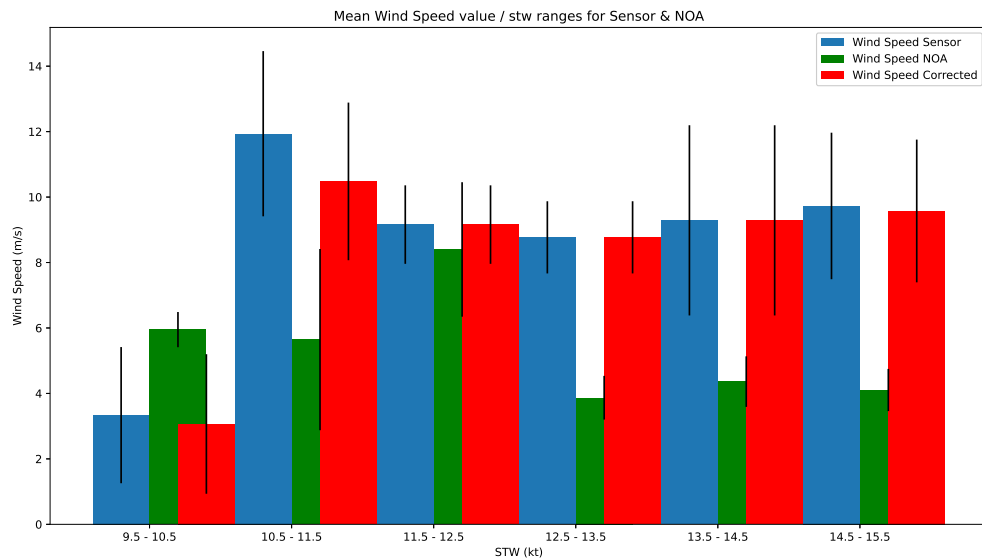


Figure 9: Initial / Weather Features Comparison per Speed Range

Routing Optimization Info : SHEKOU - NINGBO

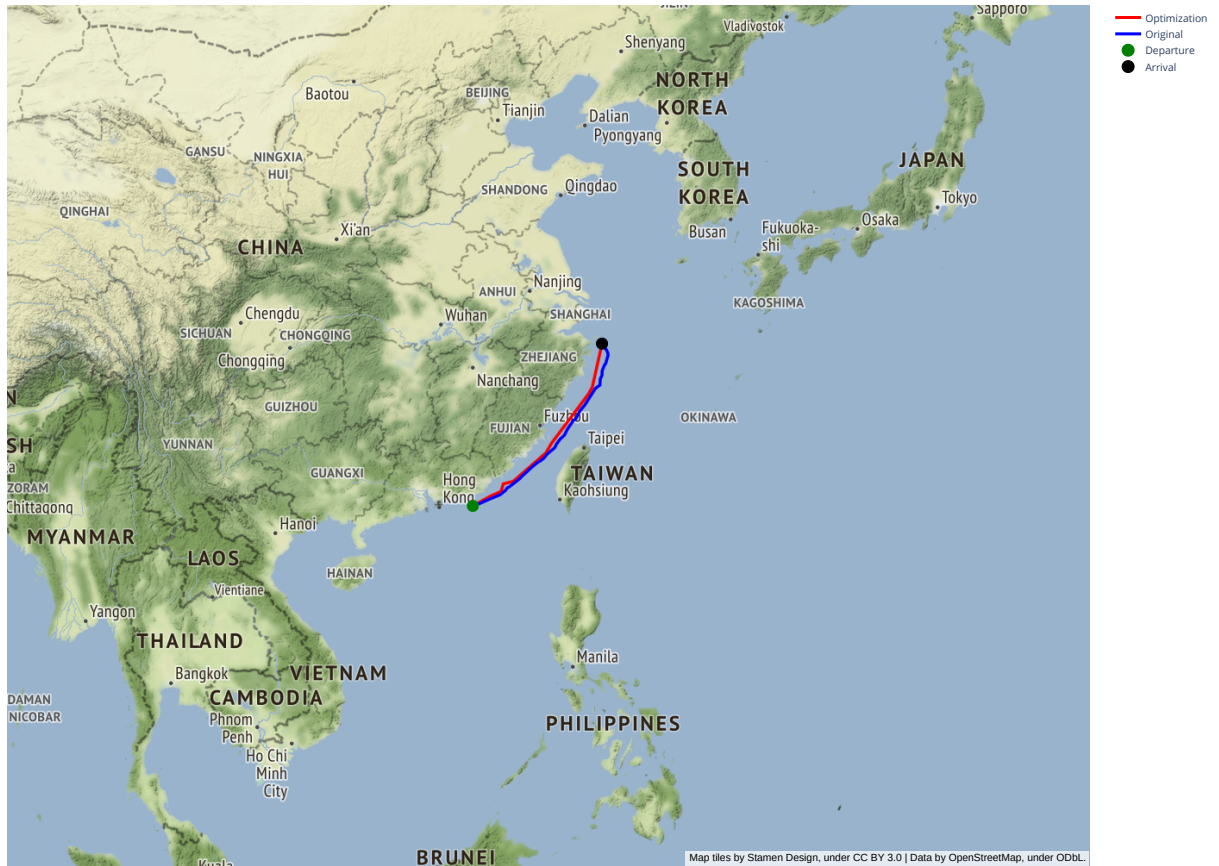


Figure 10: Initial / Optimized Route, SHEKOU - NINGBO

Voyage	Date	Latitude	Longitude
Departure	2019-11-09 20:00:00	22.0° 20.0' N	115.0° 53.0' E
Arrival	2019-11-11 20:54:00	29.0° 46.0' S	122.0° 28.0' E
BASIC COMPARISON	Actual route estimation	Optimized route estimation	
Distance (nm)	628.82	601.34	
Time (hours)	48.90	48.13	
Avg Speed (kt)	12.86	12.33	
Total FOC (MT)	112.33	109.73	

