

Severe convection event in southeast Bulgaria on 17th September 2022

Bilyana Kostashki*, Rosen Penchev*, Guergana Guerova**

* Bulgarian Air Traffic Services Authority

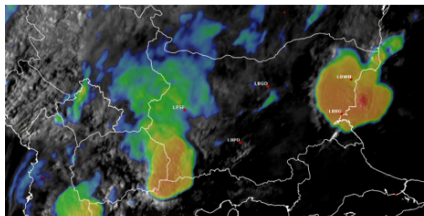
** Sofia University "St. Kliment Ohridski"



11th European Conference on Severe Storms
Bucharest Romania – May 8-12, 2023

May 9, 2023

Motivation



HRV and IR satellite 17.09.22 14.00 UTC

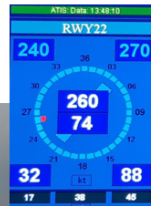


LINET lightning 17.09.22



ESSL Database 17.09.22

- 3 severe convection systems
- ESWD - 51 reports
- > 30 000 lightnings LINET
- damaging wind gusts at Burgas airport



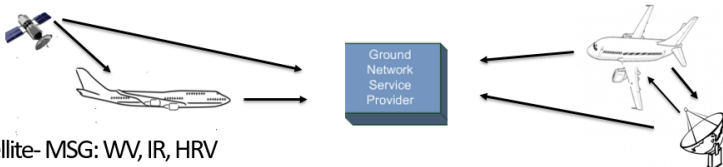
ATIS Burgas
13:48 UTC

Data used

- ERA5 Reanalysis-hourly data on pressure levels horizontal resolution $0.25^\circ \times 0.25^\circ$, 37 vertical levels cds.climate.copernicus.eu
- Lightning Detection Network (LINET)
- RT GNSS IWV-GNSS-based Storm nowcasting demonstrator (Storm Demo) suada.phys.uni-sofia.bg/?page_id=4838

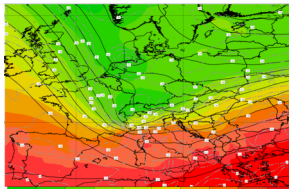


- Aircraft Meteorological Data Relay (AMDAR), Mode-S – aircraft reports

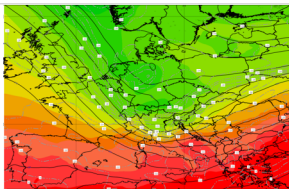


- Satellite- MSG: WV, IR, HRV
- Radar reflectivity - BULATSA
- Surface wind observations – Automated Weather Observing System (AWOS) - Burgas airport

