

```

In [1]: import pandas as pd
import matplotlib.pyplot as plt
import json
from datetime import datetime

# ---- PARAMETERS ---
FICHER_CSV = "all_data_enriched.csv"
SUMMARY_PATH = "summary.json"
MAX_POINTS = 1000

# ---- LOAD DATA ---
df = pd.read_csv(FICHER_CSV, low_memory=False)

# ---- LOAD SUMMARY
with open(SUMMARY_PATH, "r") as f:
    summary = json.load(f)

# === UTILITIES ===
def filter_intervals(df, start, end):
    return df[(df["SecondsSinceEpoch"] >= start) & (df["SecondsSinceEpoch"] <= end)].reset_index(drop=True)

def format_timestamp(ts):
    return datetime.utcfromtimestamp(ts).strftime('%Y-%m-%d %H:%M:%S.%f')[-3]

def normalize_angle(series):
    return ((series + 360) % 360) - 180

# ---- PLOTTING FUNCTION ---
def plot_senseboard_report(run_name, interval, data):
    if len(data) > MAX_POINTS:
        data = data.sample(n=MAX_POINTS).sort_values("ISODateTimeUTC")

    time = pd.to_datetime(data["ISODateTimeUTC"]).dt.tz_localize(None)
    sh_time = pd.to_datetime(data["Timestamp GPS"]).dt.tz_localize(None)

    wind_side = "Upwind" if interval["avg_Thk_bout2"] > 0 else "Downwind"
    opponent = interval["bout1_name"] if interval["bout1_name"] == "SenseBoard" else interval["bout2_name"]
    start_str = format_timestamp(interval["start_time"])
    end_str = format_timestamp(interval["end_time"])

    fig, axes = plt.subplots(2, 5, figsize=(24, 8))
    fig.suptitle(run_name, interval[1], (wind_side) + "From (" + start_str + " to " + end_str + ")")
    fig.text(0.05, 0.95, "SenseBoard (vs " + opponent + ")", fontsize=14)

    # Row 1
    axes[0, 0].plot(time, data["WS"])
    axes[0, 0].set_title("True Wind Speed (WS)")
    axes[0, 1].plot(time, data["WD"])
    axes[0, 1].set_title("True Wind Direction (WD)")
    axes[0, 2].plot(data["lat"], data["lat"], label="SenseBoard", color="orange", linestyle="--")
    axes[0, 2].plot(data["longitude"], data["latitude"], label="Vakaros", color="blue")
    axes[0, 2].legend()
    axes[0, 3].plot(time, data["deg"])
    axes[0, 3].set_title("True Angle (deg)")
    axes[0, 4].plot(time, data["SOG"])
    axes[0, 4].set_title("Speed Over Ground (SOG)")

    # Row 2
    axes[1, 0].plot(time, data["Heel"], label="Vakaros", color="blue")
    axes[1, 0].plot(sh_time, normalize_angle(data["uler_X_(deg)"]), label="SenseBoard", color="orange", linestyle="--")
    axes[1, 0].plot(sh_time, data["uler_X_(deg)"], label="SenseBoard", color="orange", linestyle="--")
    axes[1, 0].set_title("Heel Angle")
    axes[1, 1].plot(time, data["Trim"], label="Vakaros", color="blue")
    axes[1, 1].plot(sh_time, data["uler_Y_(deg)"], label="SenseBoard", color="orange", linestyle="--")
    axes[1, 1].set_title("Pitch Angle")
    axes[1, 1].set_label("Pitch Angle")
    axes[1, 2].plot(time, data["Front"])
    axes[1, 2].set_title("Front Force")
    axes[1, 3].plot(time, data["Back"])
    axes[1, 3].set_title("Back Force")
    axes[1, 4].axis("off")

    # Set x-labels and rotation only for relevant plots
    for i in [0, 0, (0, 1), (0, 3), (0, 4), (1, 0), (1, 1), (1, 2), (1, 3)]:
        axes[i].xaxis.set_label("Time", rotation=90)
        axes[i].xaxis.set_params(label="Time", rotation=90)

    # Set proper labels for GPS
    axes[0, 2].set_xlabel("Longitude")
    axes[0, 2].set_ylabel("Latitude")
    plt.tight_layout(rect=[0, 0.03, 1, 0.95])
    plt.show()

# ---- MAIN LOOP ---
for entry in summary:
    run = entry["run"]
    intervals = entry.get("intervals", [])
    if len(intervals) < 1:
        continue

    interval = intervals[0]
    if "SenseBoard" not in [interval["bout1_name"], interval["bout2_name"]]:
        continue

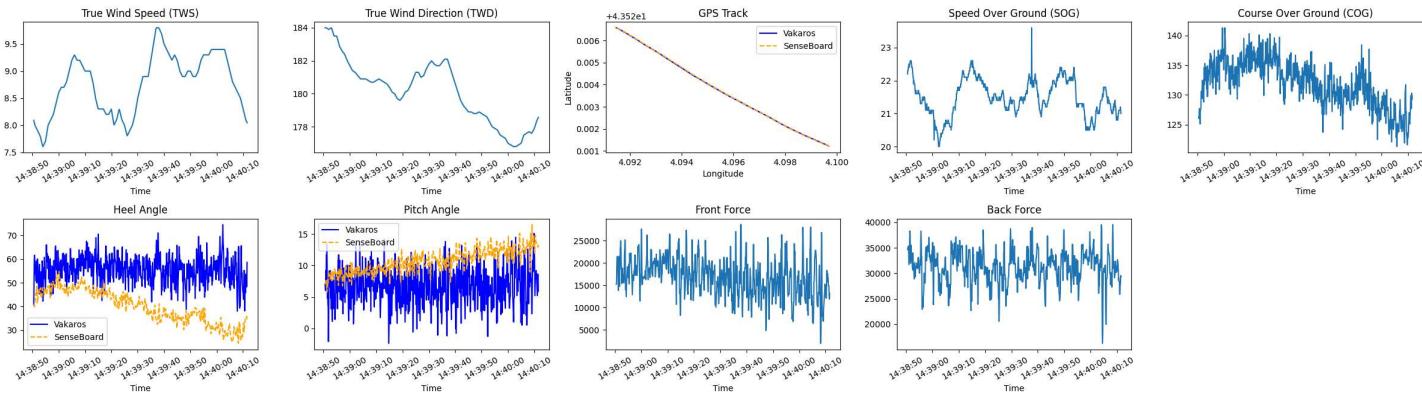
    run_df = df[df["run"] == run]
    sb_df = run_df[run_df["boat_name"] == "SenseBoard"]
    if sb_df.empty:
        print("(*SKIPPED*) No SenseBoard data for run (" + run + ")")
        continue

    filtered_data = filter_intervals(sb_df, interval["start_time"], interval["end_time"])
    if filtered_data.empty:
        print("(*SKIPPED*) Empty interval data for run (" + run + ")")
        continue

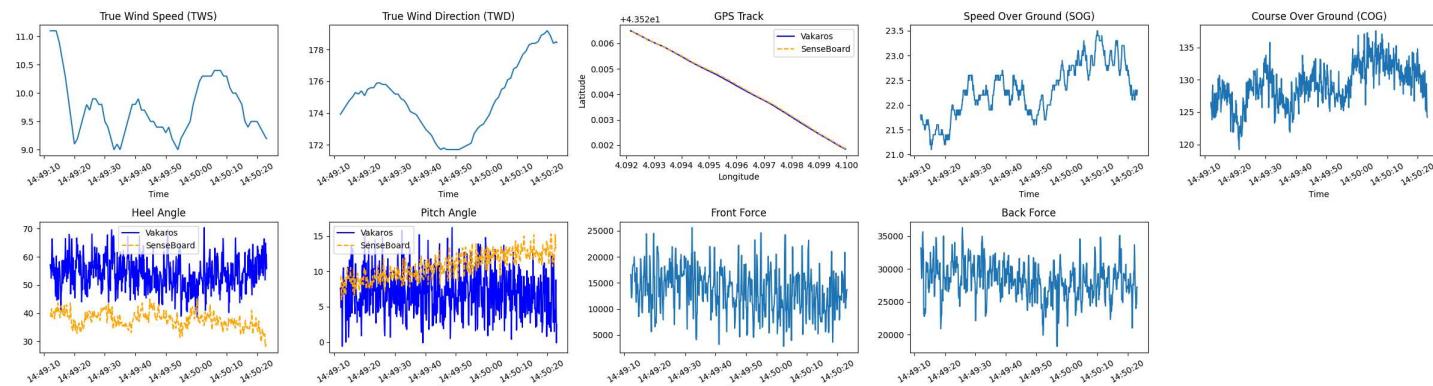
    plot_senseboard_report(run, interval, filtered_data)

```

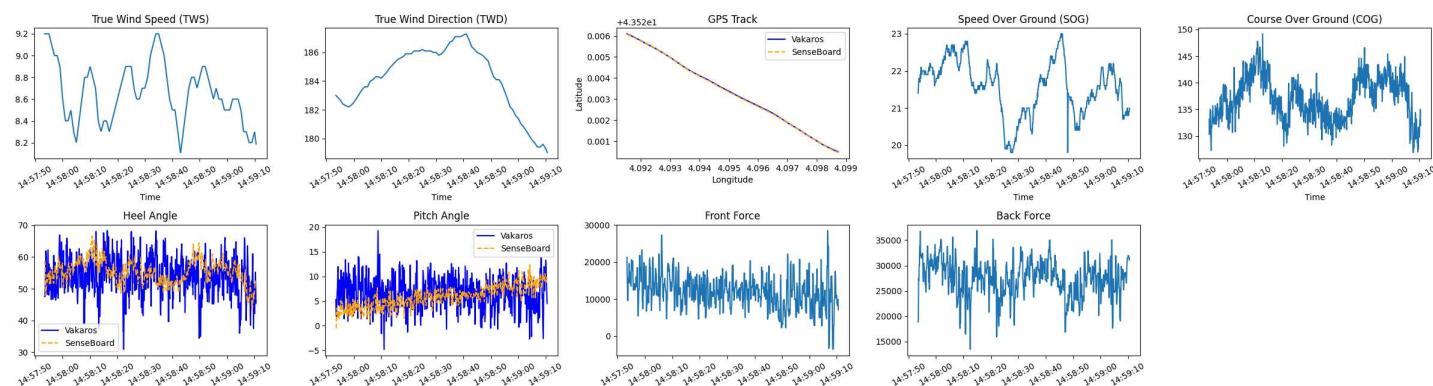
Run 06\_06\_Run5, Interval 1: Upwind from 2025-06-06 14:38:50.460 to 2025-06-06 14:40:11.654  
SenseBoard (vs Karl Maeder)



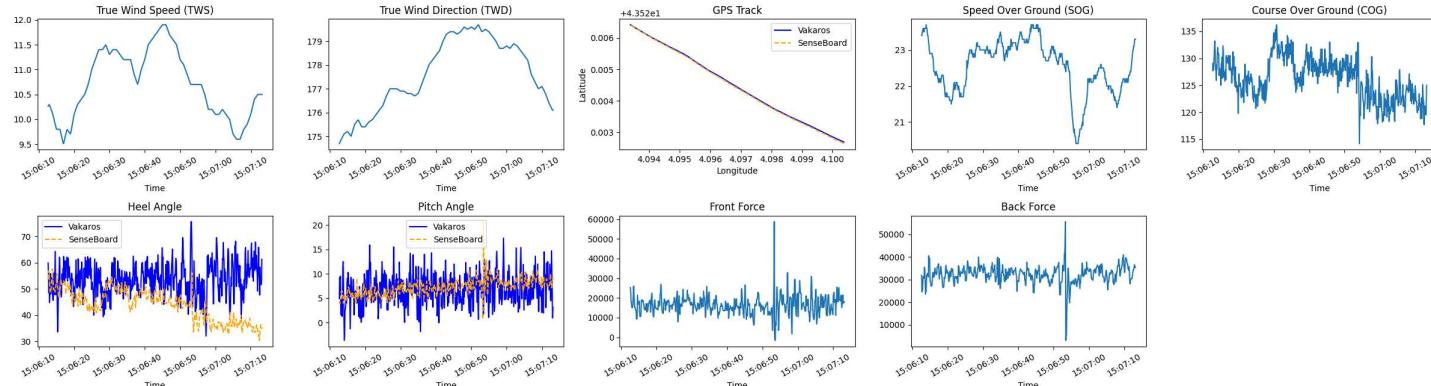
Run 06\_06\_Run6, Interval 1: Upwind from 2025-06-06 14:49:11.961 to 2025-06-06 14:50:23.255  
SenseBoard (vs Karl Maeder)



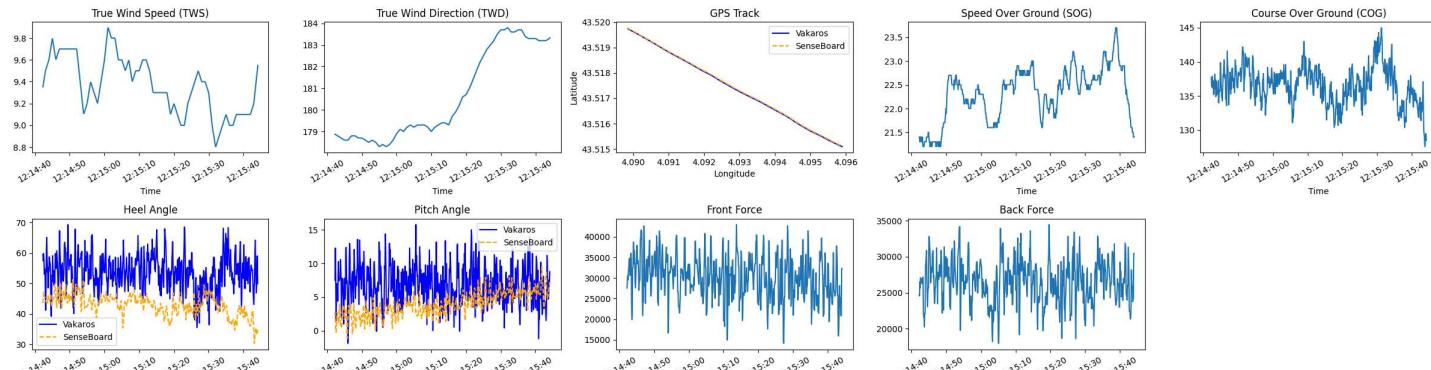
Run 06\_06\_Run7, Interval 1: Upwind from 2025-06-06 14:57:53.364 to 2025-06-06 14:59:10.560  
SenseBoard (vs Karl Maeder)