Table 3: Estimation based on Weather Service data (NOA)

Weather comparison optimization / initial:

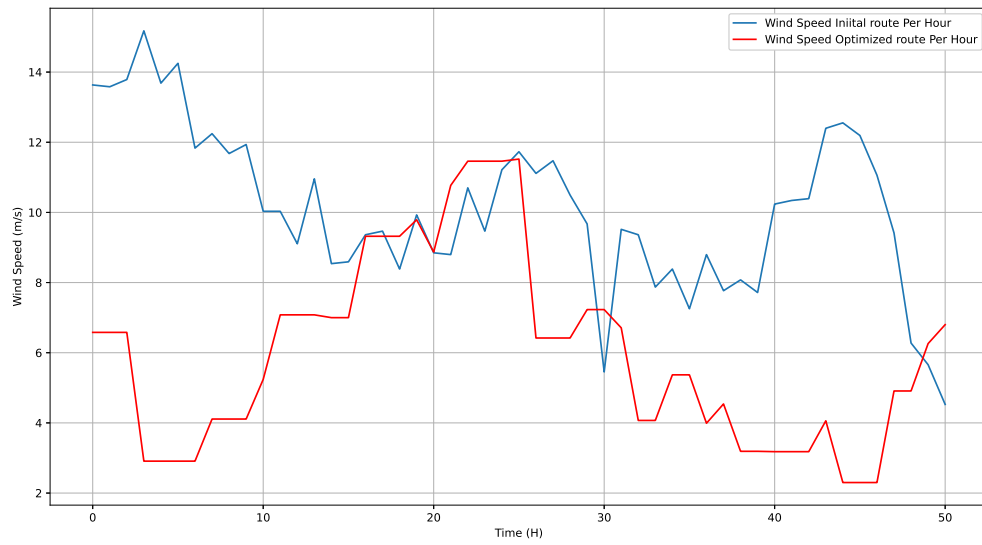


Figure 11: Wind Speed comparison Initial / Optimized Route, SHEKOU - NINGBO

4 PUSAN - PANAMA

- Total Actual FOC : **2,221.28 MT**
 - Total Predicted FOC (Neural Net): **2,241.73 MT**
 - FOC Perc Diff (Neural Net): **0.92 %**
- Departure Port : **PUSAN / 2019-11-17 01:00:00**
- Arrival Port : **PANAMA / 2019-12-05 20:30:00**
- Total Sailing Time: **452 hours**
- Distance Travelled: **7,941.02 n mi**
- Draft: **12.8 m**