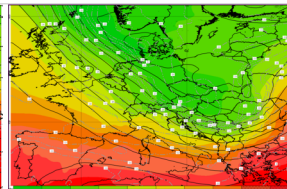
ERA5 Reanalyse synoptic situation



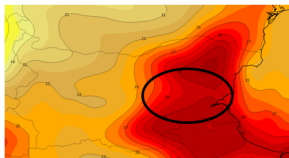
RT 500/1000 hPa 17.09 06 UTC



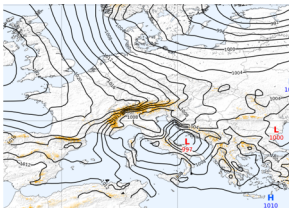
RT 500/1000 hPa 17.09 12 UTC



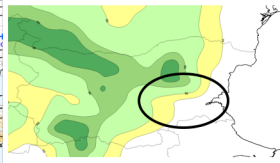
RT 500/1000 hPa 18.09 06 UTC



SFC Temperature 17.09 12 UTC

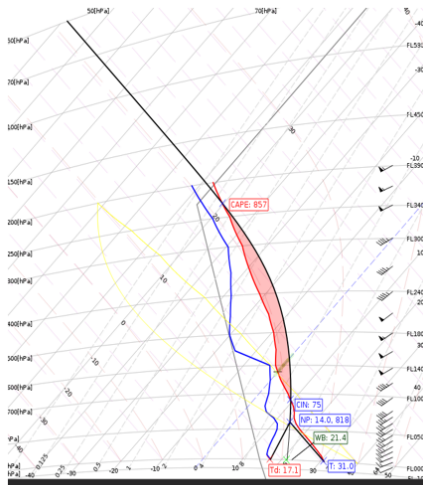


MSLP 17.09 12 UTC



SFC RH 17.09 12 UTC

ERA5 Reanalyse Burgas airport 12 UTC



Thermodiagram

THERMODYNAMIC INDICES

Index Value Moderate Severe

Showalter **-1.2** 4.0 -4.0

K Index **35.3** 20.0

Rackliff **29.8** 29.0 30.0

Potential Instability **-2.5** 3.0 -2.0

Cross Totals **21.6** 18.0 24.0

Vertical Totals **27.6** 24.0 26.0

Jefferson **31.8** 27.0 28.0

KO Index **-8.6** 6.0 2.0

S Index **44.8** 40.0 46.0

Total Totals **49.3** 45.0 55.0

SWEAT **254** 300 400

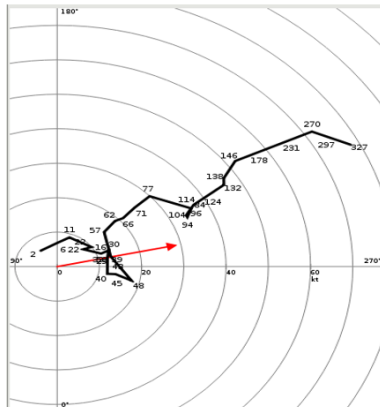
BOYDEN **98.1** 94.0 95.0

Precipitable Water Amount (kg/m²) **40.2** 32.0 45.0

- CAPE **1000** : moderate convective potential
- 0-3 km wind shear 30 kt (15 m/s)
- 0-6 km wind shear 45 kt (22 m/s)

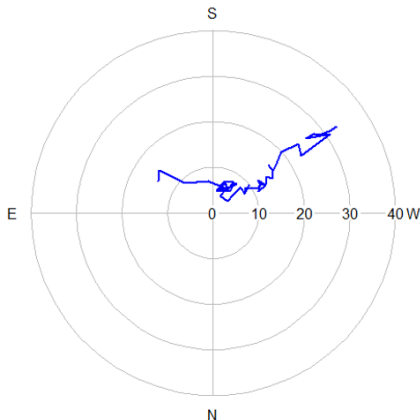
Observations: Varna AMDAR EU8556 12:14 UTC and Burgas Mode - S WZZ910 13.26 UTC

- 0-3 km wind shear 24 kt (12 m/s)
- 0-6 km wind shear 55 kt (28 m/s)



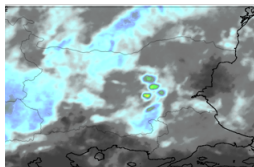
AMDAR Hodograph SFC/FL330

- 0-3 km wind shear ≈ 20 kt (10 m/s)

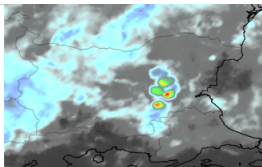


Mode-S Hodograph SFC/FL085

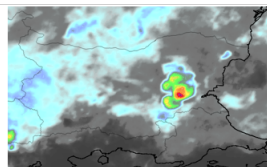
Satellite WV, Real-Time GNSS IWW and LINET



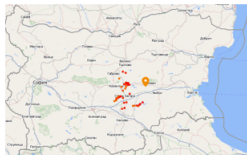
SAT WV 12:15 UTC



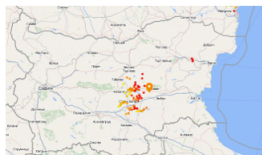
SAT WV 12:30 UTC



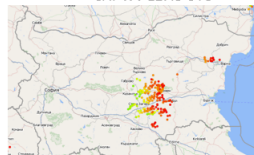
SAT WV 12:45 UTC



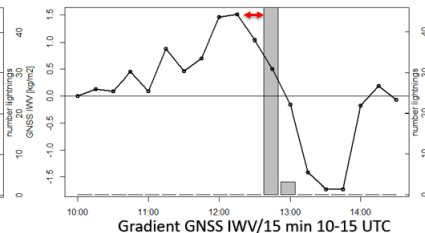
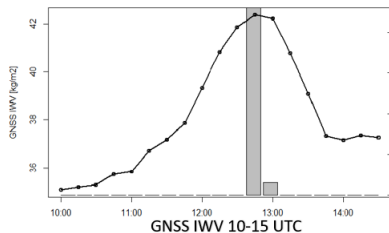
LINET 12:15 UTC