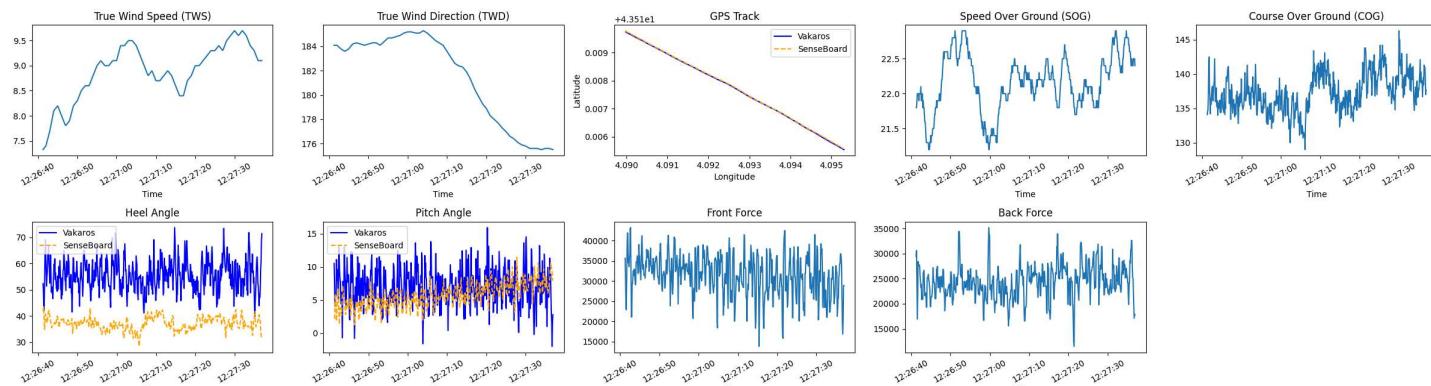
Run 06\_06\_Run8, Interval 1: Upwind from 2025-06-06 15:06:12.562 to 2025-06-06 15:07:13.253  
SenseBoard (vs Karl Maeder)



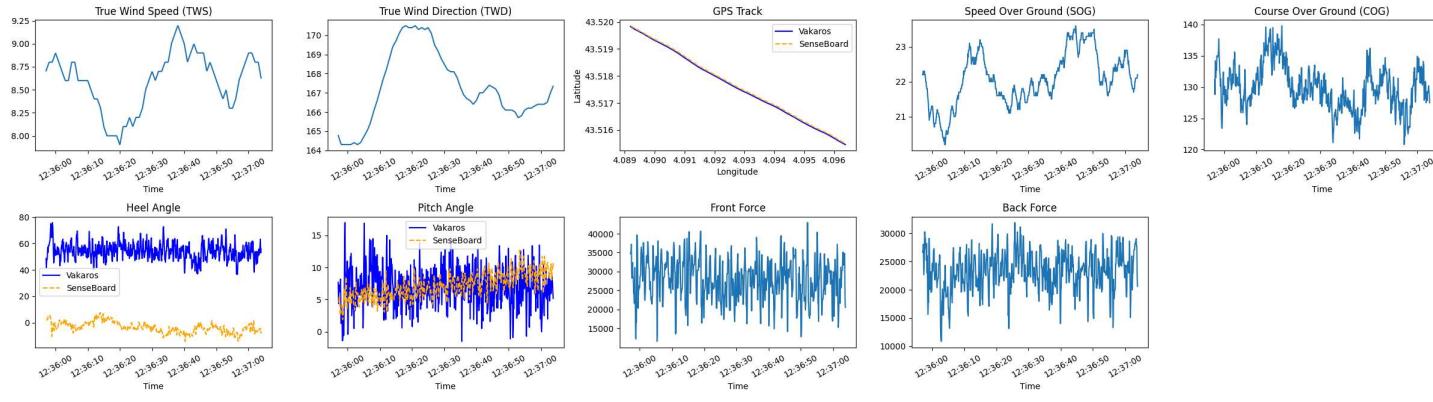
Run 07\_06\_Run3, Interval 1: Upwind from 2025-06-07 12:14:42.161 to 2025-06-07 12:15:44.164  
SenseBoard (vs Gian Stragiotti)



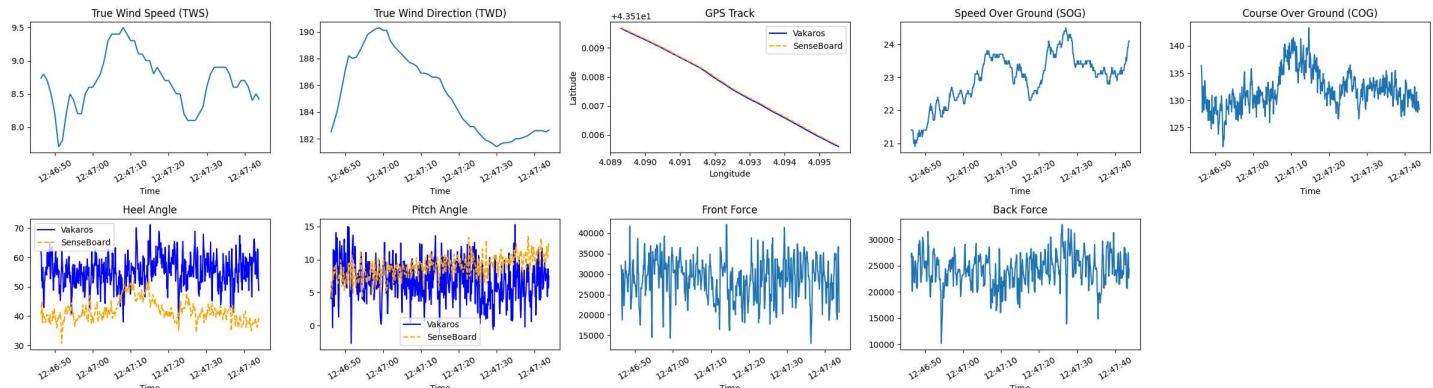
Run 07\_06\_Run4, Interval 1: Upwind from 2025-06-07 12:26:41.160 to 2025-06-07 12:27:36.957  
SenseBoard (vs Gian Stragiotti)



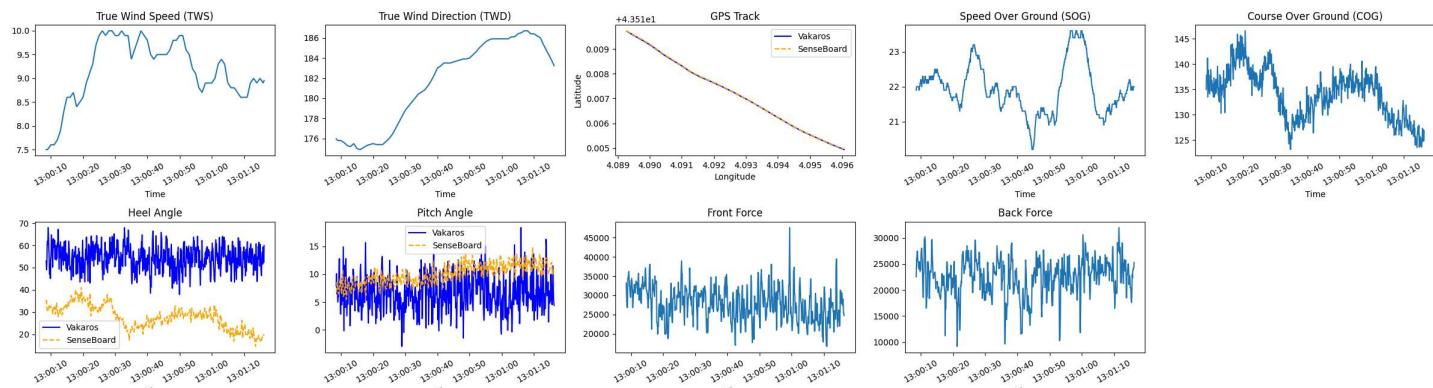
Run 07\_06\_Run5, Interval 1: Upwind from 2025-06-07 12:35:57.058 to 2025-06-07 12:37:03.864  
SenseBoard (vs Gian Stragiotti)



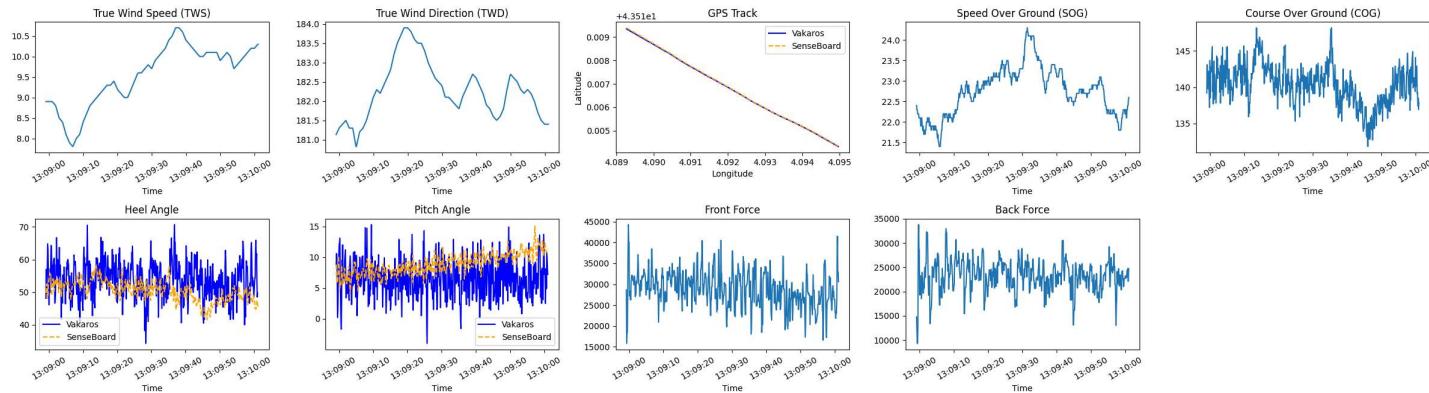
Run 07\_06\_Run6, Interval 1: Upwind from 2025-06-07 12:46:46.267 to 2025-06-07 12:47:43.756  
SenseBoard (vs Gian Stragiotti)



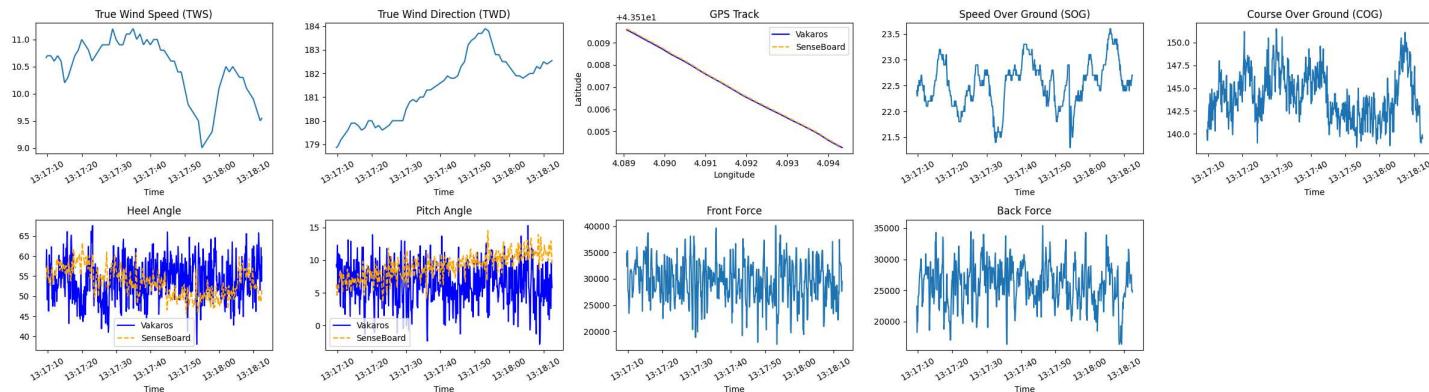
Run 07\_06\_Run7, Interval 1: Upwind from 2025-06-07 13:00:08.552 to 2025-06-07 13:01:16.356  
SenseBoard (vs Karl Maeder)



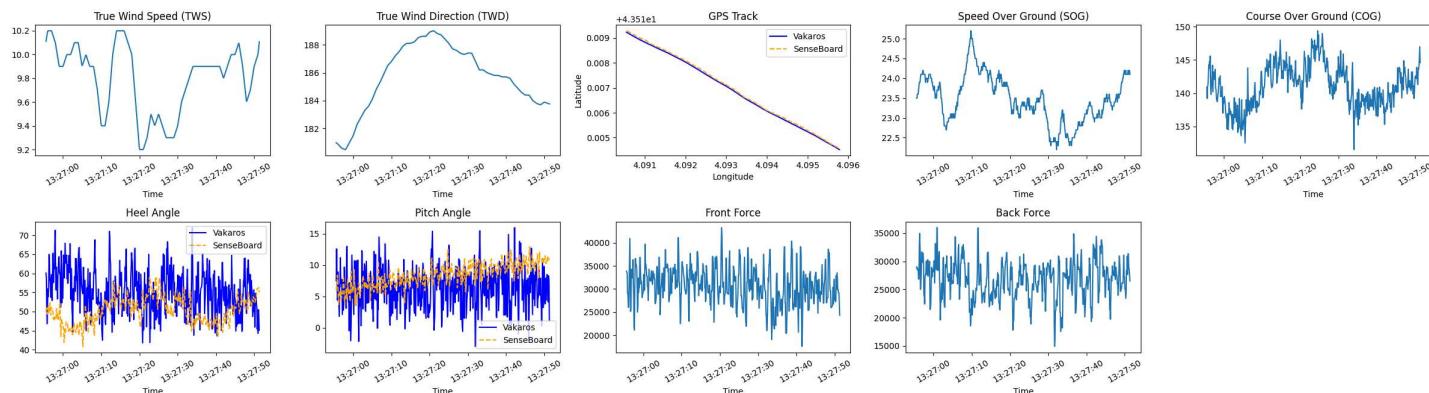
Run 07\_06\_Run8, Interval 1: Upwind from 2025-06-07 13:08:59.076 to 2025-06-07 13:10:01.155  
SenseBoard (vs Karl Maeder)