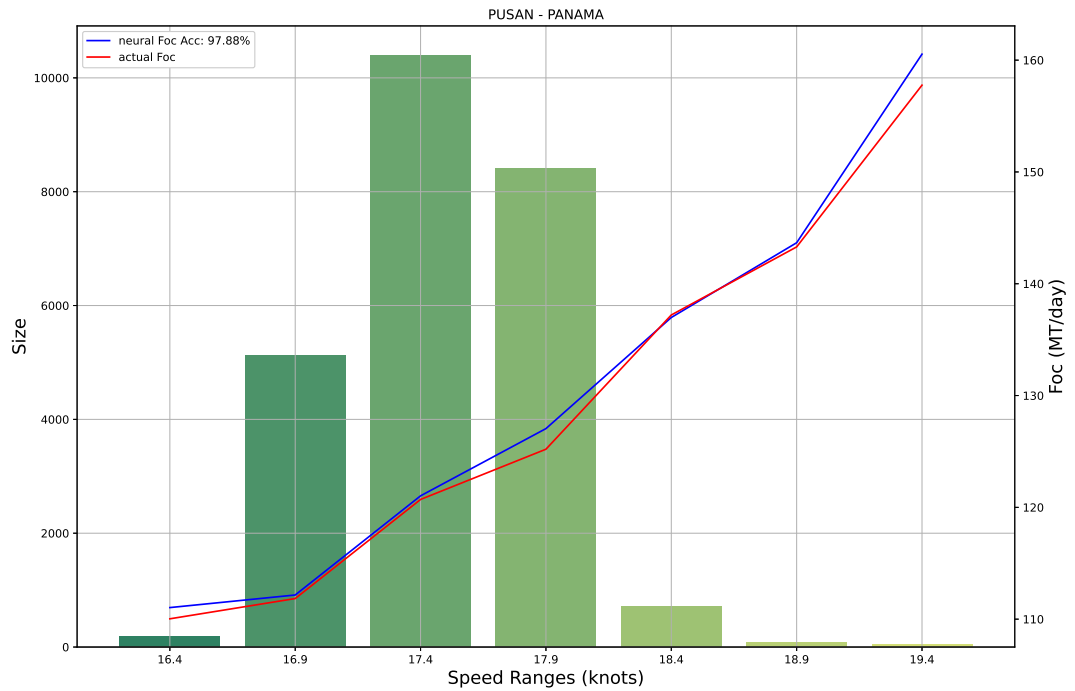


Figure 12: FOC Actual vs Predicted / Speed Ranges, PUSAN - PANAMA

Weather Comparison - Sensor / Weather Service (NOA)