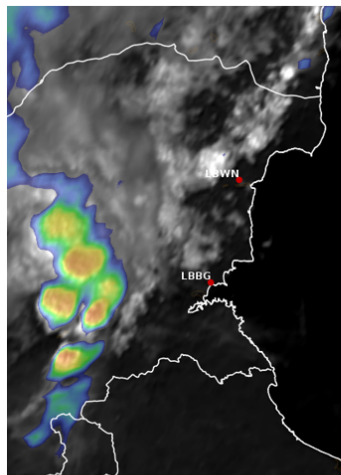
LINET 12:30 UTC



LINET 12:45 UTC



Observations: Satellite IR 12:30-13:30 UTC



Squallline 12.30 UTC
55 km x 130 km, top 14 km -60 °C

✓ Gravitational waves

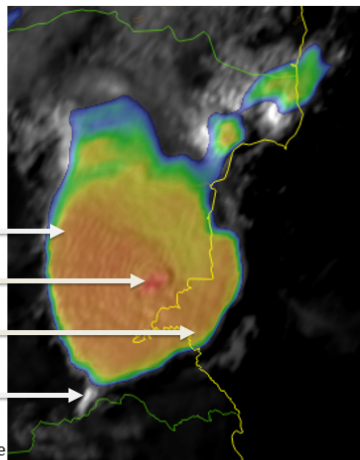
✓ -70 °C overshooting top

✓ Cold-U shape

✓ Flanking line

✗ Mesovortex

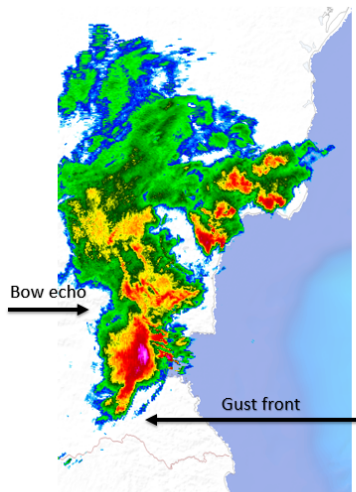
✗ Deviation from the mainstream



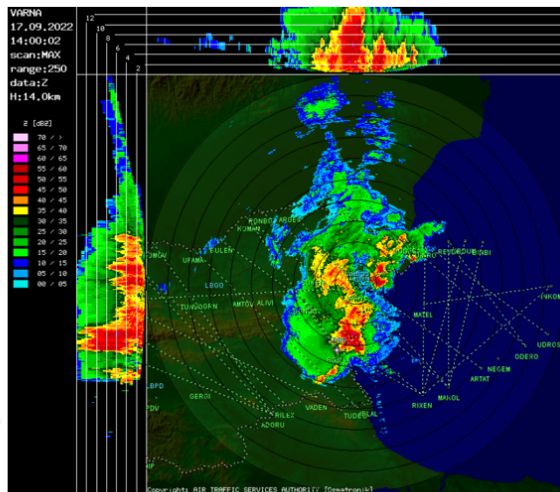
Supercell? 13.30 UTC
110 km x 170 km, top >16 km -70 °C

100 km/h

Observations: Radar 14:00 UTC

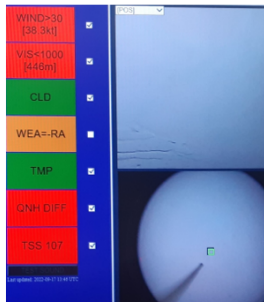


2 km dBz cross section 14:00 UTC



Max dBz 14:00 UTC

Observations: Burgas AWOS 13:48 UTC



ATIS BURGAS

Time: 1430Z Information: Z RWY: 04

TRN: 140

NP approach. Flock of birds in VC of the RWY. ALT unknown. ILS 27 out of use. IPI 04 out of use. Center Line Lights out of use. Approach Lights RWY 04 out of use. Threshold Lights RWY 04 out of use.

- 88 kt (45 m/s) - exceeded the estimated maximum possible wind speed once per 50 years. (Branzov H., 2010)

THANK YOU FOR YOUR ATTENTION!



Burgas airport (photograph by N. Hristov)