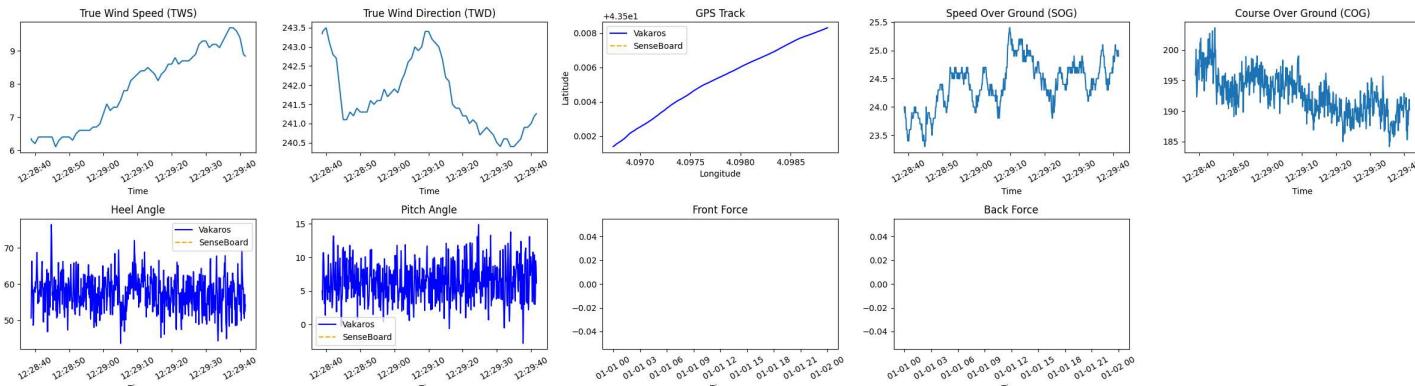
Run 07\_06\_Run9, Interval 1: Upwind from 2025-06-07 13:17:09.658 to 2025-06-07 13:18:12.460  
SenseBoard (vs Karl Maeder)



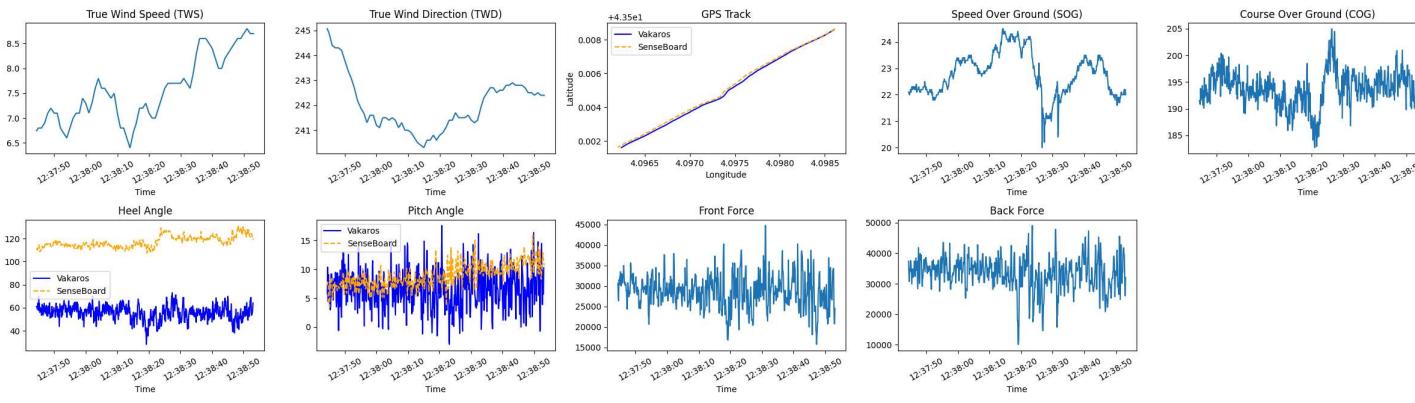
Run 07\_06\_Run10, Interval 1: Upwind from 2025-06-07 13:26:55.460 to 2025-06-07 13:27:51.359  
SenseBoard (vs Karl Maeder)



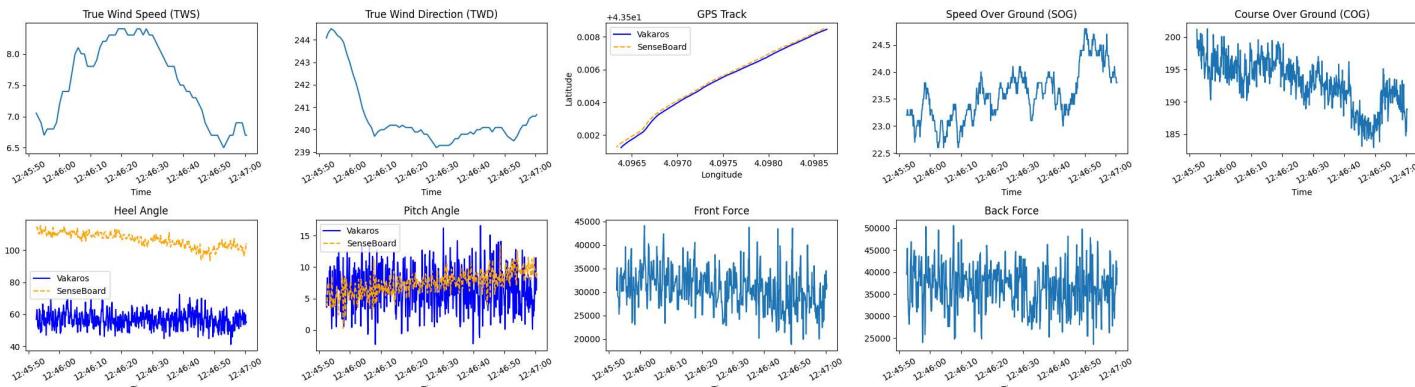
Run 09\_06\_Run4, Interval 1: Upwind from 2025-06-09 12:28:38.849 to 2025-06-09 12:29:41.650  
SenseBoard (vs Karl Maeder)



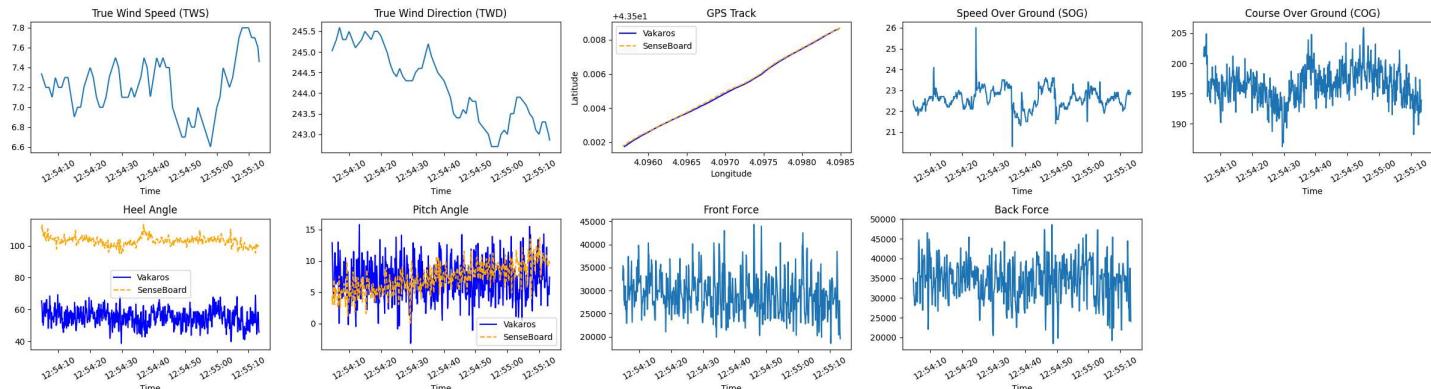
Run 09\_06\_Run5, Interval 1: Upwind from 2025-06-09 12:37:44.452 to 2025-06-09 12:38:53.165  
SenseBoard (vs Karl Maeder)



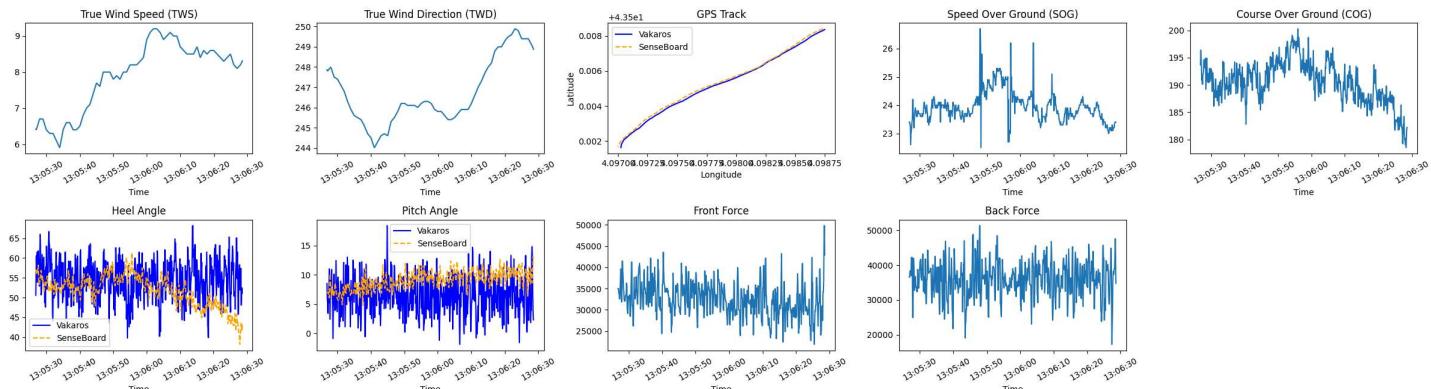
Run 09\_06\_Run6, Interval 1: Upwind from 2025-06-09 12:45:52.452 to 2025-06-09 12:47:00.452  
SenseBoard (vs Karl Maeder)



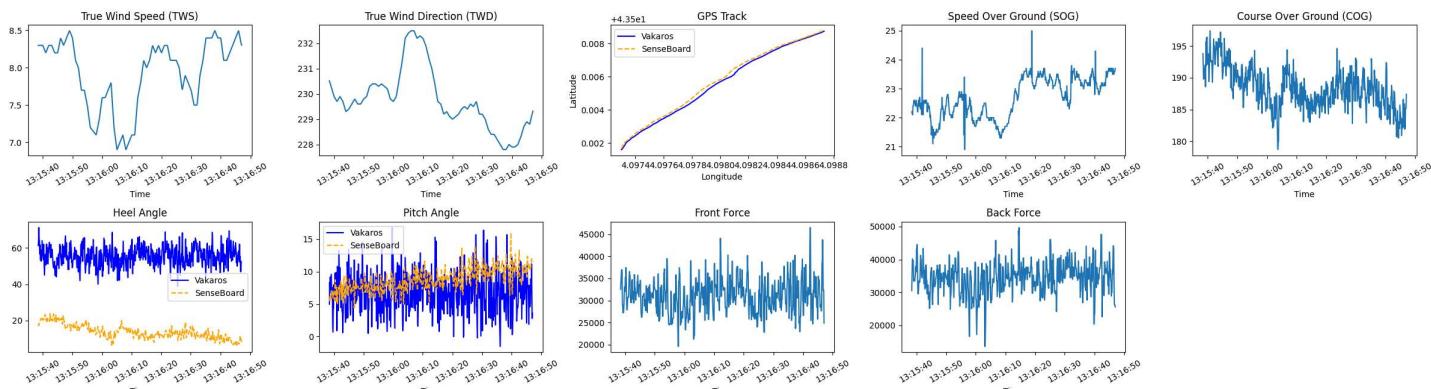
Run 09\_06\_Run7, Interval 1: Upwind from 2025-06-09 12:54:04.561 to 2025-06-09 12:55:13.441  
SenseBoard (vs Karl Maeder)



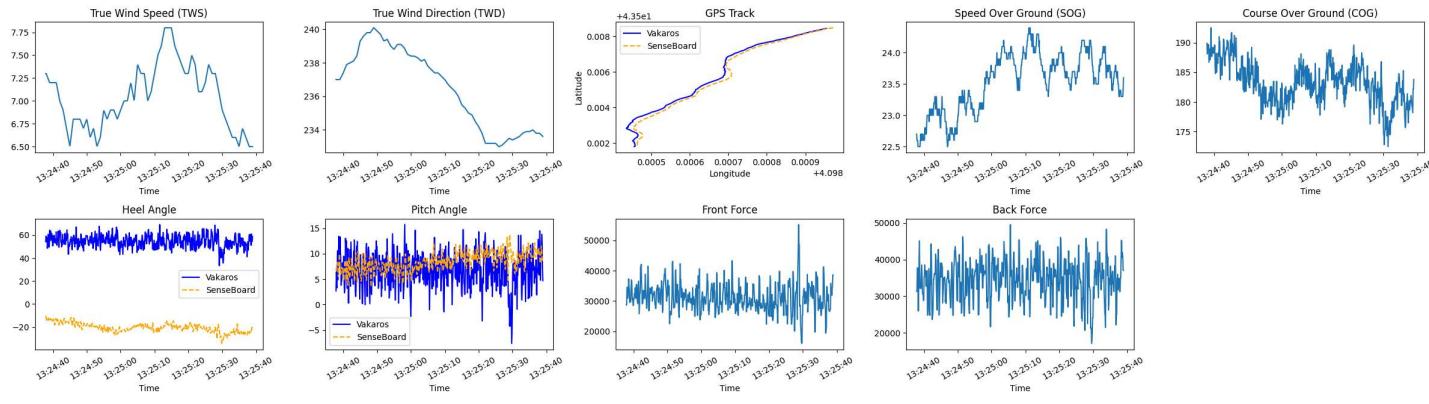
Run 09\_06\_Run8, Interval 1: Upwind from 2025-06-09 13:05:26.852 to 2025-06-09 13:06:28.641  
SenseBoard (vs Karl Maeder)



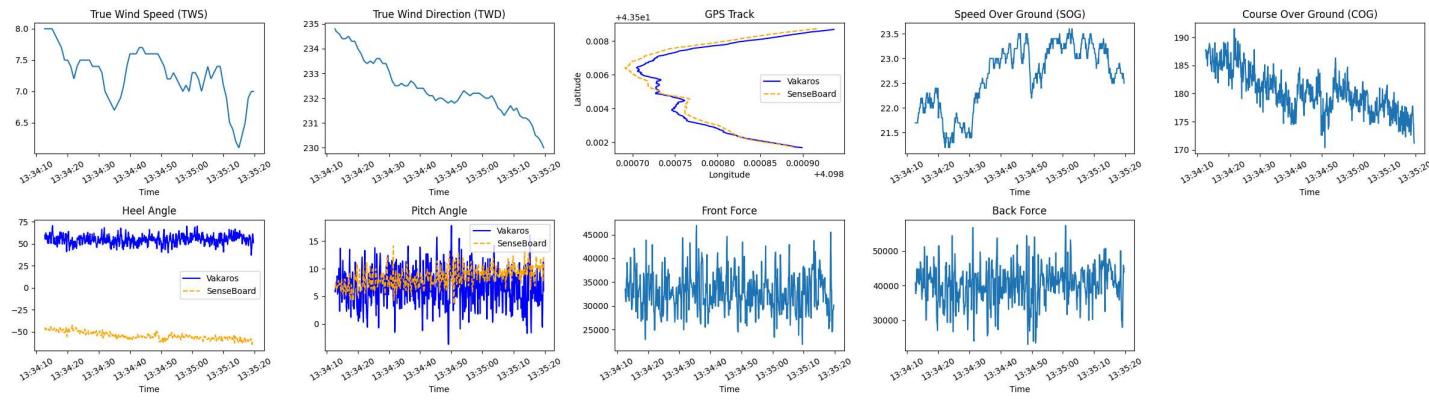
Run 09\_06\_Run9, Interval 1: Upwind from 2025-06-09 13:15:38.364 to 2025-06-09 13:16:47.056  
SenseBoard (vs Karl Maeder)