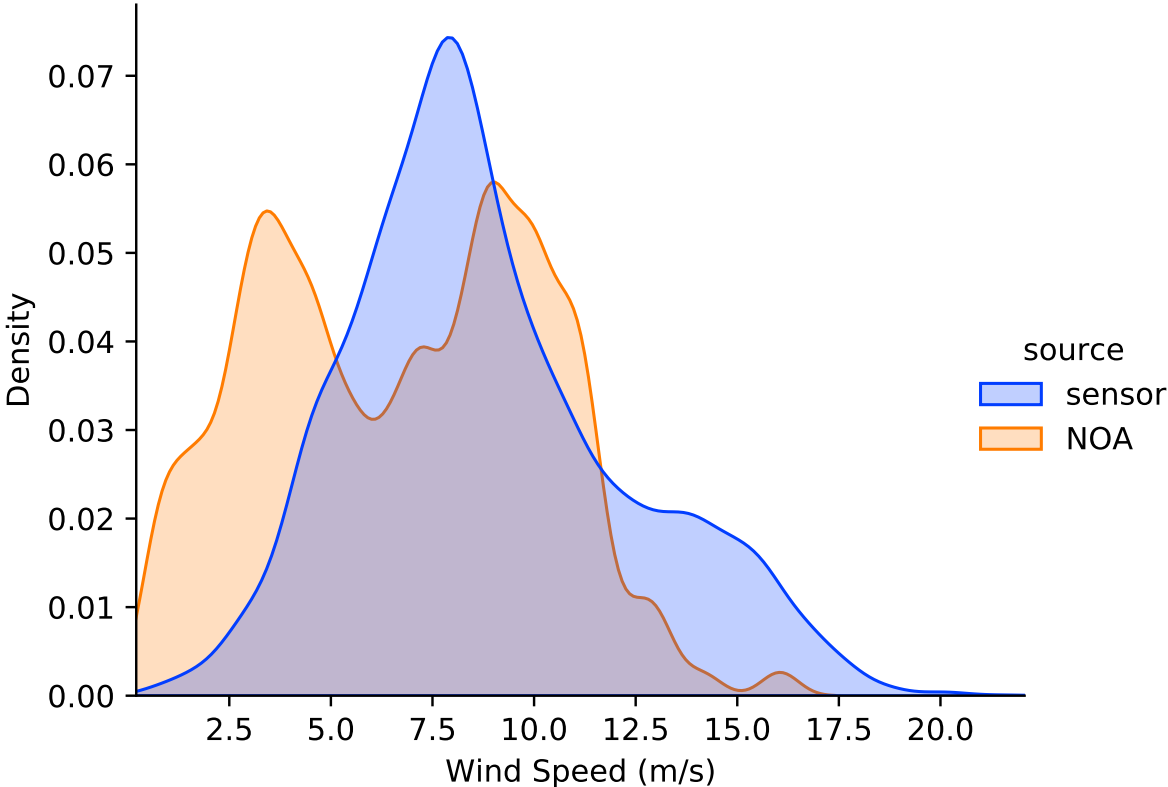


Figure 13: Wind Speed Sensor VS NOA Distributions comparison

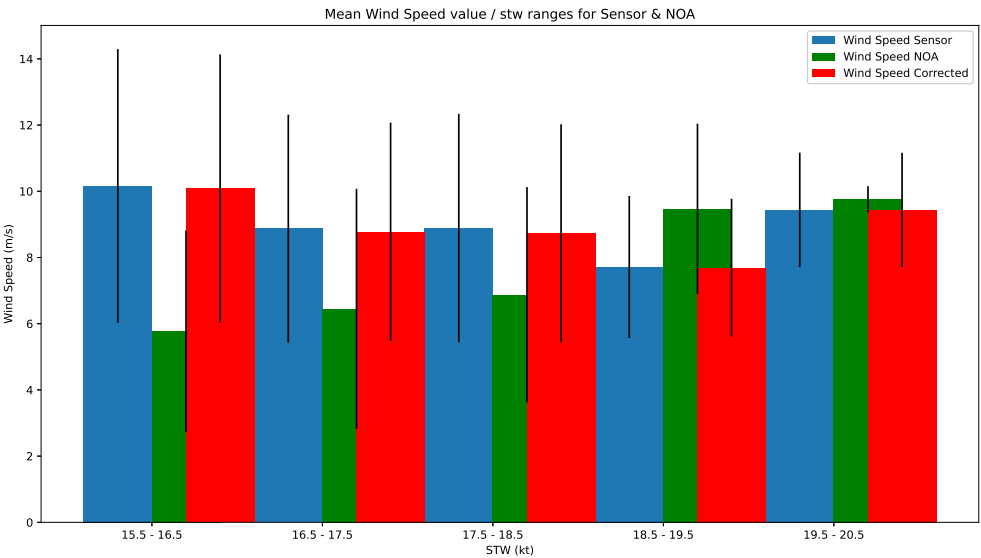


Figure 14: Initial / Weather Features Comparison per Speed Range

Routing Optimization Info : PUSAN - PANAMA

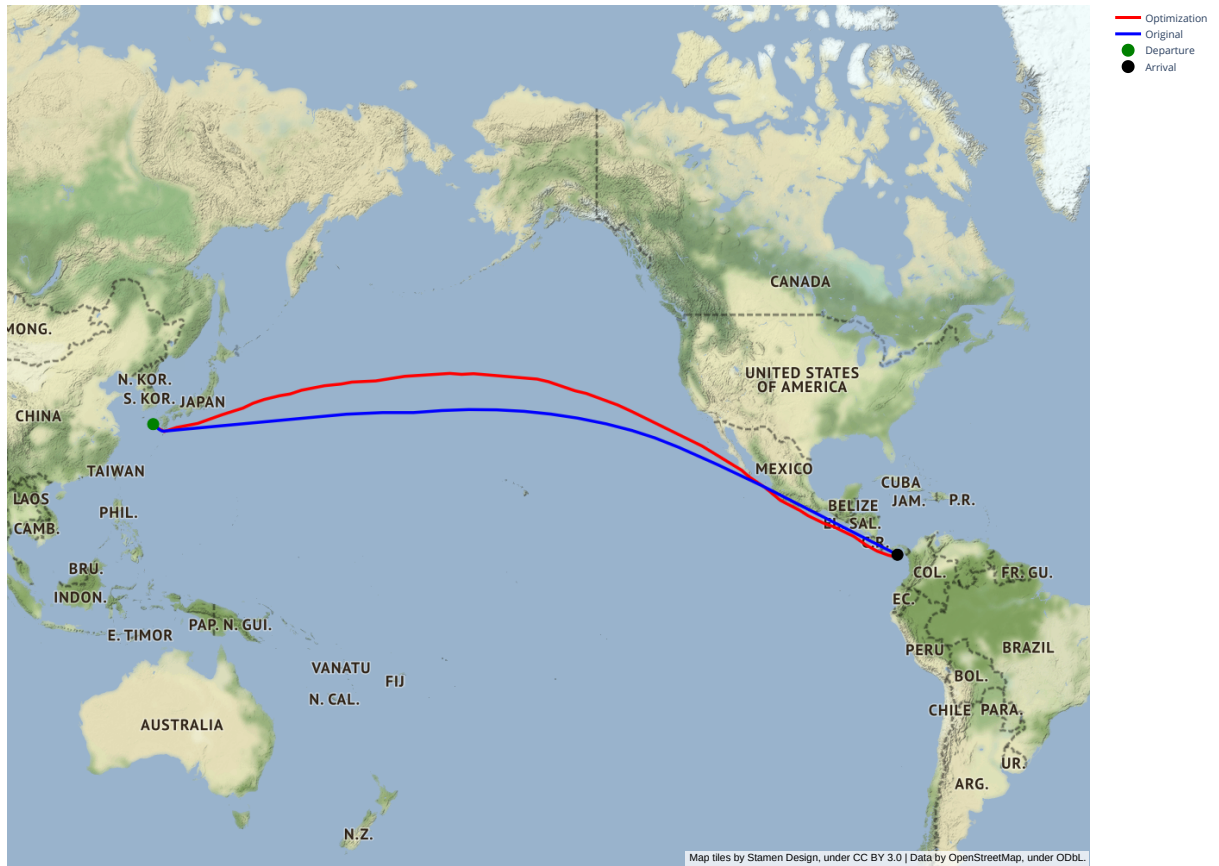


Figure 15: Initial / Optimized Route, PUSAN - PANAMA

Voyage	Date	Latitude	Longitude
Departure	2019-11-17 01:00:00	32.0° 10.0' N	128.0° 31.0' E
Arrival	2019-12-05 20:30:00	7.0° 22.0' S	80.0° 15.0' E
BASIC COMPARISON	Actual route estimation	Optimized route estimation	
Distance (nm)	8,343.37	8,274.61	
Time (hours)	451.50	449.92	
Avg Speed (kt)	18.48	18.12	
Total FOC (MT)	2,497.53	2,437.34	

Table 4: Estimation based on Weather Service data (NOA)

Weather comparison optimization / initial:

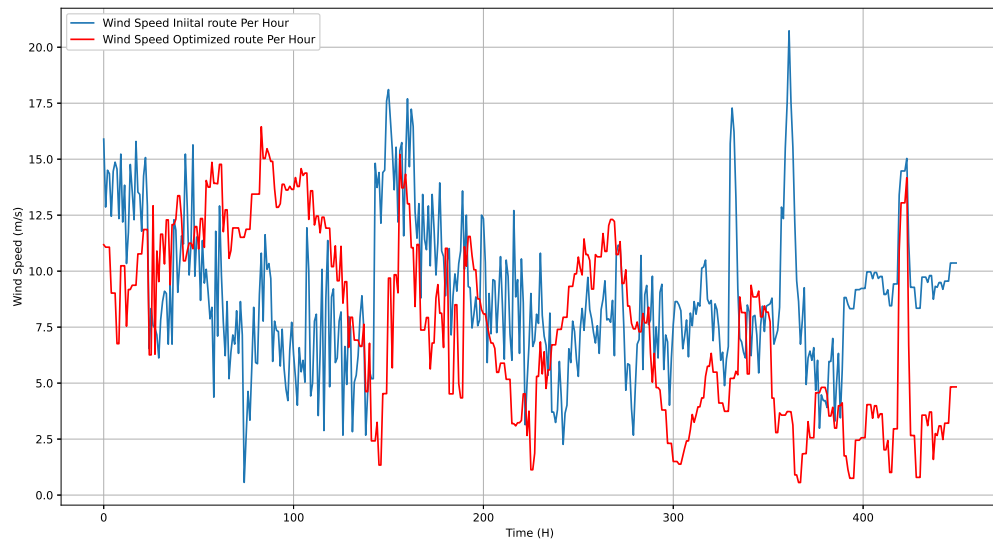


Figure 16: Wind Speed comparison Initial / Optimized Route, PUSAN - PANAMA

5 MIAMI - SUEZ

- Total Actual FOC : **671.54 MT**
 - Total Predicted FOC (Neural Net): **671.27 MT**
 - FOC Perc Diff (Neural Net): **0.04 %**
- Departure Port : **MIAMI / 2019-12-26 17:03:00**
- Arrival Port : **SUEZ / 2020-01-01 11:59:00**
- Total Sailing Time: **139 hours**
- Distance Travelled: **2,429.10 n mi**
- Draft: **11.6 m**