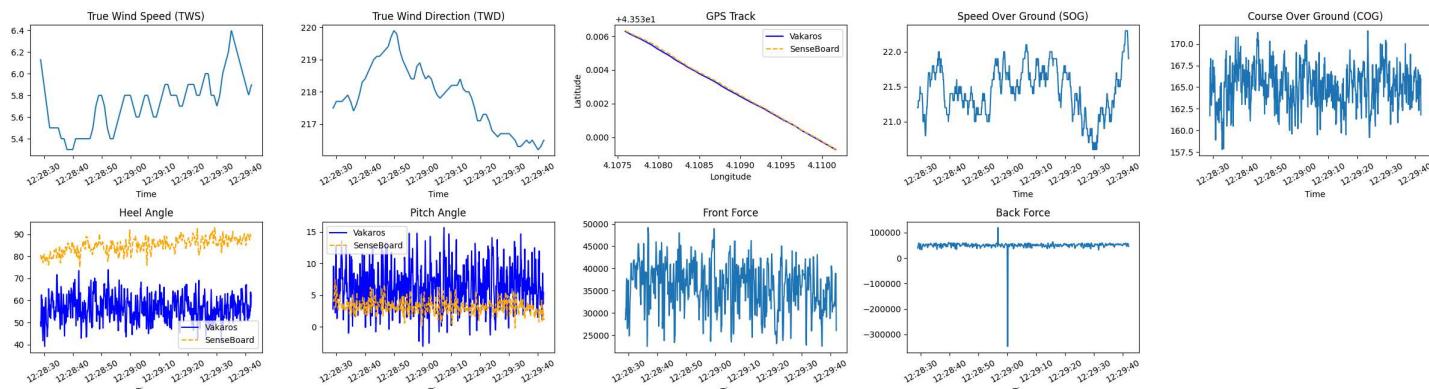
Run 09\_06\_Run10, Interval 1: Upwind from 2025-06-09 13:24:37.855 to 2025-06-09 13:25:39.060  
SenseBoard (vs Karl Maeder)



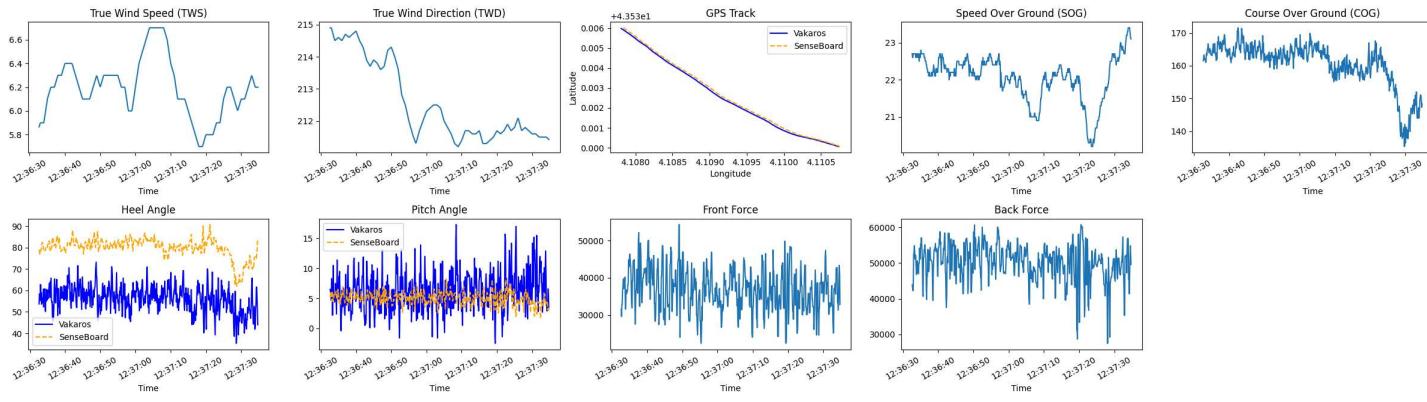
Run 09\_06\_Run11, Interval 1: Upwind from 2025-06-09 13:34:12.564 to 2025-06-09 13:35:19.654  
SenseBoard (vs Karl Maeder)



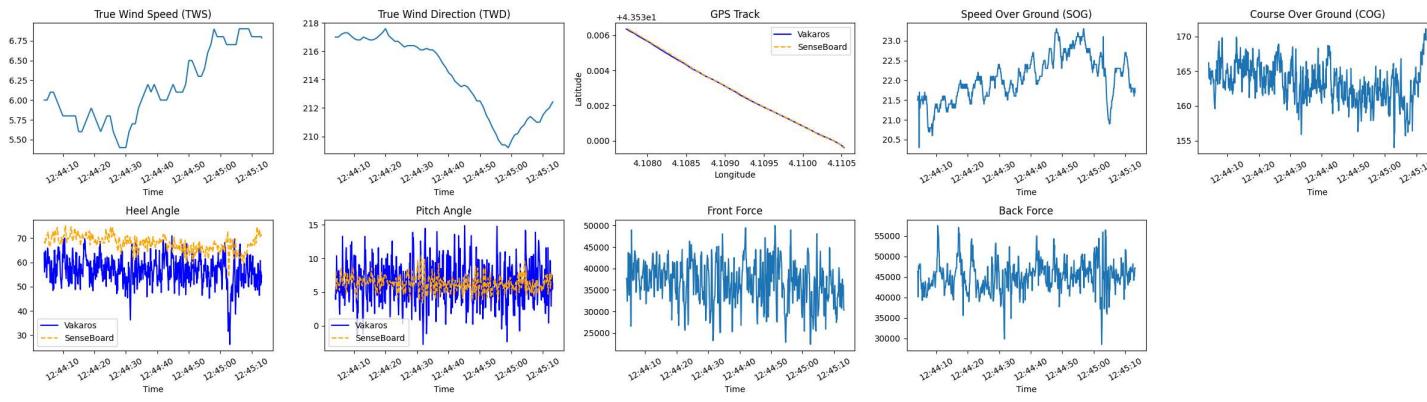
Run 10\_06\_Run1, Interval 1: Upwind from 2025-06-10 12:28:28.753 to 2025-06-10 12:29:42.059  
SenseBoard (vs Gian Stragiotti)



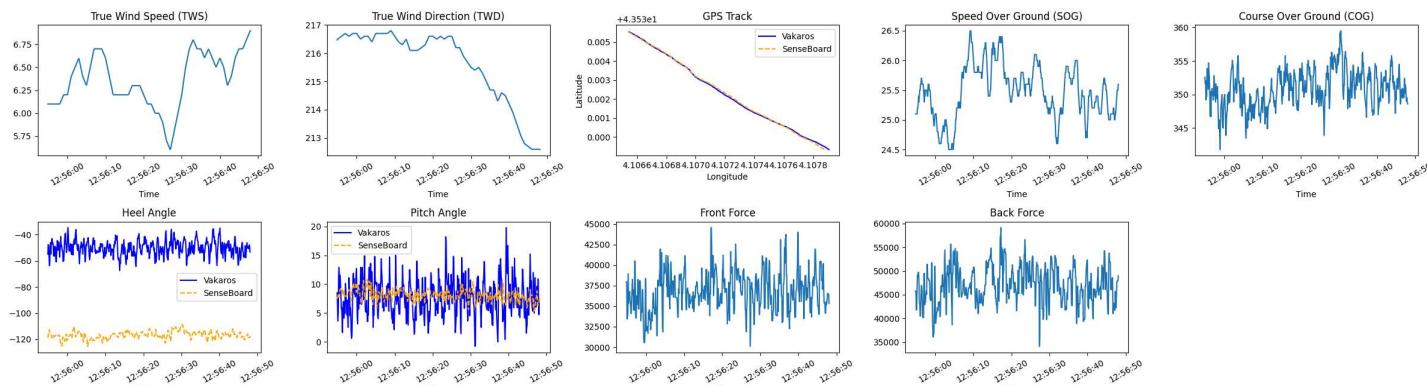
Run 10\_06\_Run2, Interval 1: Upwind from 2025-06-10 12:36:32.654 to 2025-06-10 12:37:34.755  
SenseBoard (vs Gian Stragiotti)



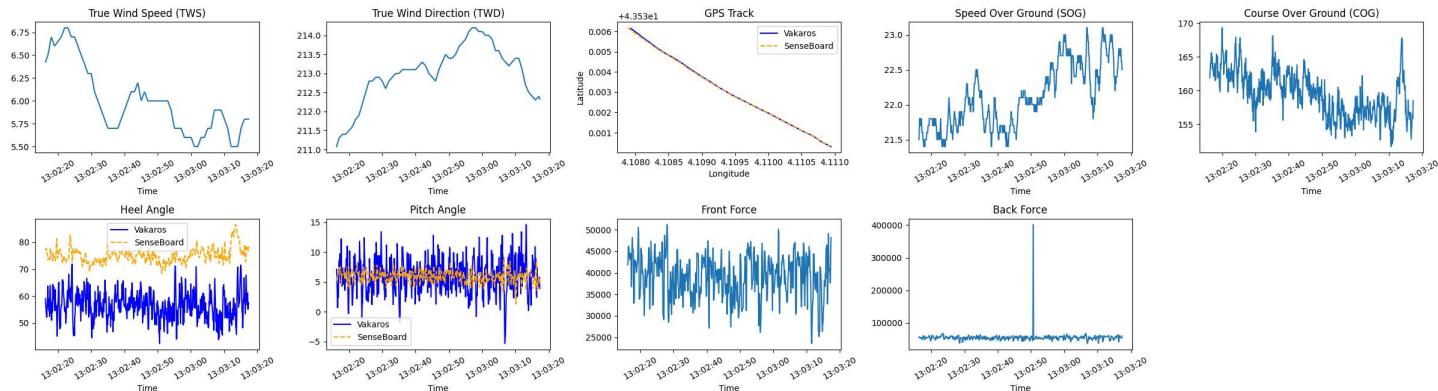
Run 10\_06\_Run3, Interval 1: Upwind from 2025-06-10 12:44:03.953 to 2025-06-10 12:45:13.154  
SenseBoard (vs Gian Stragiotti)



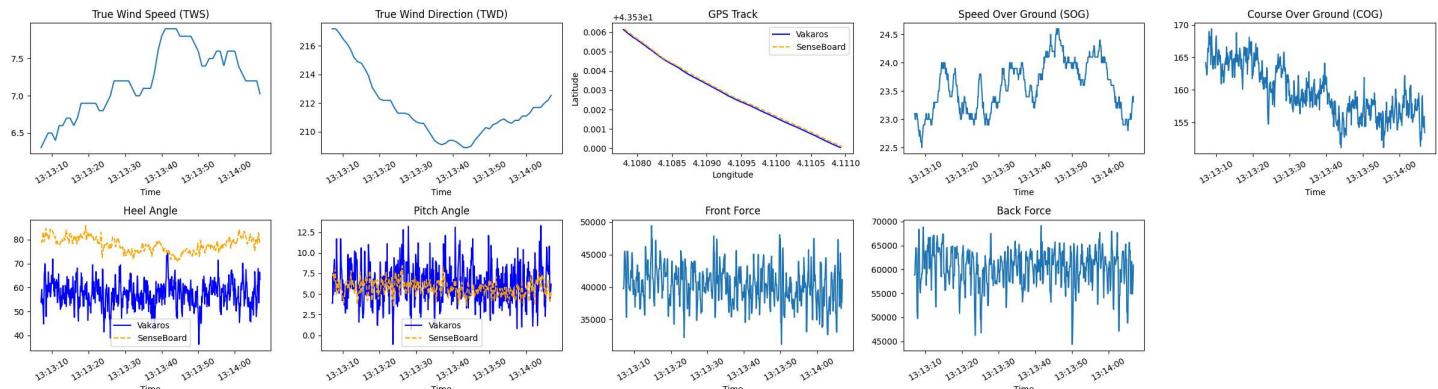
Run 10\_06\_Run4, Interval 1: Downwind from 2025-06-10 12:55:54.753 to 2025-06-10 12:56:48.072  
SenseBoard (vs Gian Stragiotti)



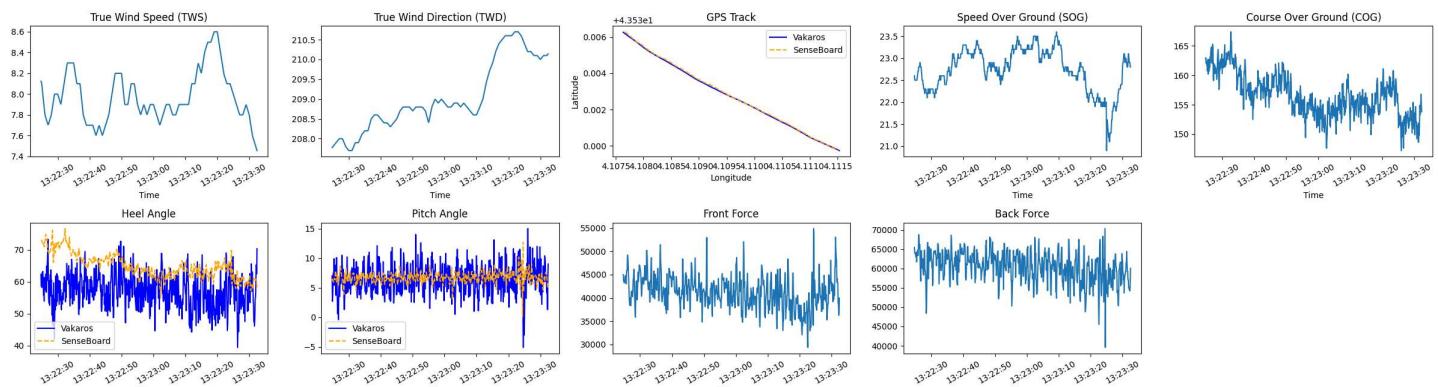
Run 10\_06\_Run5, Interval 1: Upwind from 2025-06-10 13:02:16.155 to 2025-06-10 13:03:17.354  
SenseBoard (vs Gian Stragiotti)