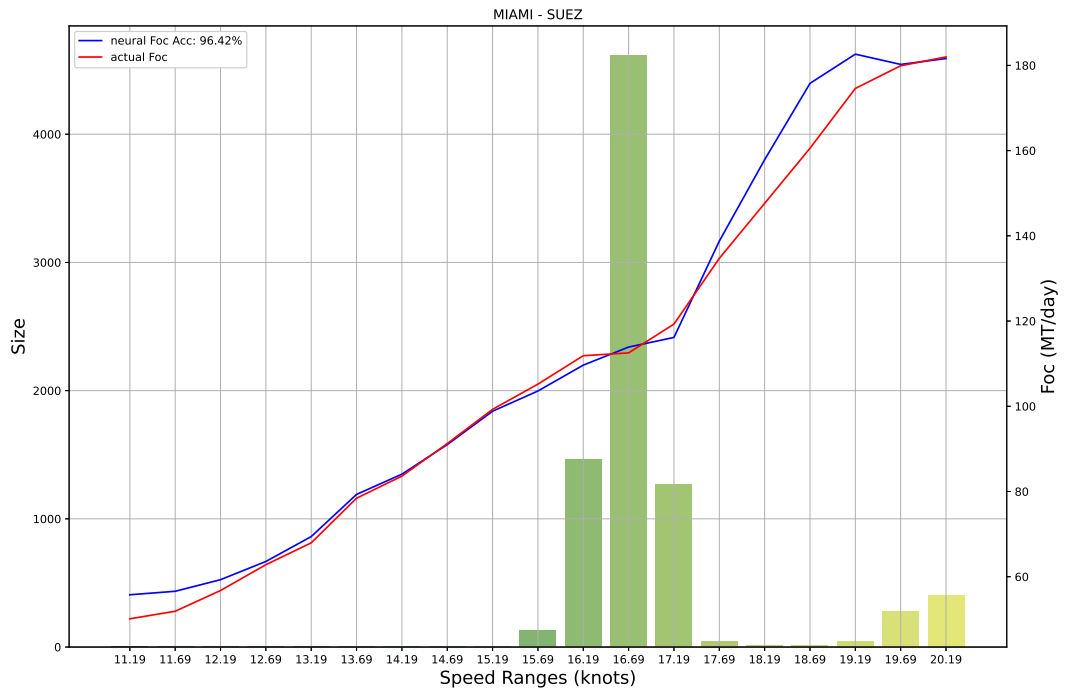


Figure 17: FOC Actual vs Predicted / Speed Ranges, MIAMI - SUEZ

Weather Comparison - Sensor / Weather Service (NOA)