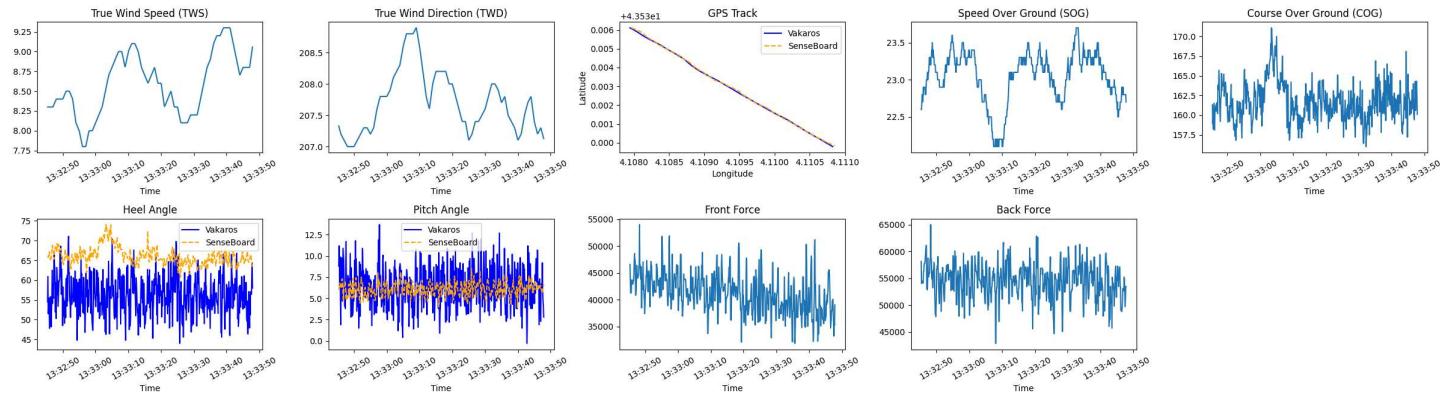
Run 10\_06\_Run6, Interval 1: Upwind from 2025-06-10 13:13:07.052 to 2025-06-10 13:14:06.953  
SenseBoard (vs Karl Maeder)



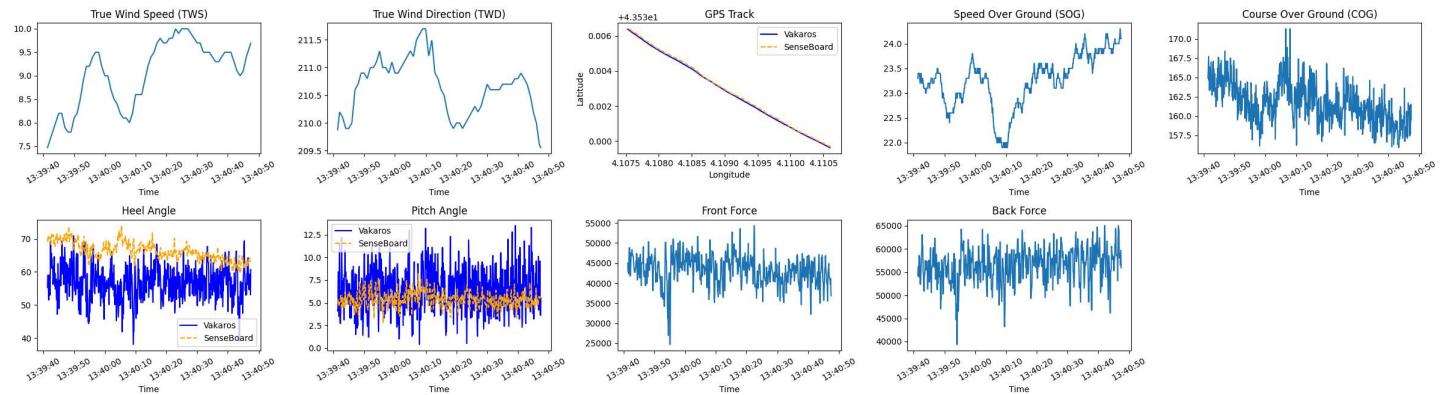
Run 10\_06\_Run7, Interval 1: Upwind from 2025-06-10 13:22:24.755 to 2025-06-10 13:23:32.555  
SenseBoard (vs Karl Maeder)



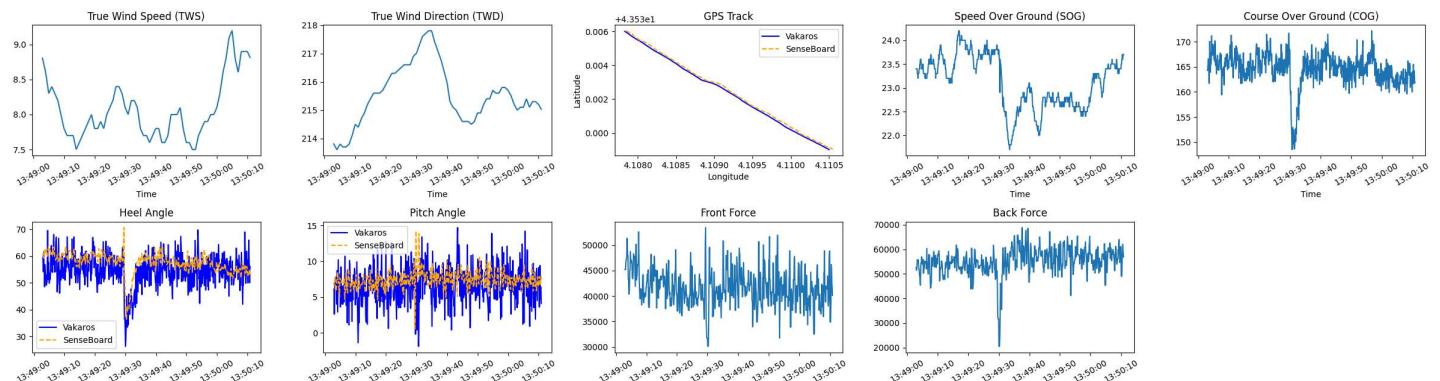
Run 10\_06\_Run8, Interval 1: Upwind from 2025-06-10 13:32:45.356 to 2025-06-10 13:33:47.954  
SenseBoard (vs Karl Maeder)



Run 10\_06\_Run9, Interval 1: Upwind from 2025-06-10 13:39:41.260 to 2025-06-10 13:40:47.457  
SenseBoard (vs Karl Maeder)

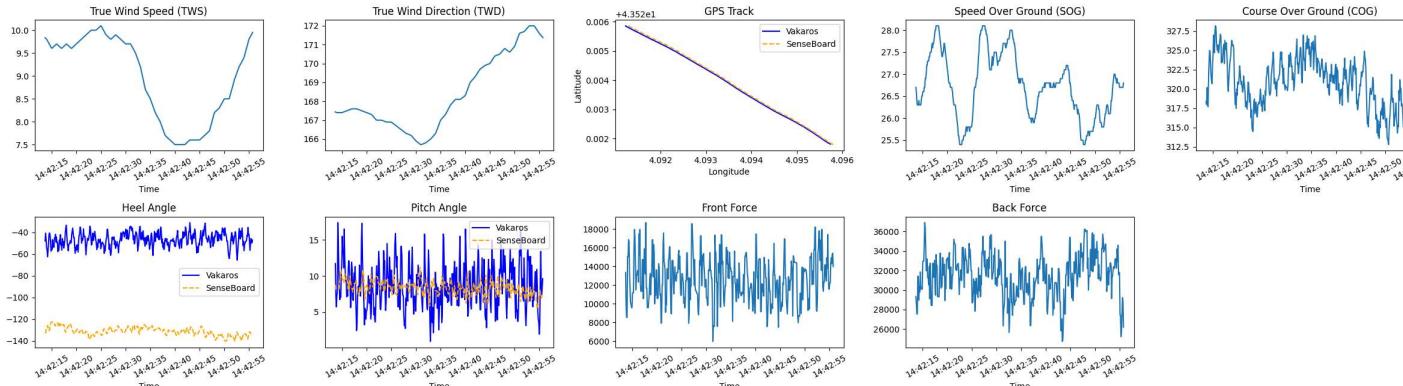


Run 10\_06\_Run10, Interval 1: Upwind from 2025-06-10 13:49:02.953 to 2025-06-10 13:50:10.858  
SenseBoard (vs Karl Maeder)

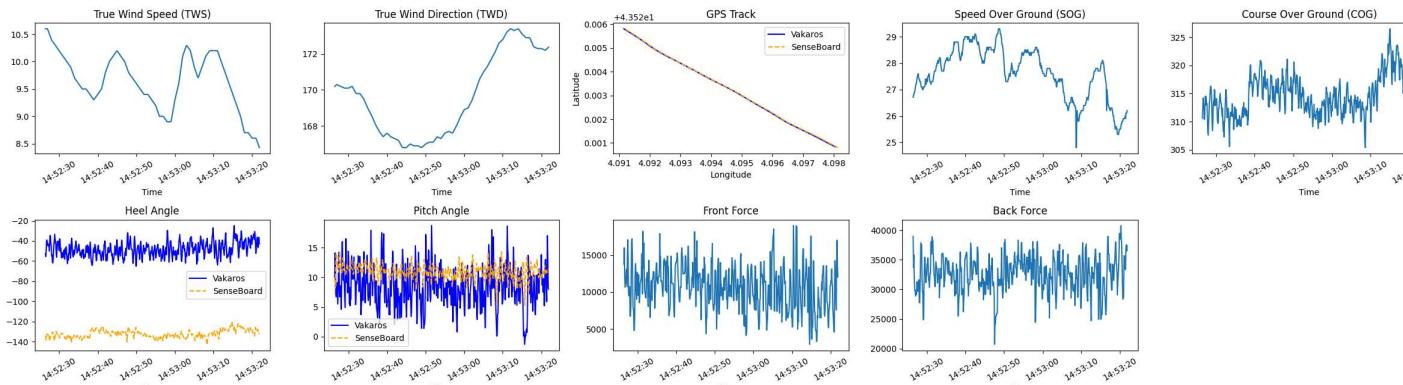


```
In [2]: # ---- DOWNLOAD LOGS ---
for entry in summary:
    run = entry["run"]
    intervals = entry.get("Intervals", [])
    if len(intervals) < 2:
        continue # Skip if no download interval
    interval = intervals[1] # Always use second interval (Downwind)
    if interval["boat_name"] != "SenseBoard":
        continue
    run_df = df[df["run"] == run]
    sb_df = run_df[run_df["boat_name"] == "SenseBoard"]
    if sb_df.empty:
        print(f"[SKIPPED] No Senseboard data for run {run}")
        continue
    filtered_data = filter_interval(sb_df, interval["start_time"], interval["end_time"])
    if filtered_data.empty:
        print(f"[SKIPPED] Empty interval data for run {run}")
        continue
    plot_senseboard_report(run, interval, filtered_data)
```

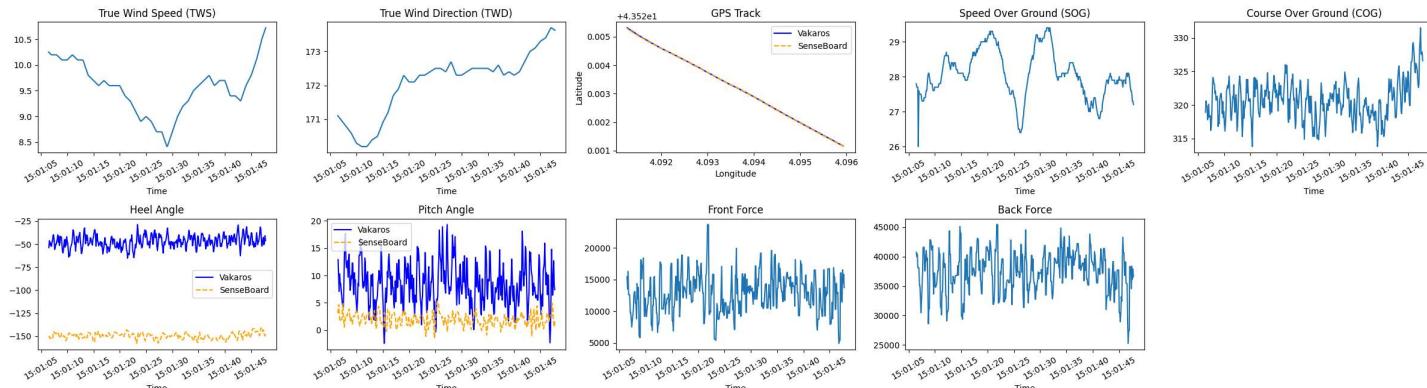
Run 06\_06\_Run5, Interval 1: Downwind from 2025-06-06 14:42:13.563 to 2025-06-06 14:42:55.854  
SenseBoard (vs Karl Maeder)



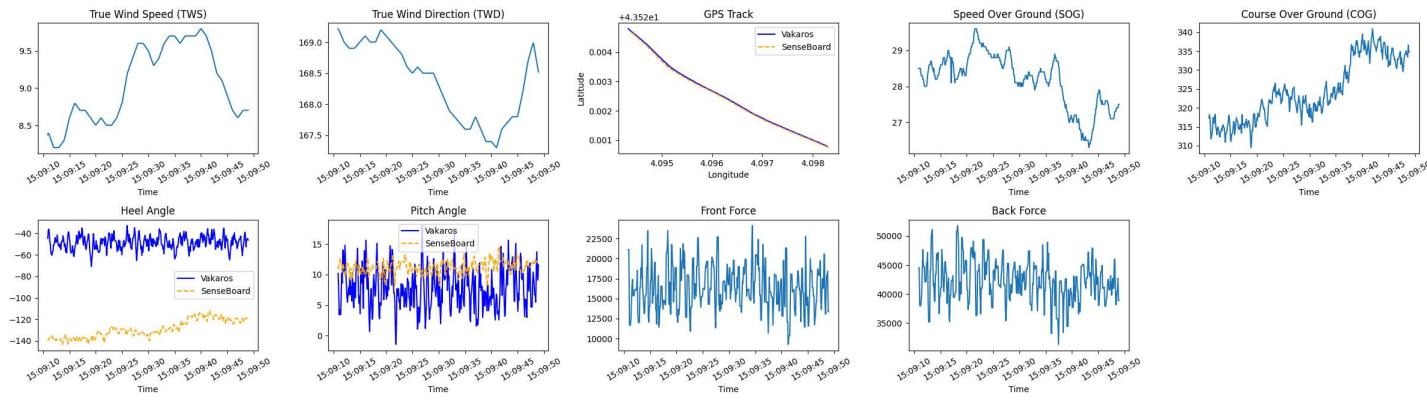
Run 06\_06\_Run6, Interval 1: Downwind from 2025-06-06 14:52:26.368 to 2025-06-06 14:53:21.952  
SenseBoard (vs Karl Maeder)