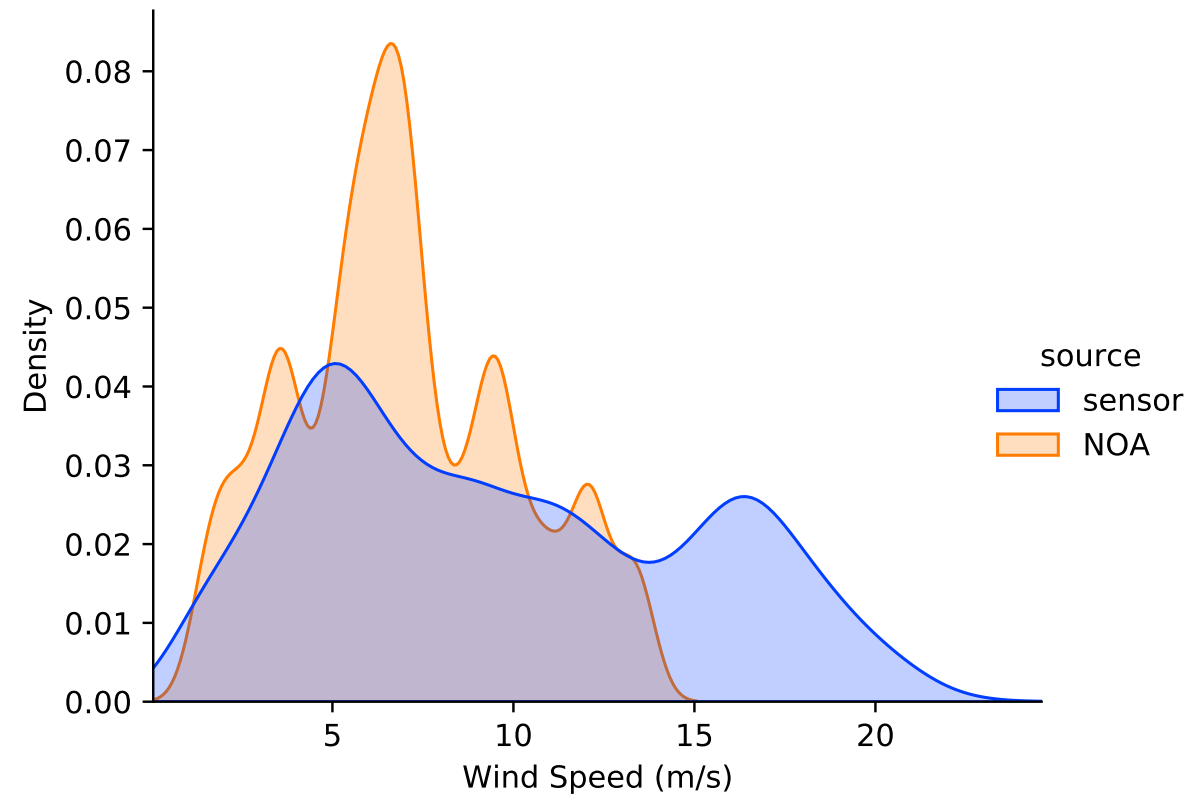


Figure 18: Wind Speed Sensor VS NOA Distributions comparison

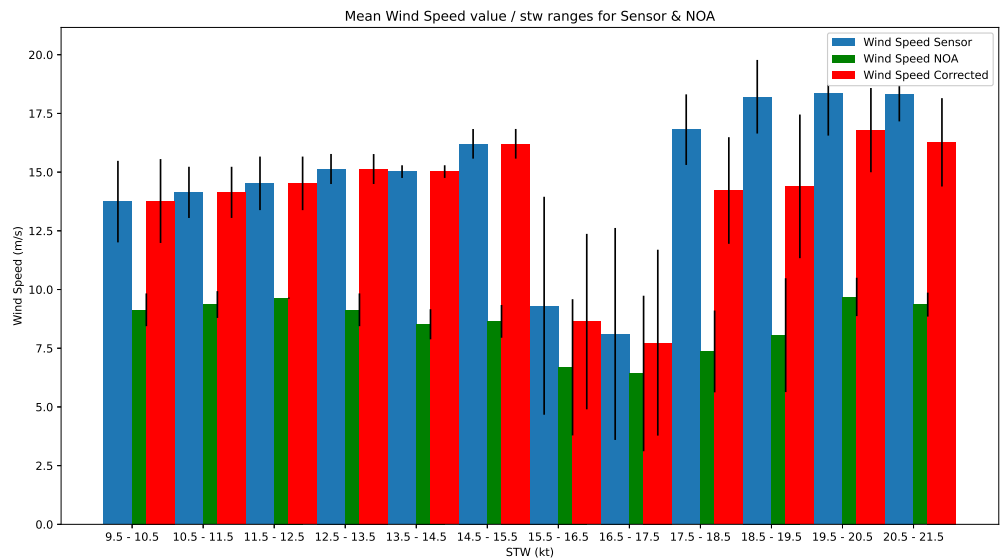


Figure 19: Initial / Weather Features Comparison per Speed Range

Routing Optimization Info : MIAMI - SUEZ

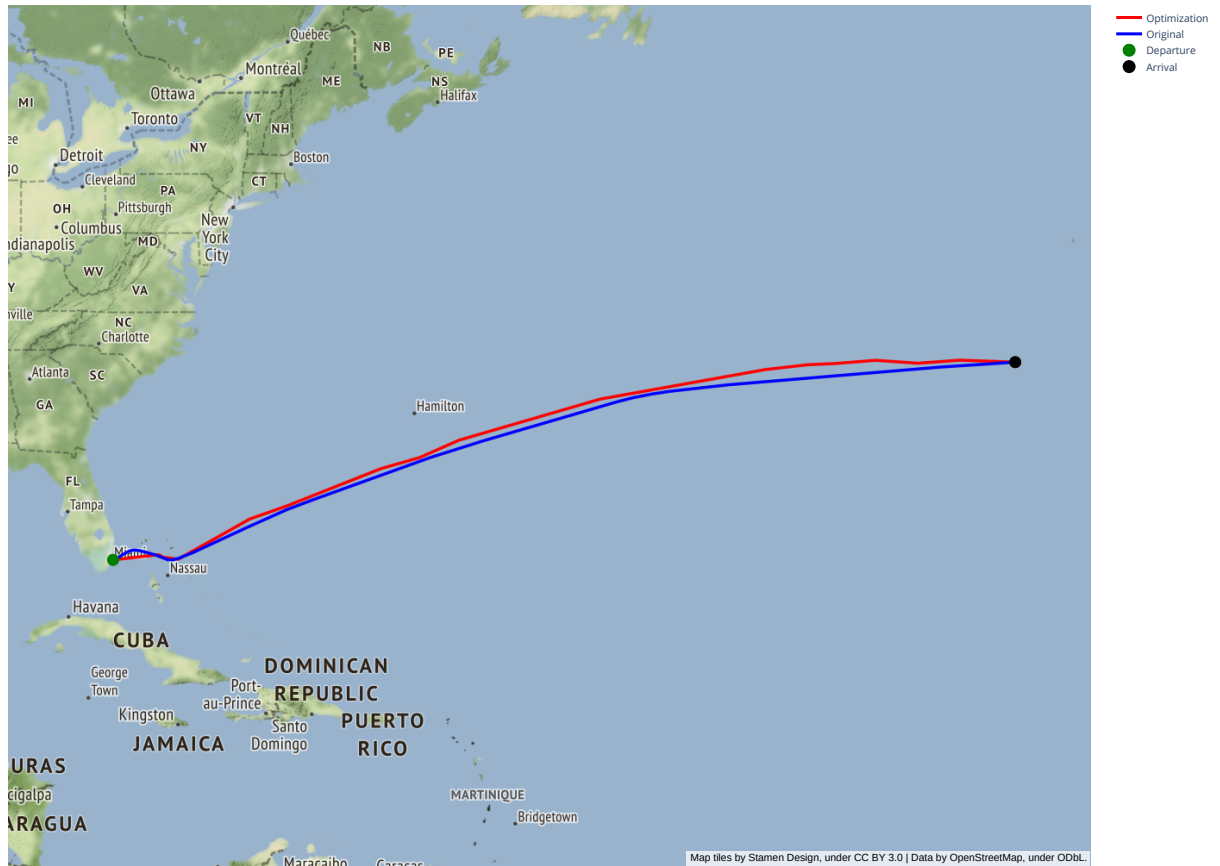


Figure 20: Initial / Optimized Route, MIAMI - SUEZ

Voyage	Date	Latitude	Longitude
Departure	2019-12-26 17:03:00	25.0° 45.0' N	81.0° 50.0' E