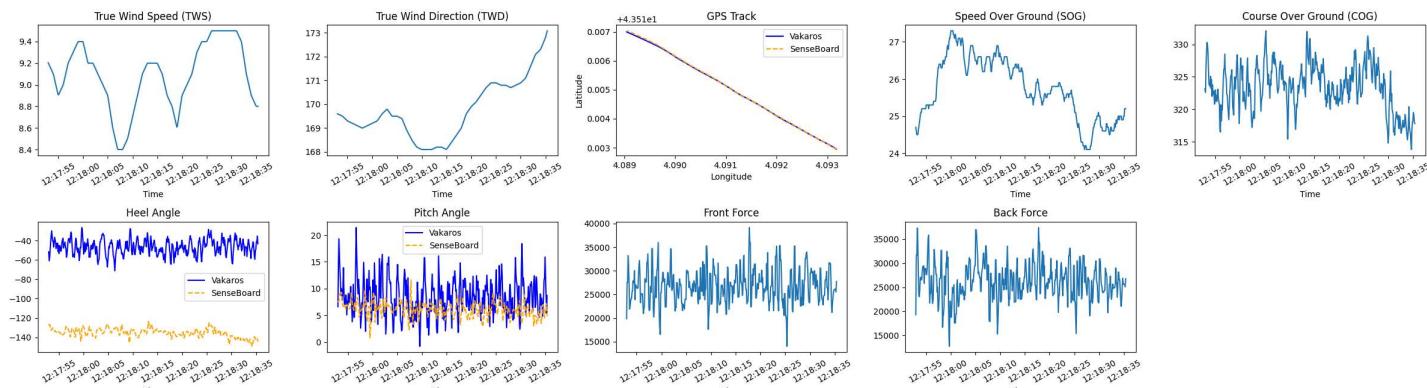
Run 06\_06\_Run7, Interval 1: Downwind from 2025-06-06 15:01:06.453 to 2025-06-06 15:01:47.762  
SenseBoard (vs Karl Maeder)



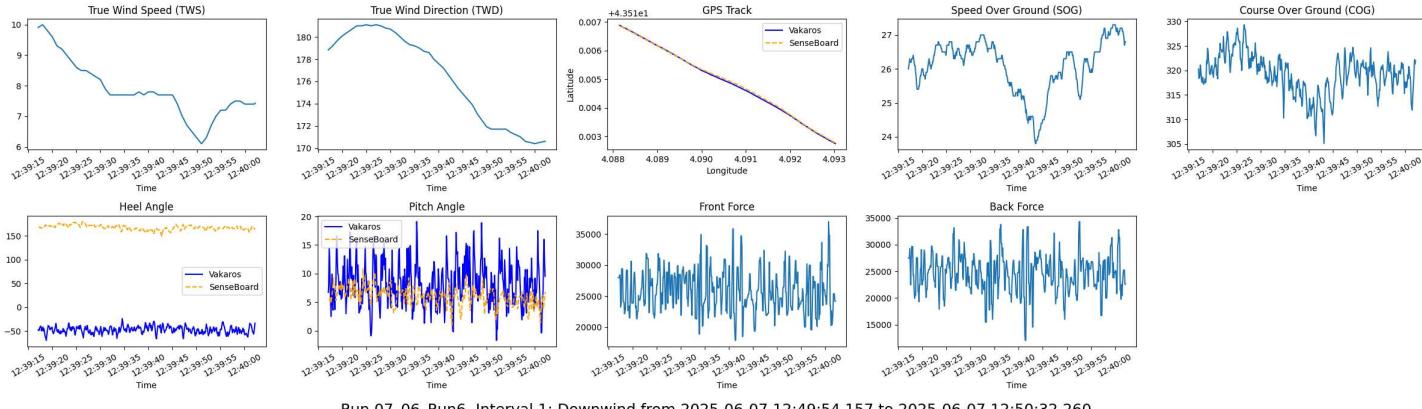
Run 06\_06\_Run8, Interval 1: Downwind from 2025-06-06 15:09:10.760 to 2025-06-06 15:09:49.053  
SenseBoard (vs Karl Maeder)



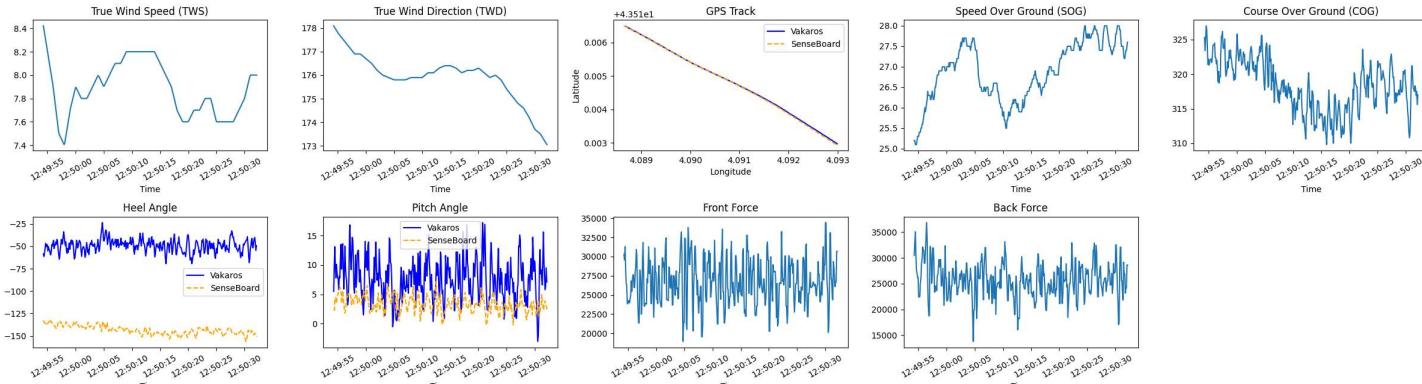
Run 07\_06\_Run3, Interval 1: Downwind from 2025-06-07 12:17:52.858 to 2025-06-07 12:18:35.364  
SenseBoard (vs Gian Stragiotti)



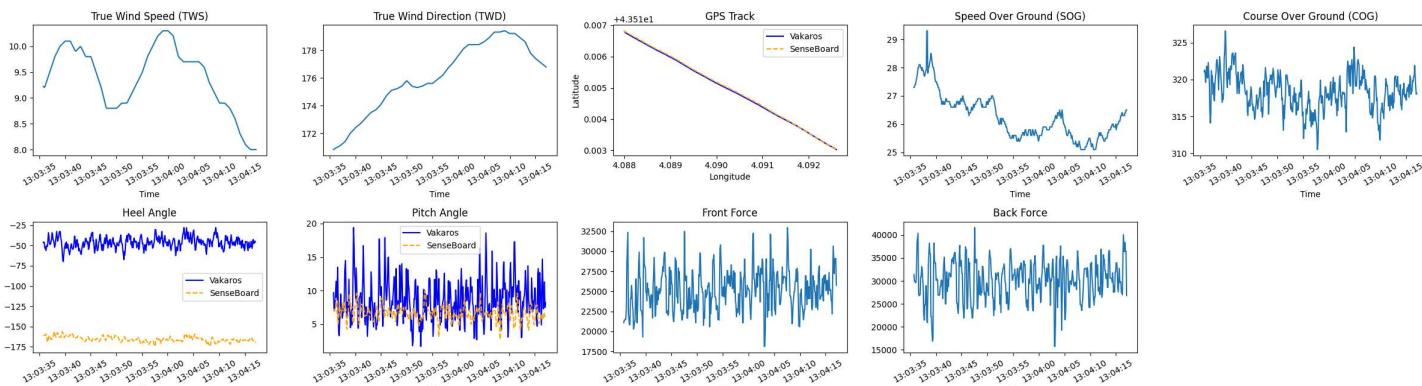
Run 07\_06\_Run5, Interval 1: Downwind from 2025-06-07 12:39:17.076 to 2025-06-07 12:40:02.263  
SenseBoard (vs Gian Stragiotti)



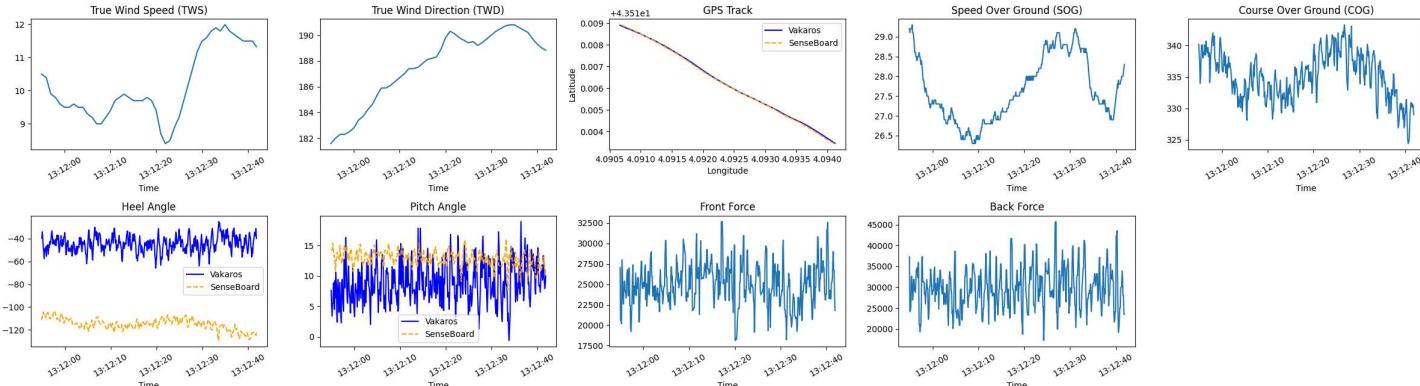
Run 07\_06\_Run6, Interval 1: Downwind from 2025-06-07 12:49:54.157 to 2025-06-07 12:50:32.260  
SenseBoard (vs Gian Stragiotti)



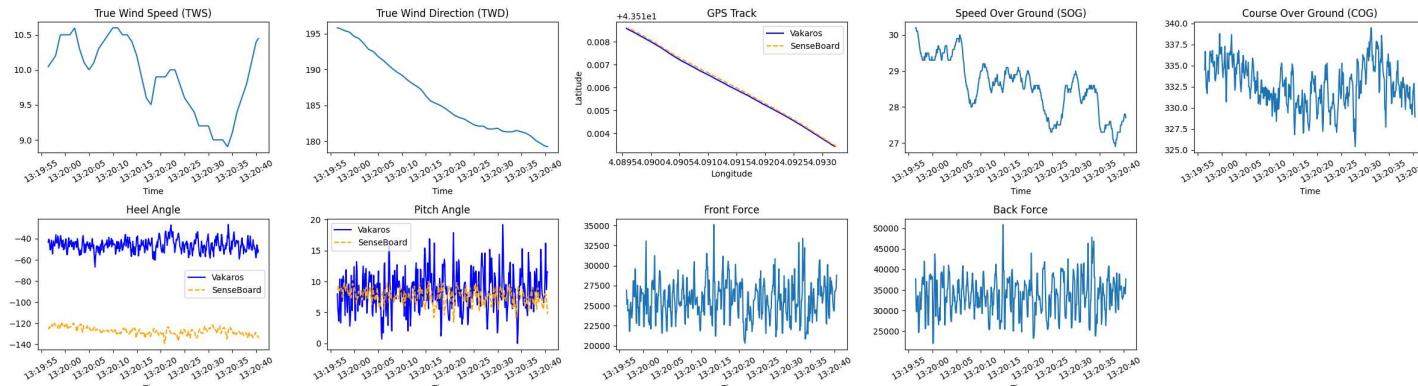
Run 07\_06\_Run7, Interval 1: Downwind from 2025-06-07 13:03:35.658 to 2025-06-07 13:04:17.157  
SenseBoard (vs Karl Maeder)



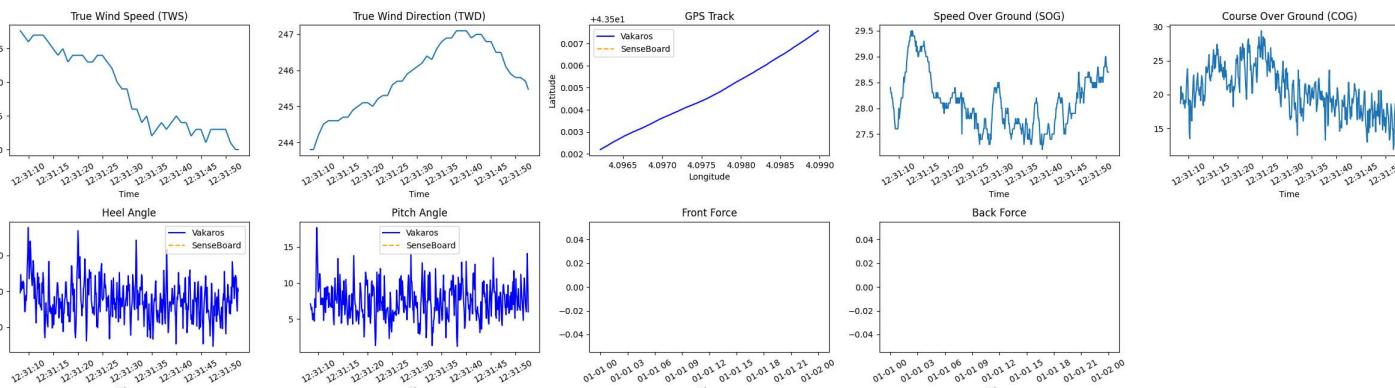
Run 07\_06\_Run8, Interval 1: Downwind from 2025-06-07 13:11:54.859 to 2025-06-07 13:12:41.953  
SenseBoard (vs Karl Maeder)