Arrival	2020-01-01 11:59:00	34.0° 28.0' S	35.0° 51.0' E
BASIC COMPARISON	Actual route estimation	Optimized route estimation	
Distance (nm)	2,469.89	2,449.31	
Time (hours)	138.93	137.85	
Avg Speed (kt)	17.78	17.50	
Total FOC (MT)	731.14	724.04	

Table 5: Estimation based on Weather Service data (NOA)

Weather comparison optimization / initial:

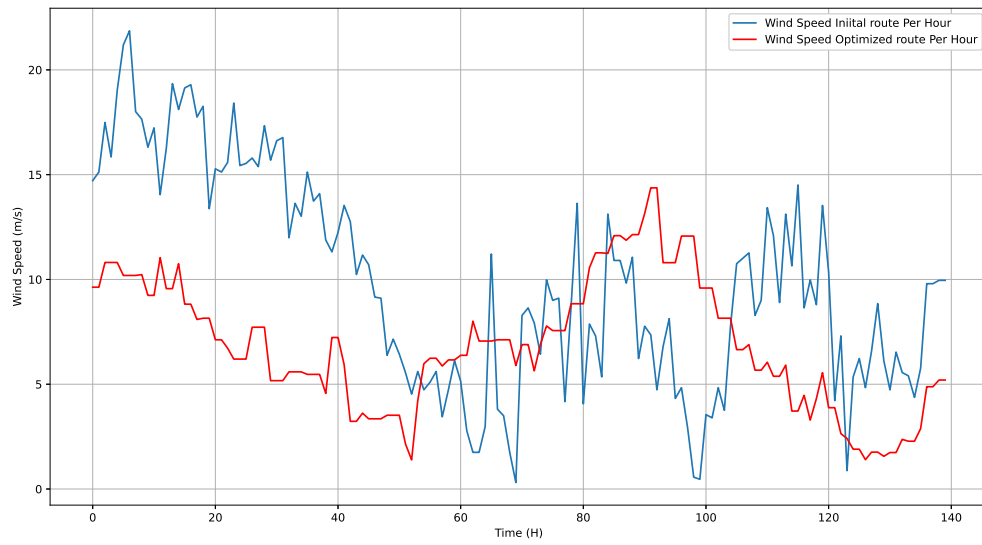


Figure 21: Wind Speed comparison Initial / Optimized Route, MIAMI - SUEZ