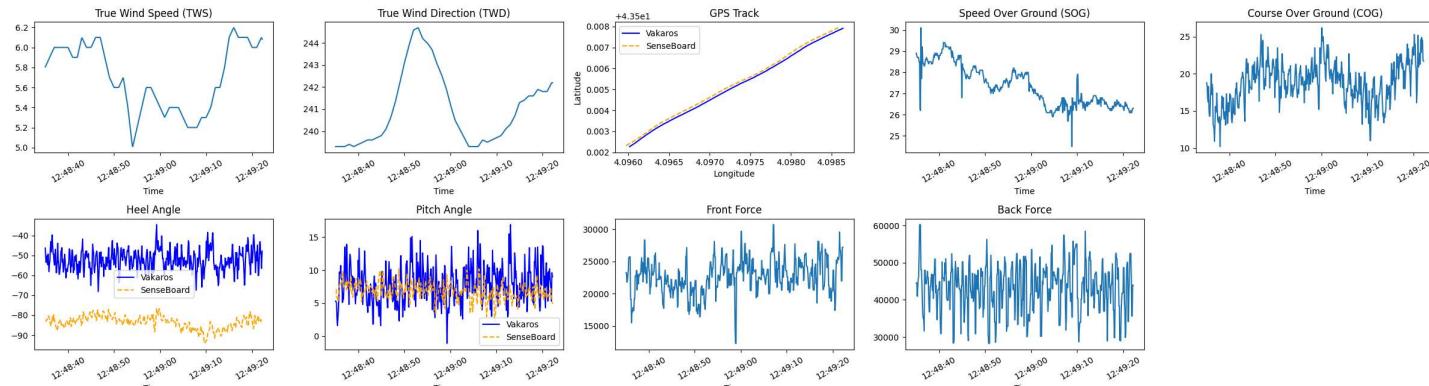
Run 07\_06\_Run9, Interval 1: Downwind from 2025-06-07 13:19:56.448 to 2025-06-07 13:20:40.459  
SenseBoard (vs Karl Maeder)



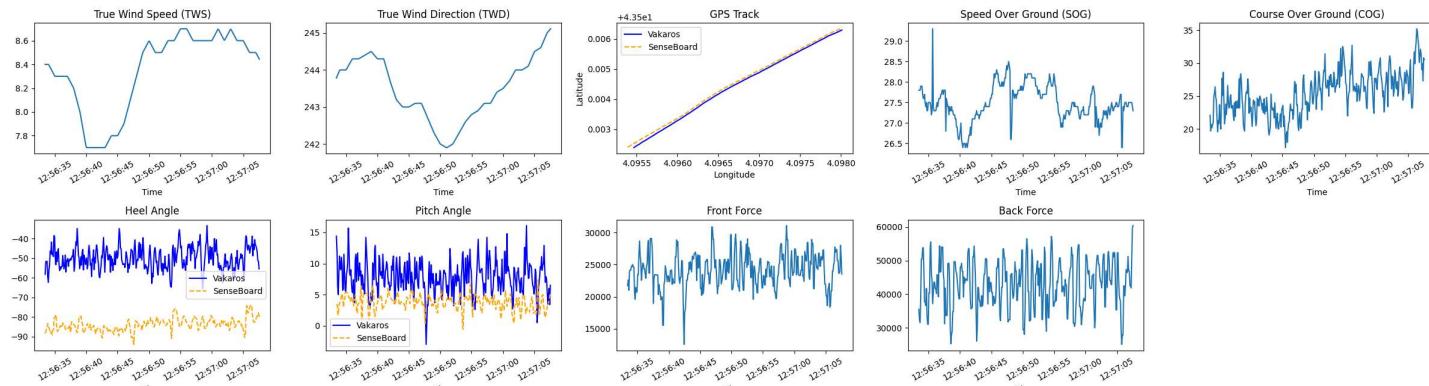
Run 09\_06\_Run4, Interval 1: Downwind from 2025-06-09 12:31:08.356 to 2025-06-09 12:31:52.650  
SenseBoard (vs Karl Maeder)



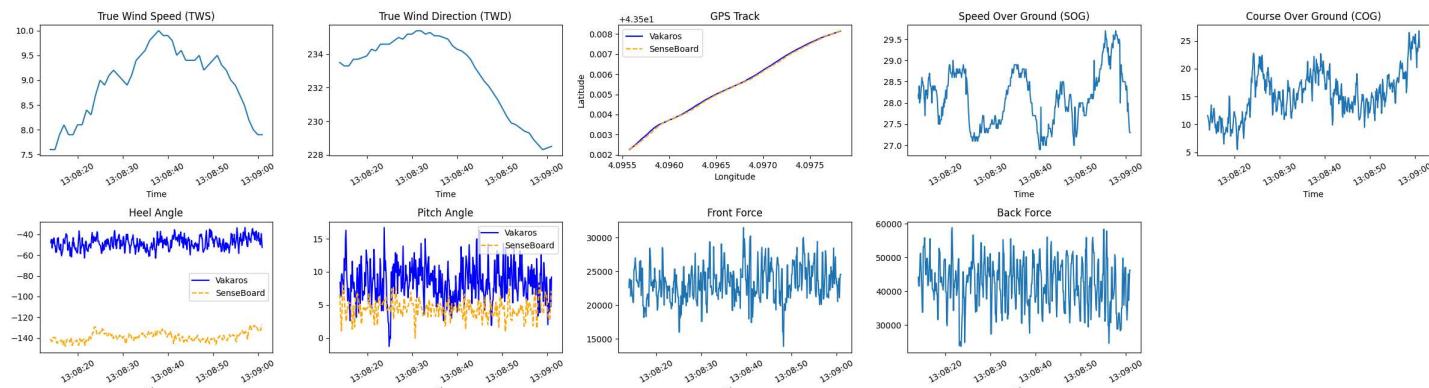
Run 09\_06\_Run6, Interval 1: Downwind from 2025-06-09 12:48:34.961 to 2025-06-09 12:49:22.253  
SenseBoard (vs Karl Maeder)



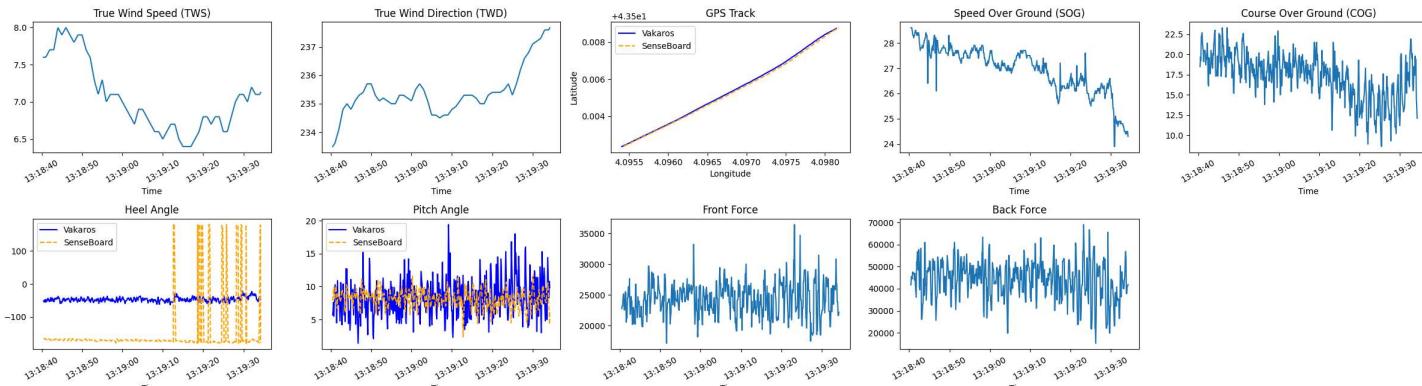
Run 09\_06\_Run7, Interval 1: Downwind from 2025-06-09 12:56:33.360 to 2025-06-09 12:57:07.653  
SenseBoard (vs Karl Maeder)



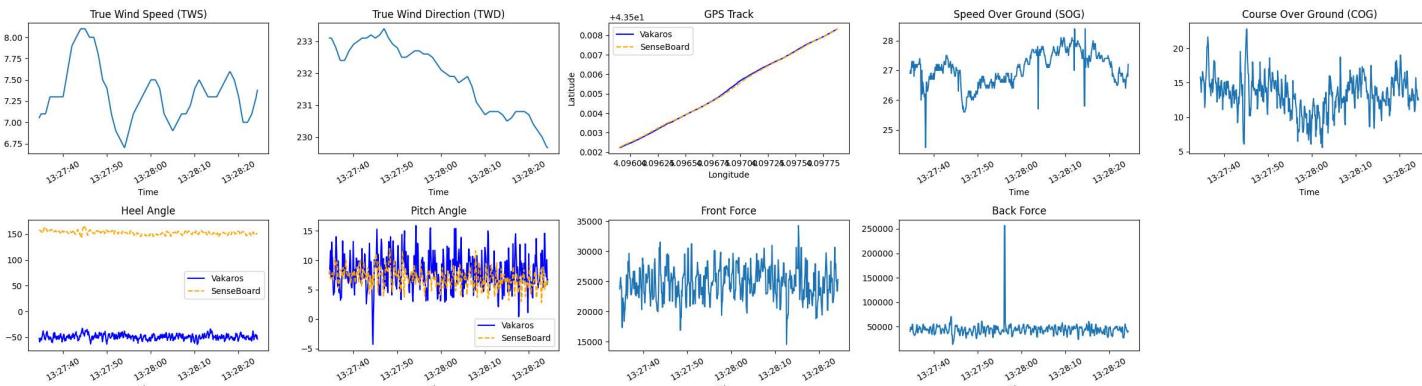
Run 09\_06\_Run8, Interval 1: Downwind from 2025-06-09 13:08:13.854 to 2025-06-09 13:09:01.045  
SenseBoard (vs Karl Maeder)



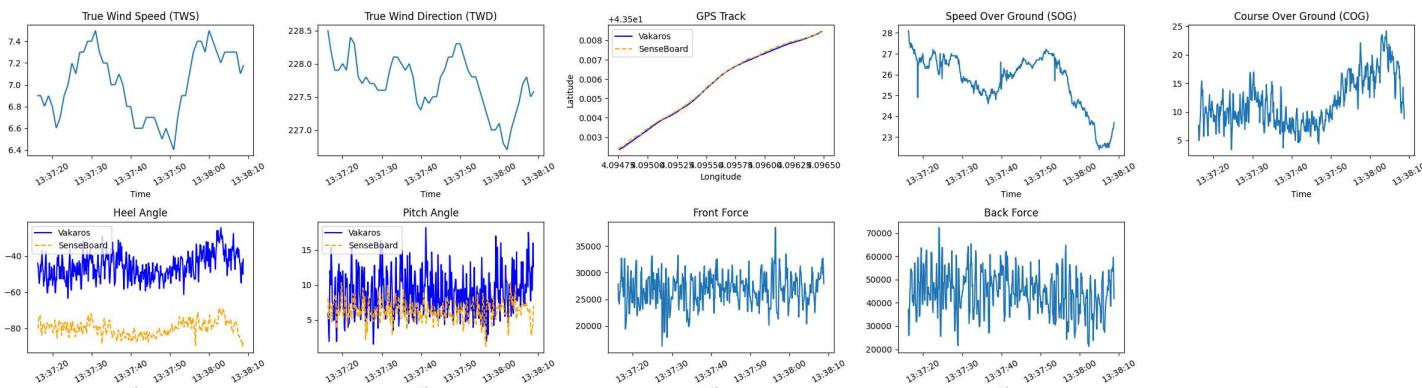
Run 09\_06\_Run9, Interval 1: Downwind from 2025-06-09 13:18:40.453 to 2025-06-09 13:19:34.256  
SenseBoard (vs Karl Maeder)



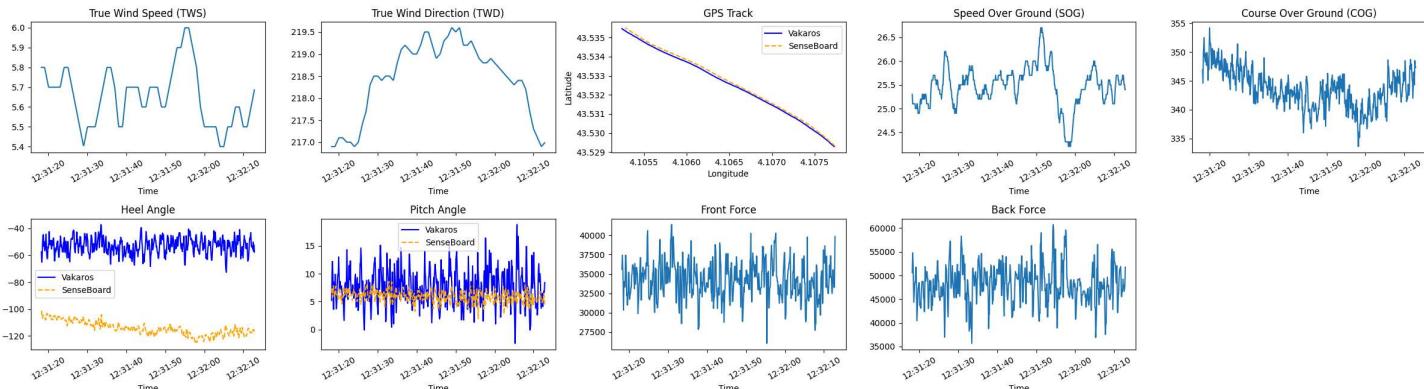
Run 09\_06\_Run10, Interval 1: Downwind from 2025-06-09 13:27:34.454 to 2025-06-09 13:28:24.256  
SenseBoard (vs Karl Maeder)



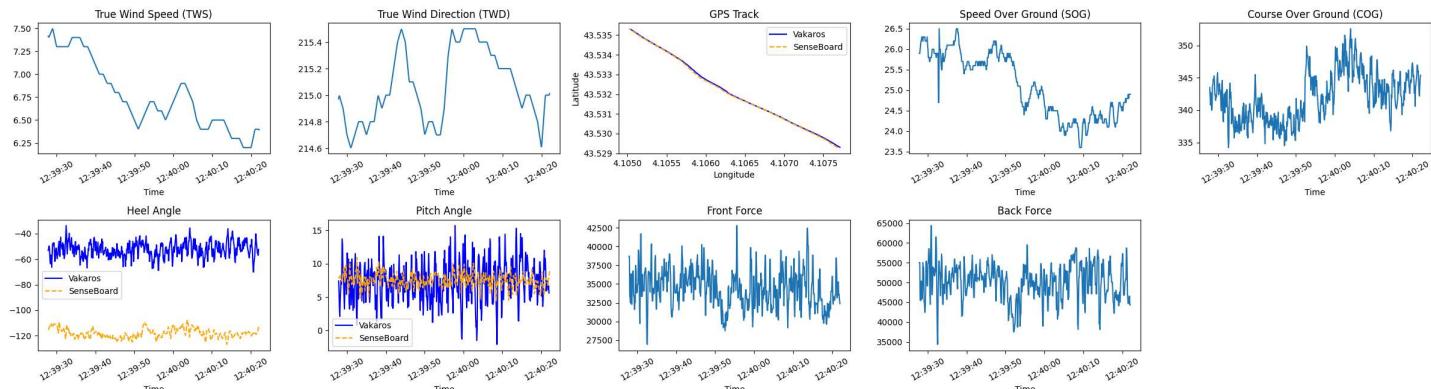
Run 09\_06\_Run11, Interval 1: Downwind from 2025-06-09 13:37:16.256 to 2025-06-09 13:38:08.852  
SenseBoard (vs Karl Maeder)



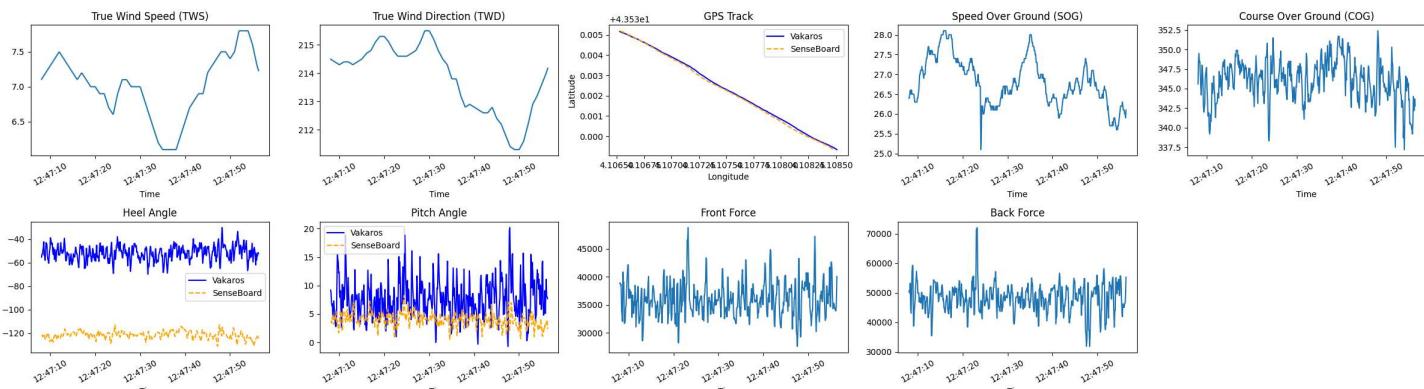
Run 10\_06\_Run1, Interval 1: Downwind from 2025-06-10 12:31:18.071 to 2025-06-10 12:32:12.858  
SenseBoard (vs Gian Stragiotti)



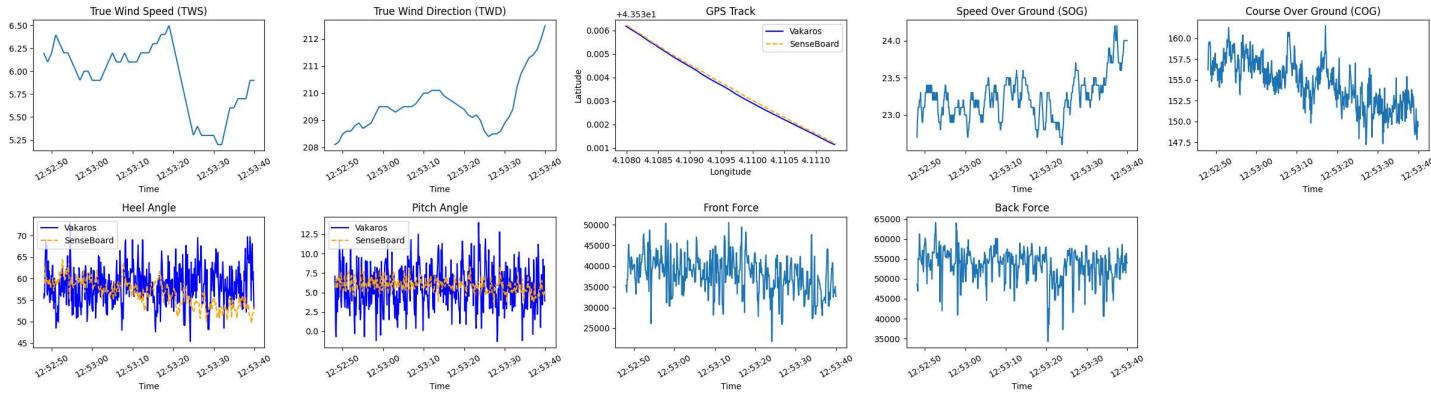
Run 10\_06\_Run2, Interval 1: Downwind from 2025-06-10 12:39:27.753 to 2025-06-10 12:40:22.144  
SenseBoard (vs Gian Stragiotti)



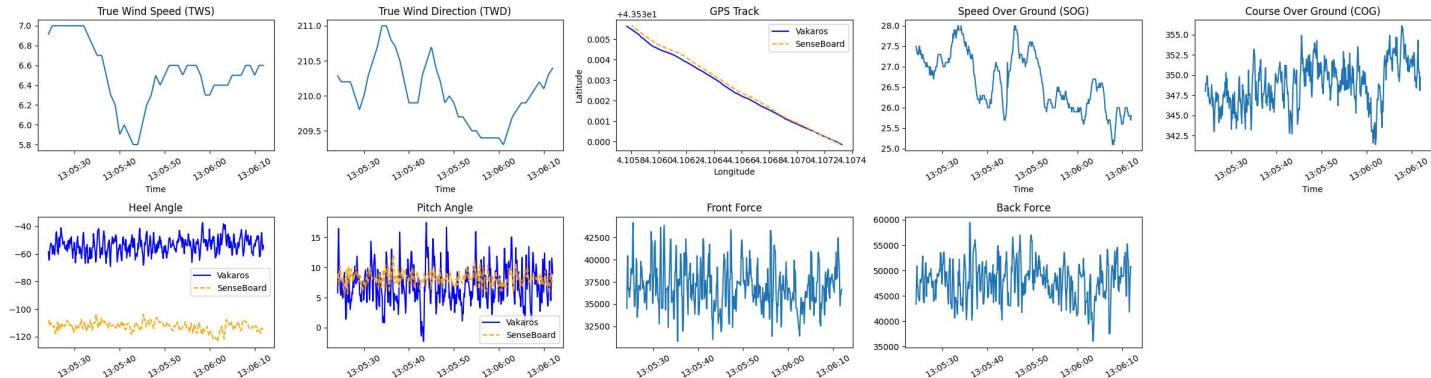
Run 10\_06\_Run3, Interval 1: Downwind from 2025-06-10 12:47:07.953 to 2025-06-10 12:47:56.354  
SenseBoard (vs Gian Stragiotti)



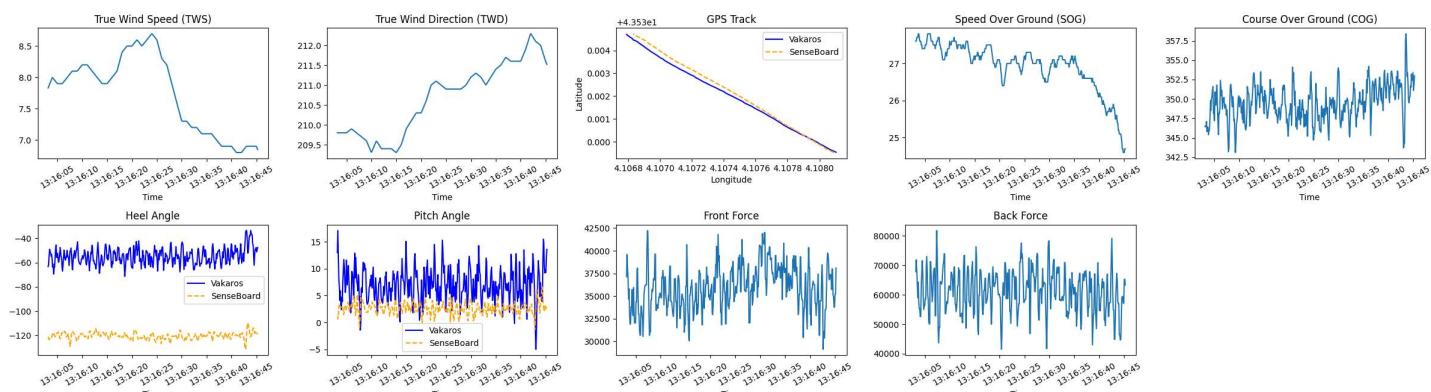
Run 10\_06\_Run4, Interval 1: Upwind from 2025-06-10 12:52:48.055 to 2025-06-10 12:53:40.046  
SenseBoard (vs Gian Stragiotti)



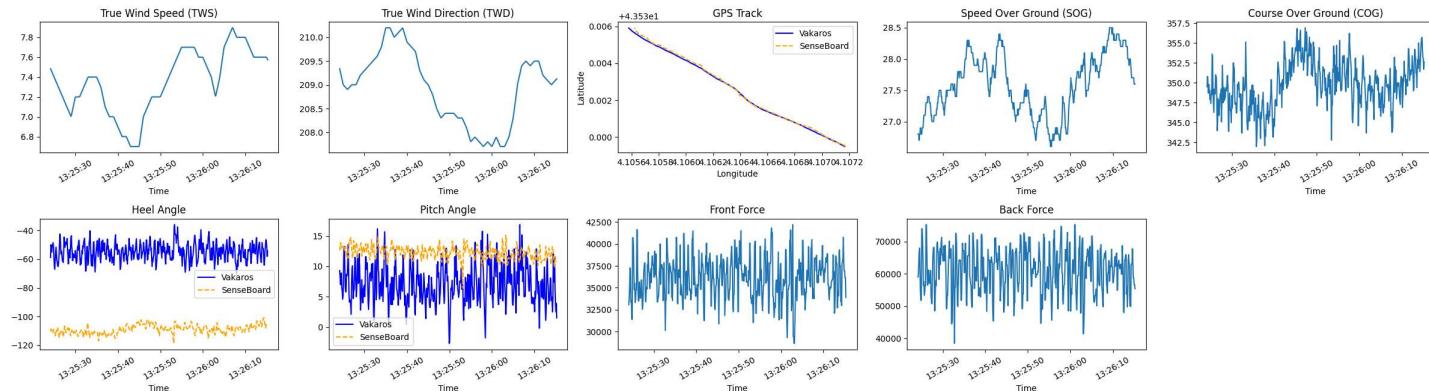
Run 10\_06\_Run5, Interval 1: Downwind from 2025-06-10 13:05:24.157 to 2025-06-10 13:06:11.956  
SenseBoard (vs Gian Stragiotti)



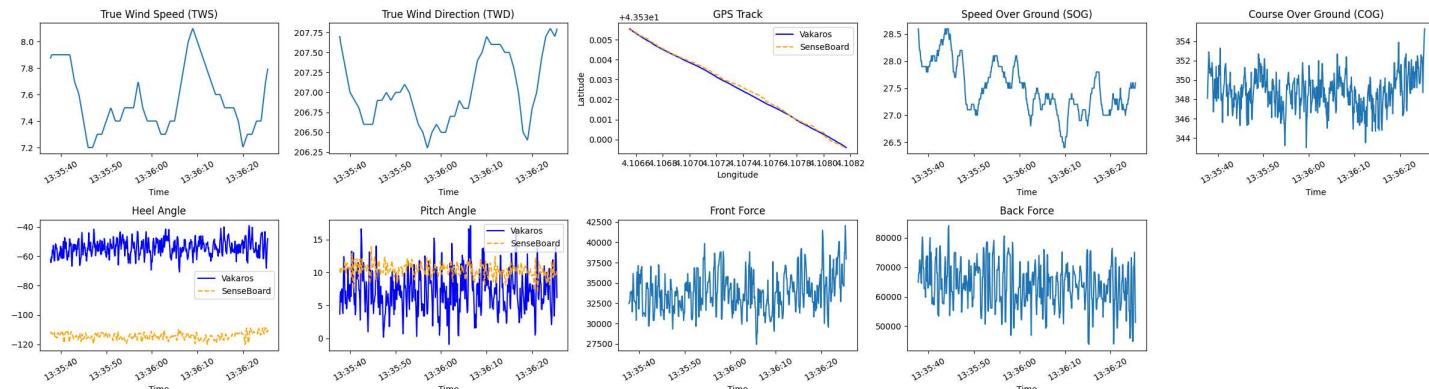
Run 10\_06\_Run6, Interval 1: Downwind from 2025-06-10 13:16:03.049 to 2025-06-10 13:16:45.263  
SenseBoard (vs Karl Maeder)



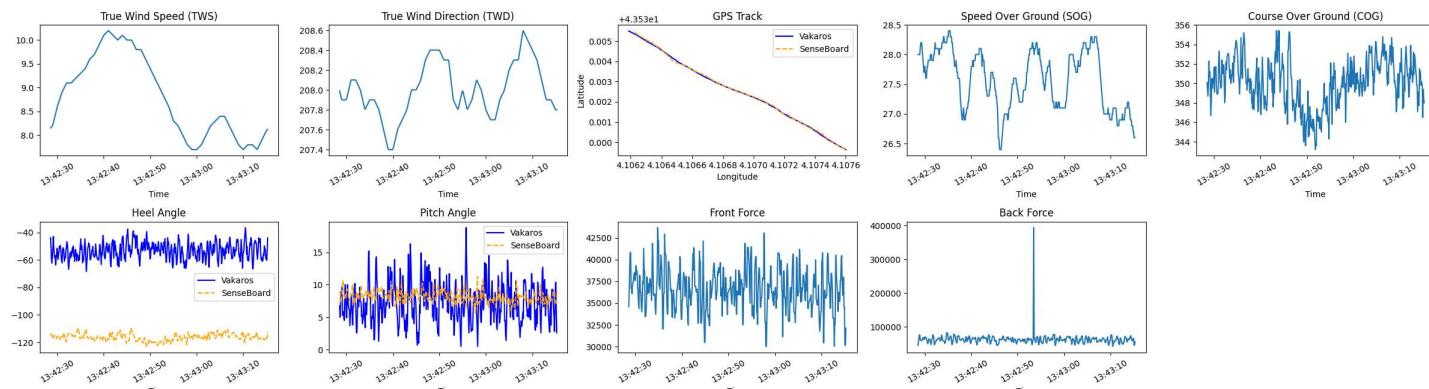
Run 10\_06\_Run7, Interval 1: Downwind from 2025-06-10 13:25:24.157 to 2025-06-10 13:26:15.263  
SenseBoard (vs Karl Maeder)



Run 10\_06\_Run8, Interval 1: Downwind from 2025-06-10 13:35:37.657 to 2025-06-10 13:36:25.552  
SenseBoard (vs Karl Maeder)



Run 10\_06\_Run9, Interval 1: Downwind from 2025-06-10 13:42:28.459 to 2025-06-10 13:43:15.342  
SenseBoard (vs Karl Maeder)



In [ 1]: