Victoria school network of automatic meteorological stations at Vancouver Island (BC, Canada) as a tool for monitoring of meteorological extremes at high temporal-spatial resolution

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Outline

- Motivation
- Amateur meteorological networks
- School network Victoria

Motivation

- Research of meteotsunamis – **destructive sea level oscillations which appear at tsunami periods**, but which are generated by **intense short-lasting air pressure/wind disturbances**

- Atmospheric disturbances which generate meteotsunamis are highly variable, both in space (dimensions of O(10 – 100 km)), and in time (O(10 – 100 min))

- Official networks do not have high enough spatial-temporal resolution for „catching" these disturbances

The Adriatic meteotsunami, 25 – 26 June 2014

The eastern Adriatic coast was hit by a series of meteotsunamis during 25 – 26 June 2014.

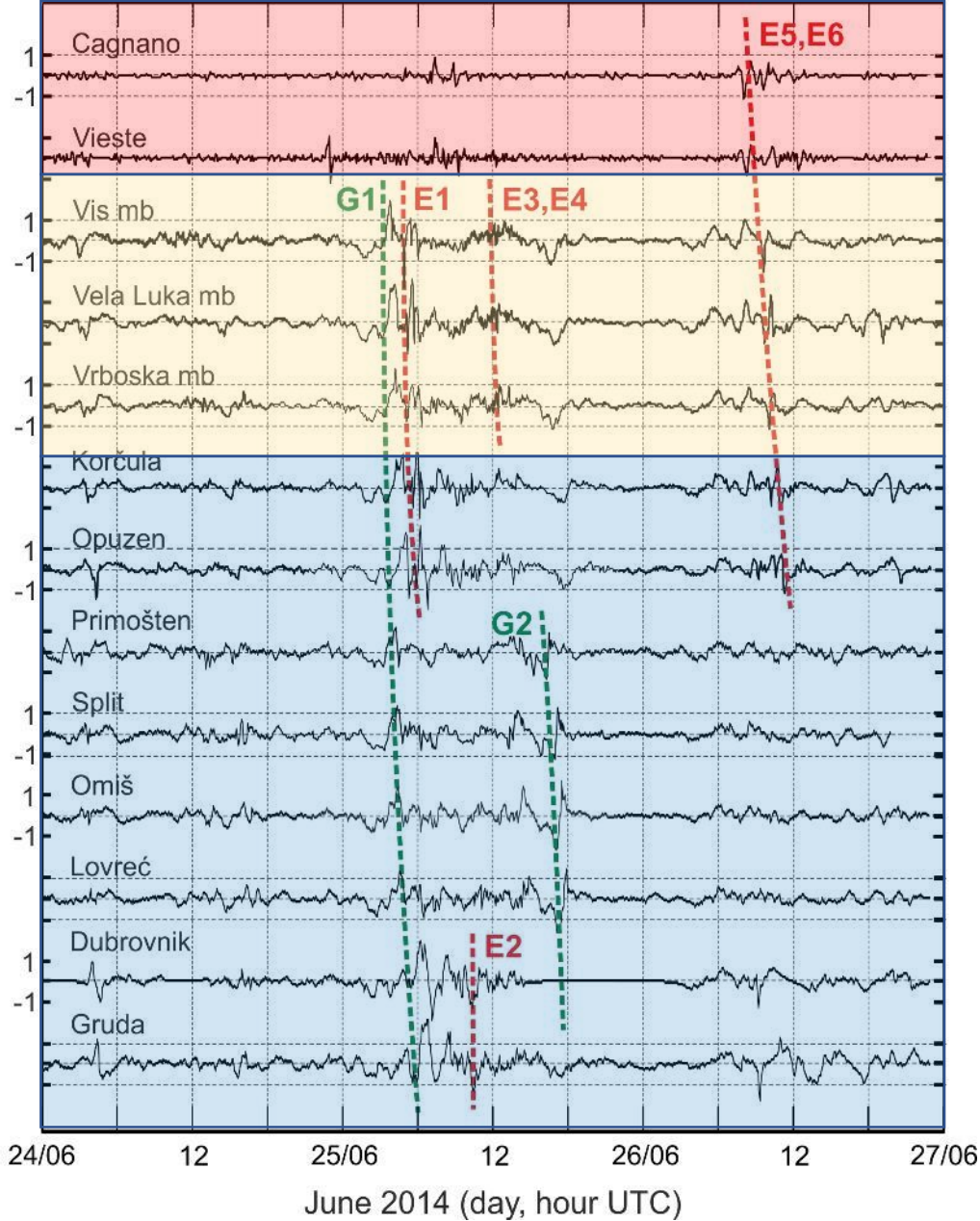| Location	Date	Observed wave height
Vela Luka	25.06. (06:00)	~ 3 m
Rijeka dub.	25.06. (11:30)	~ 2.5 m
Stari Grad	25.06. (13:00)	~ 1.0 m
Vrboska	25.06. (15:00)	~ 1.5 m
Viganj	26.06. (12:00)	~ 0.8 m
Ston	26.06. (12:00)	~ 1.0 m

Šepić et al., 2016
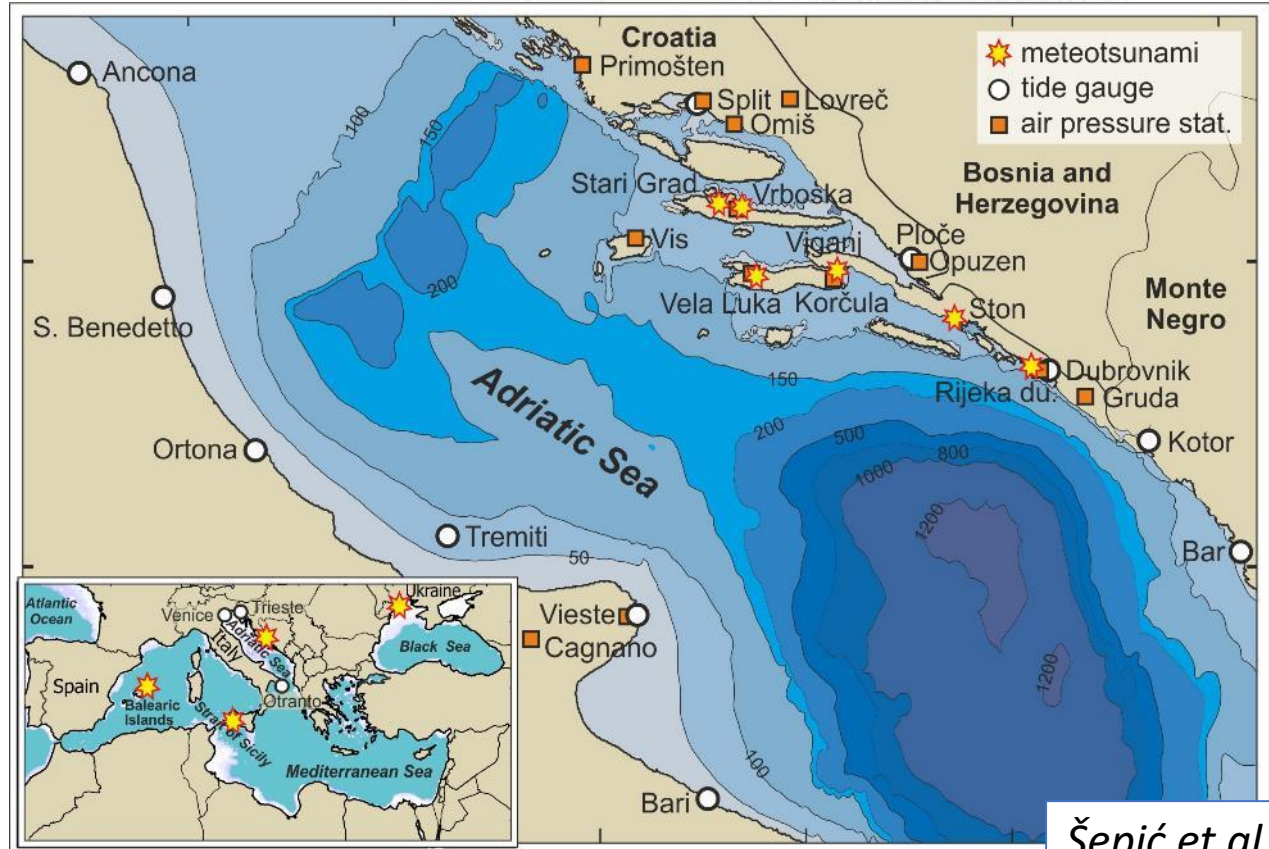
The Adriatic meteotsunamis, 25 – 26 June 2014

Wunderground

IOF

Pljusak

Meteotsunamis were generated by individual air pressure disturbances which propagated over the Adriatic during 25 – 26 June 2014.
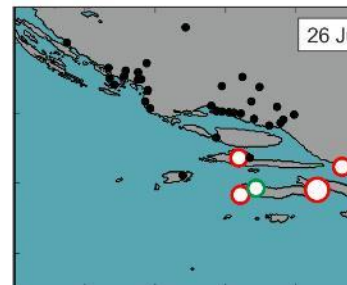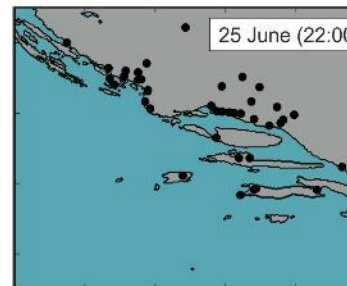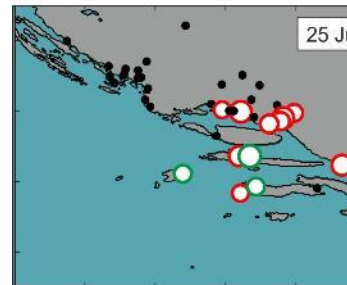
Official 1-min data were nonexistent.

We analyzed data from the IOF microbarograph network, as well as data from amateur meteorological stations available via: *pljusak.com and wunderground.com* web pages.
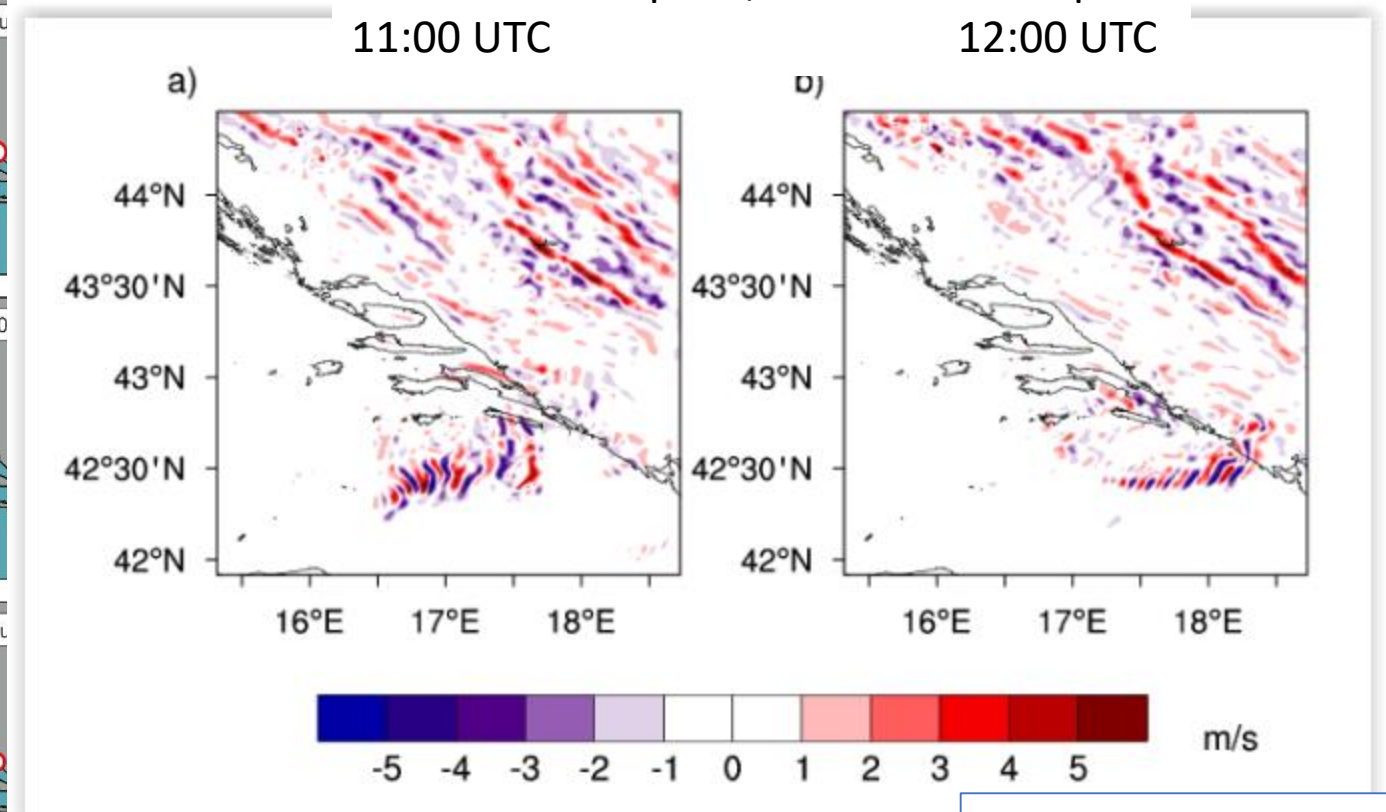
Šepić et al., 2016

The Adriatic meteotsunamis, 25 – 26 June 2014
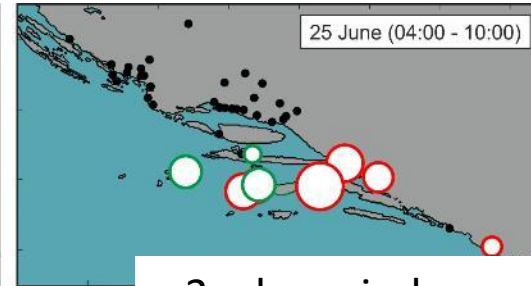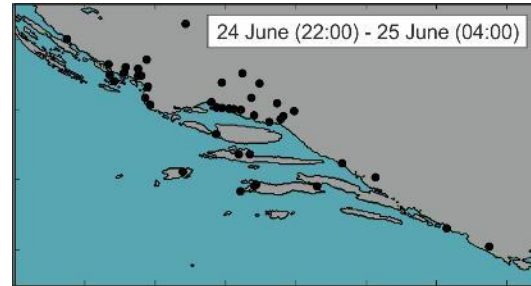
Disturbances propagated over limited areas and with small cross-propagation dimensions (20-30 km)

3 – km wind speed, WRF model output
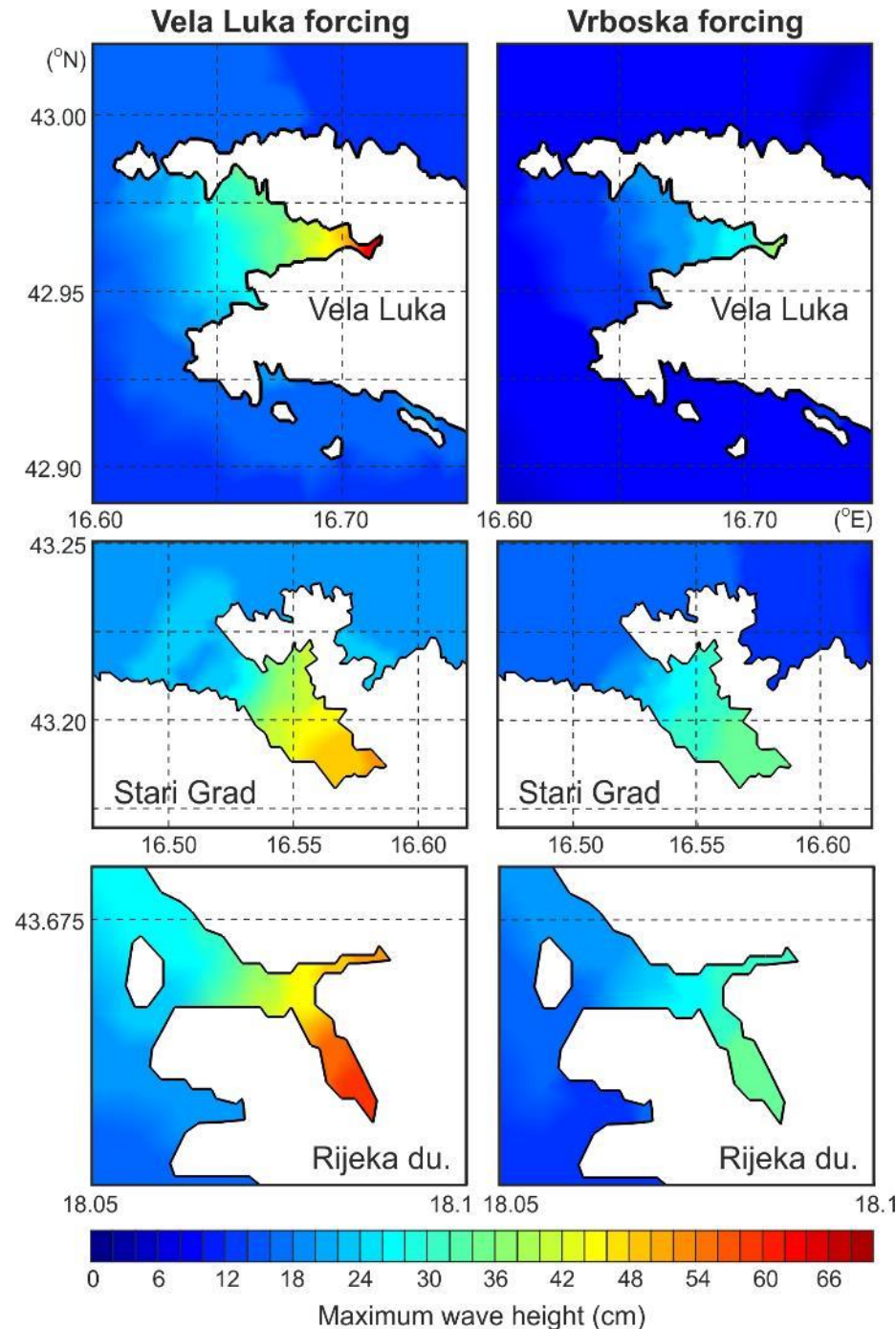11:00 UTC   12:00 UTC

Horvath et al., 2018

Šepić et al., 2016

The Adriatic meteotsunamis, 25 – 26 June 2014

Vela Luka forcing — Vrboska forcing

Maximum wave height (cm)

Šepić et al., 2016

The Adriatic Sea response to atmospheric disturbances was modelled with barotropic version of SCHISM model.

Model was forced with air pressure measurements from
(a) Vela Luka (Korčula)
(b) Vrboska (Hvar)
Measurements from one station were extrapolated over the entire domain.

Distance between these two locations is ~20 km.

**Simulated wave heights at locations hit by meteotsunami differ up to 75%.**

Tracking of atmospheric disturbances at network of high spatial resolution is of uttermost importance.

- In an attempt to catch atmospheric disturbances which generate meteotsunamis, we have installed, within **projects POZOR (FZOEU) and MESSI (UKF), a network of high resolution air pressure sensors** (Vaisala PTB330) along Croatian and Italian coast of the middle Adriatic.
- All data are publicly available and can be accessed and visualized at: faust.izor.hr/autodatapub/postaje

The Adriatic meteotsunamis, 25 – 26 June 2014
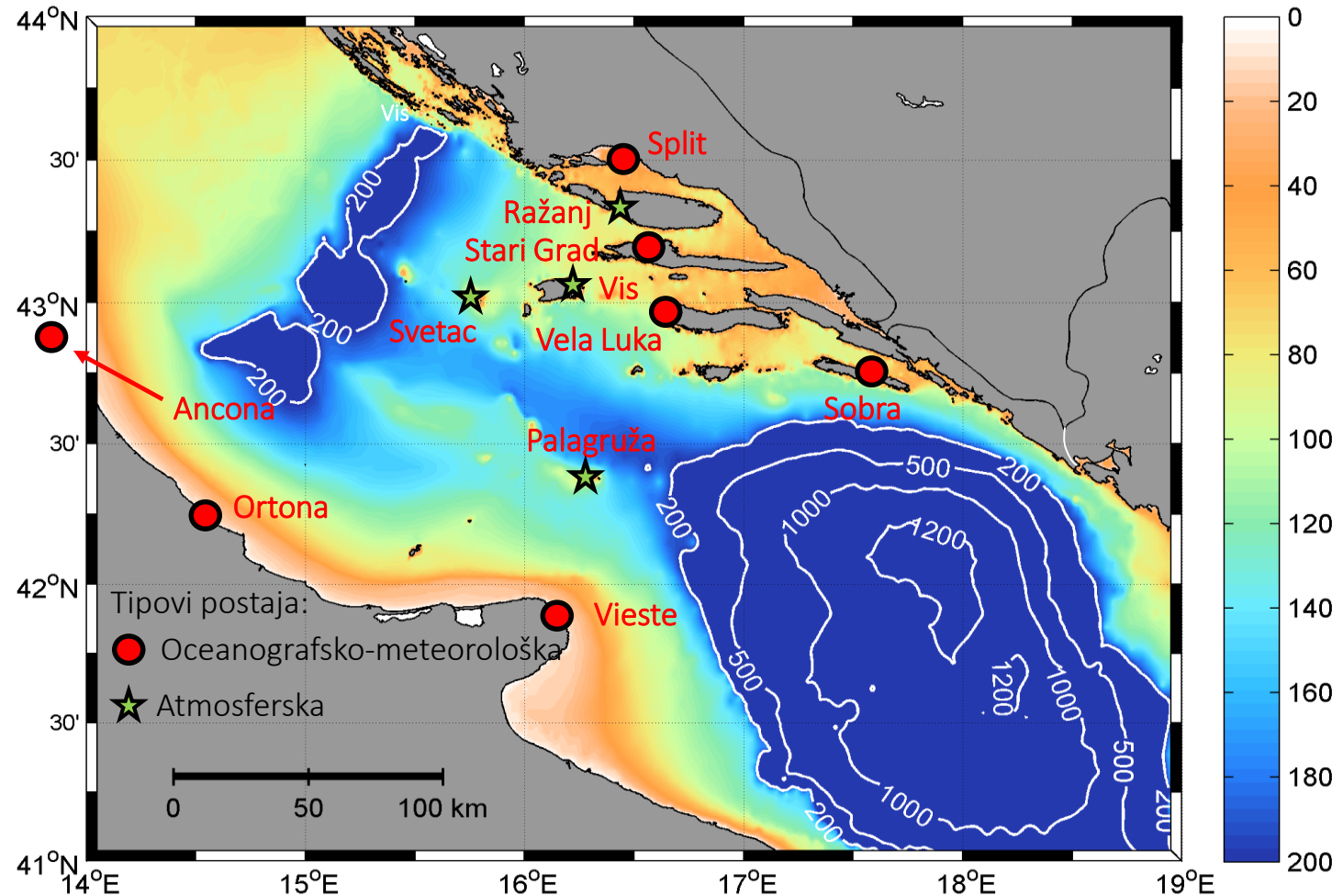
Amateur/school networks of meteorological measurements
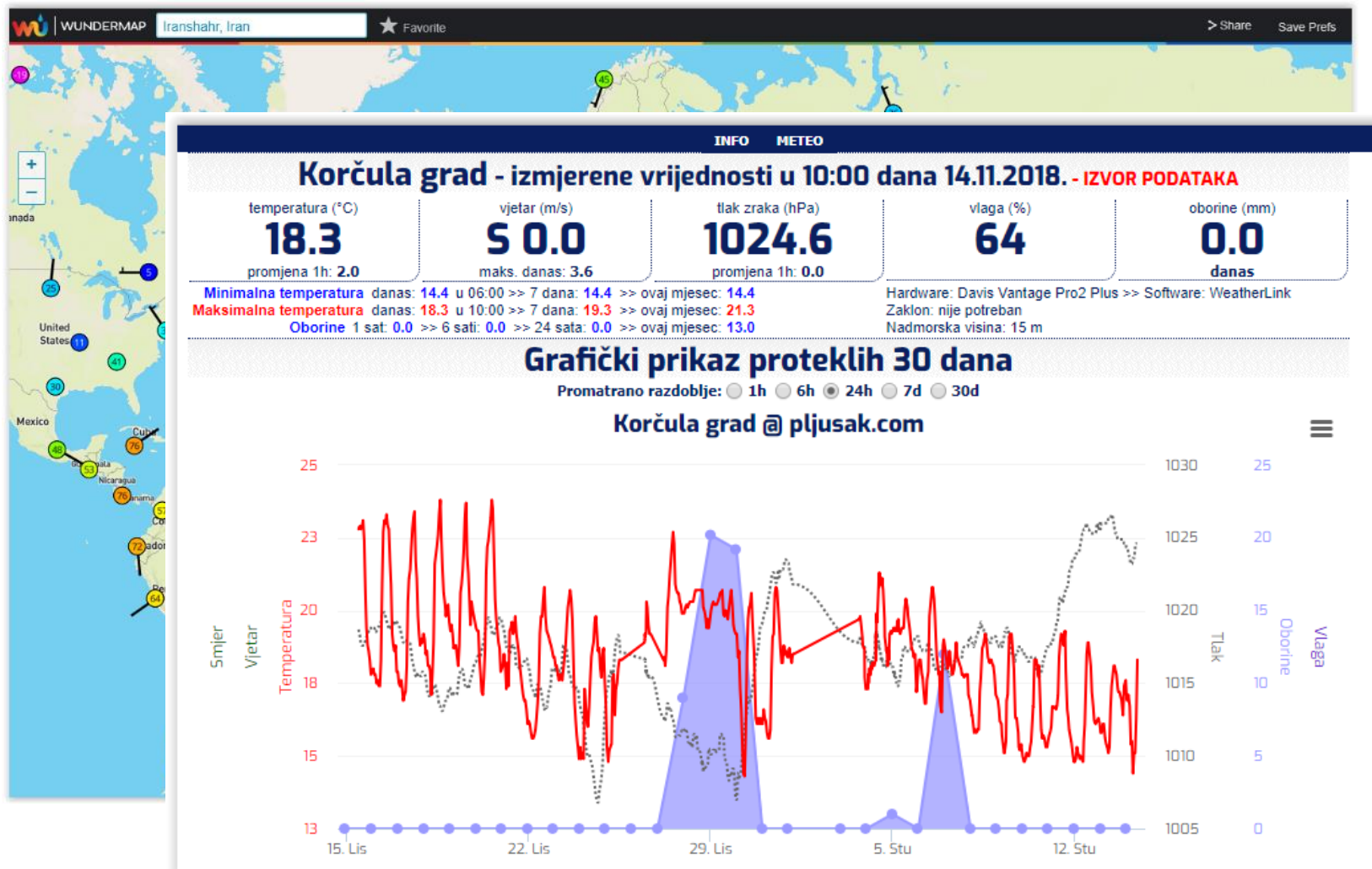
Advantages:

- Publicly available data from 10s of thousands of stations
- Good supplement to official data
- HF component of signal is often of sufficient quality to determine main spatial and temporal characteristics of disturbances

Disadvantages:

- Unchecked data of questionable quality
- Use of data for long-term monitoring not recommended
- Exact timing of measurements not reliable (± few minutes)

On 19 March 2017, Dayyer (Iran) was hit by 5-m high deadly tsunami-like waves. Five persons died. **The event was most likely meteorological tsunami.**

Amateur/school networks of meteorological measurements

Wunderground meteorological measurements were only available source of meteorological data.

Heidarzadeh et al., in preparation
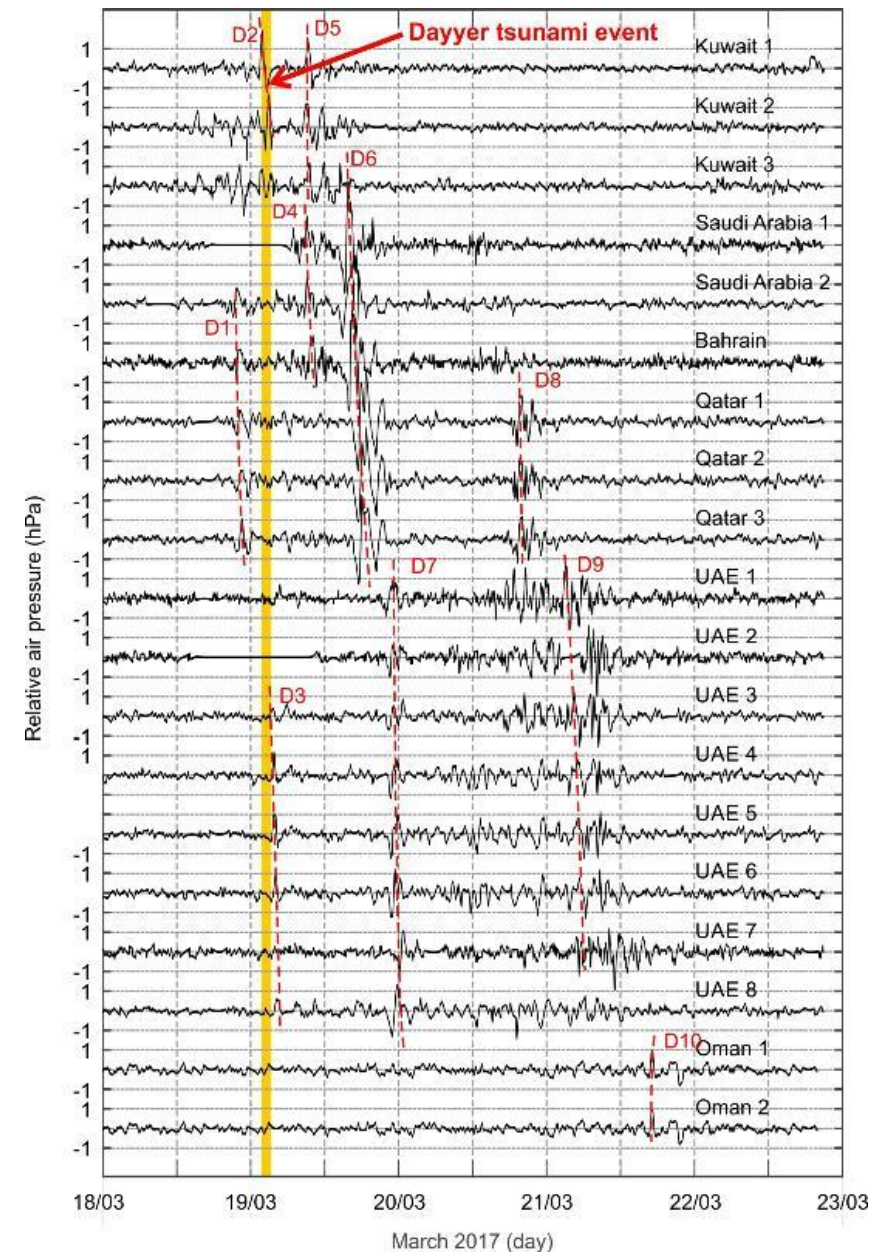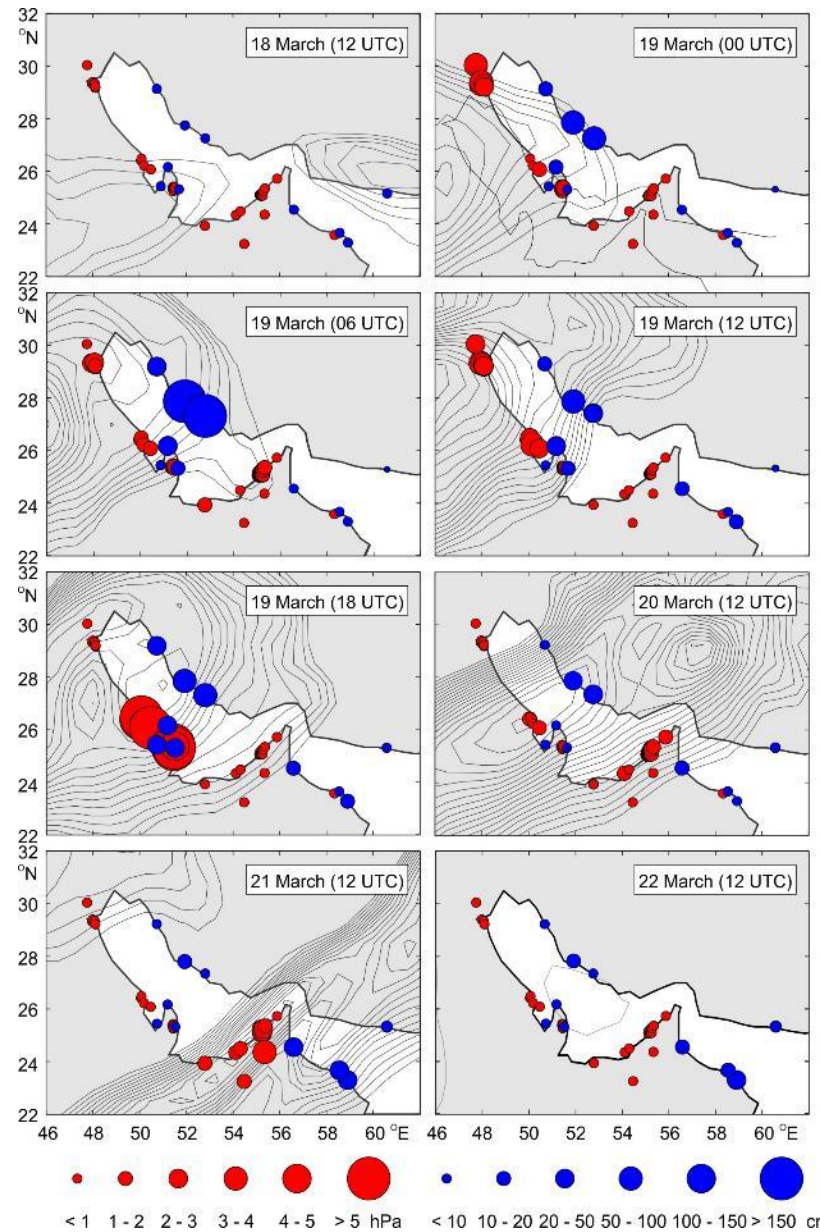
- Network of high-quality meteorological stations
- 1-min measurements of temperature, air pressure, humidity, wind speed, wind direction, wind gust, rainfall, insolation and UV index
- Network was installed by scientists of the University of Victoria (Vancouver Island, British Columbia, Canada) at elementary and high schools of Vancouver Island (+ few coastal locations)
- Network is intended for education of pupils and for awakening of their scientific interest
- 171 stations, 96 at 975 km^2 area, i.e. 1 station/300 m

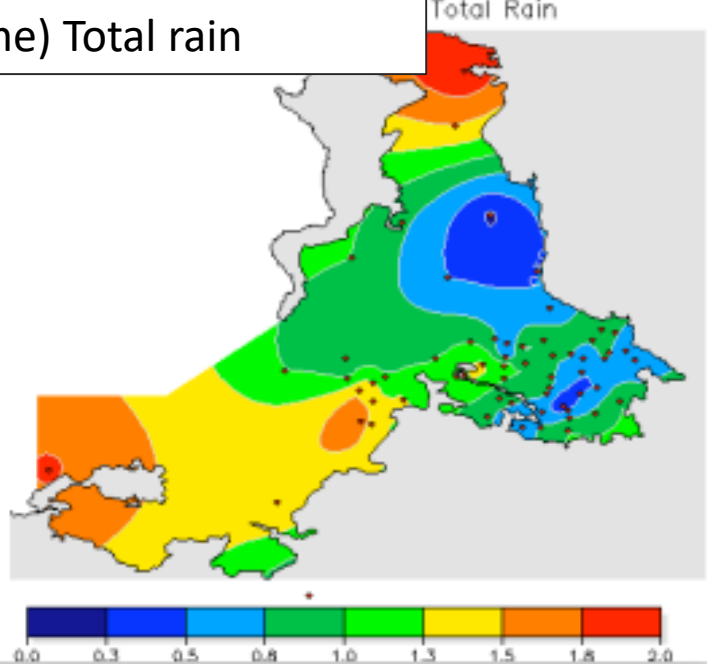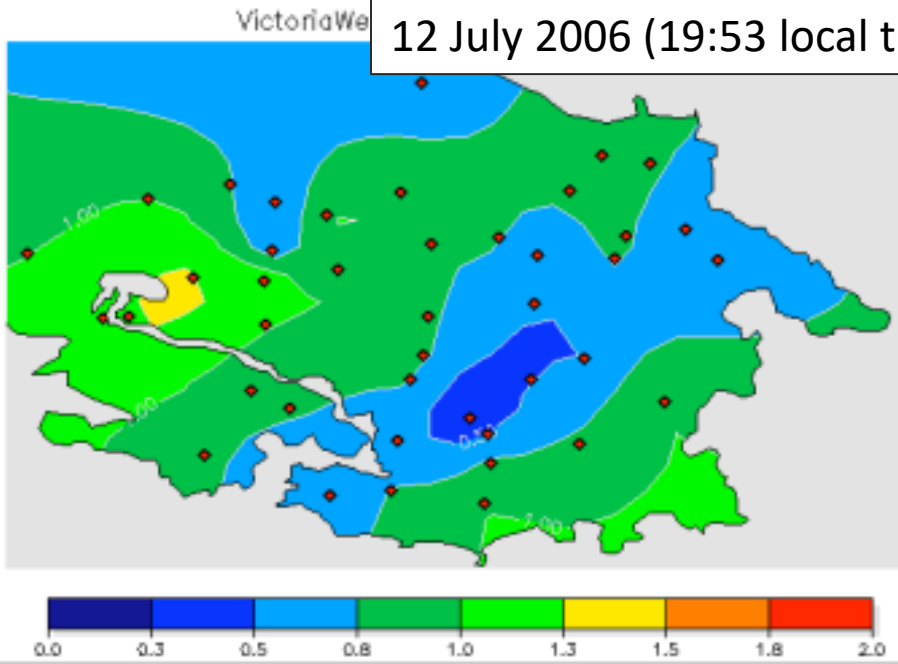School network, Victoria, BC, Canada
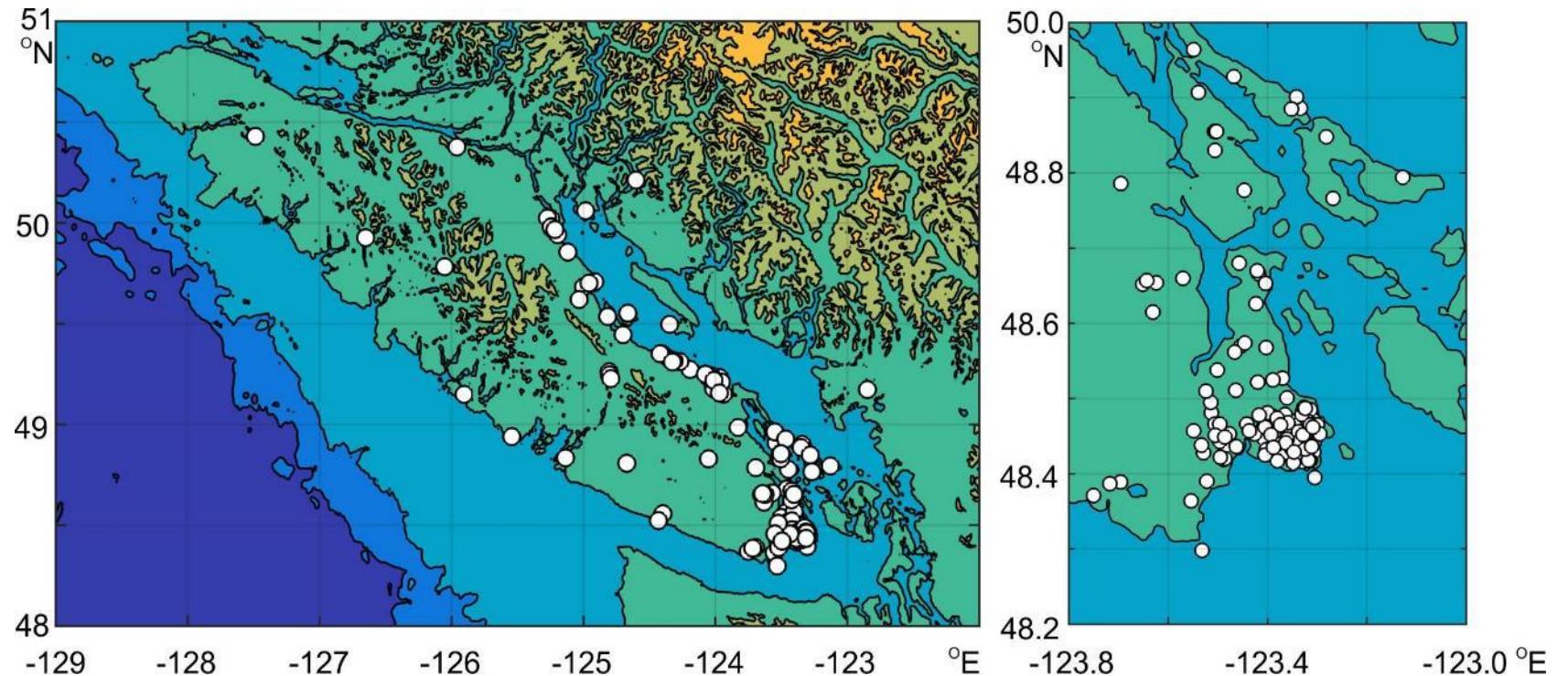
School network, Victoria, BC, Canada
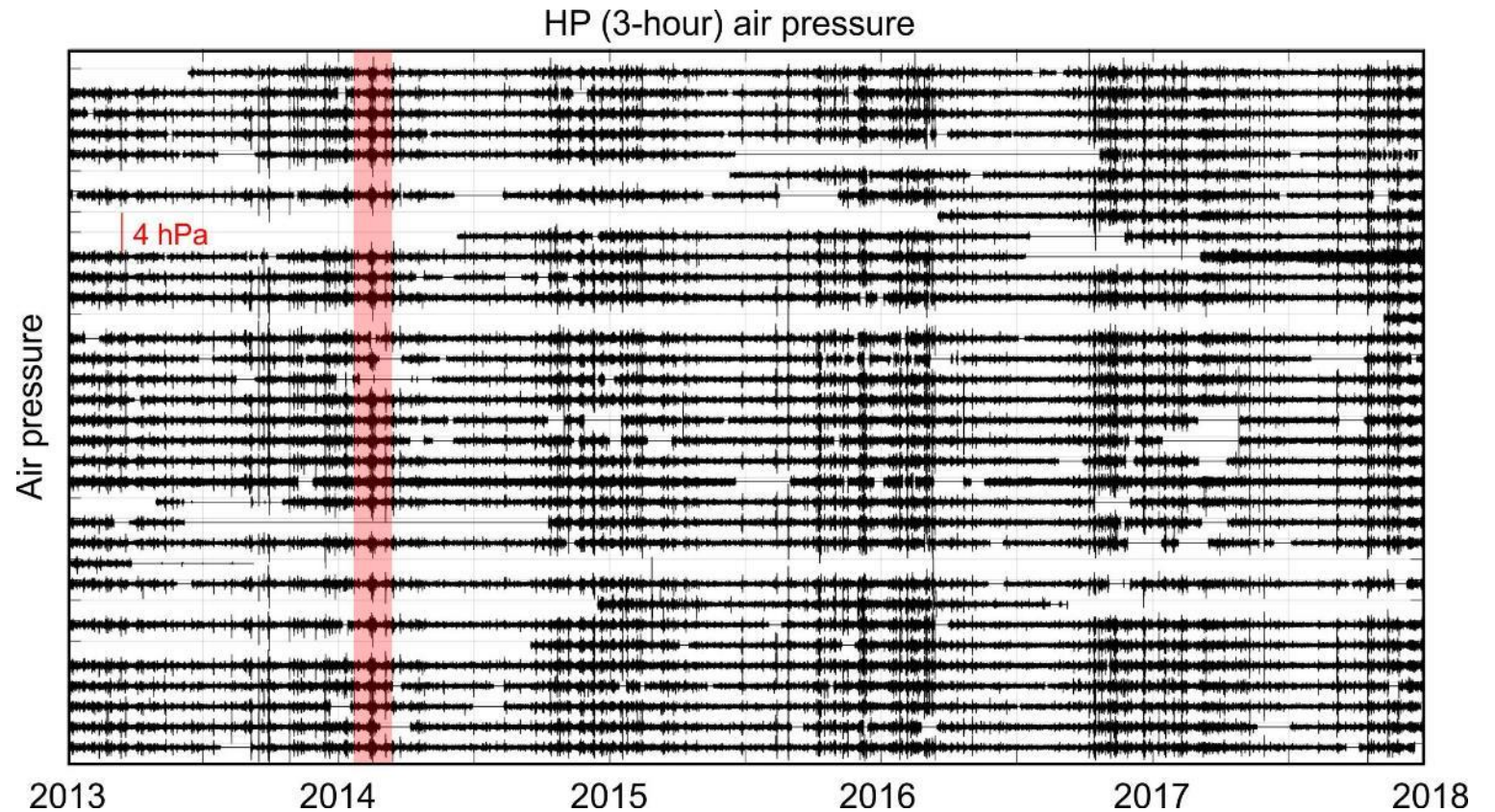
12 July 2006 (19:53 local time) Temperature
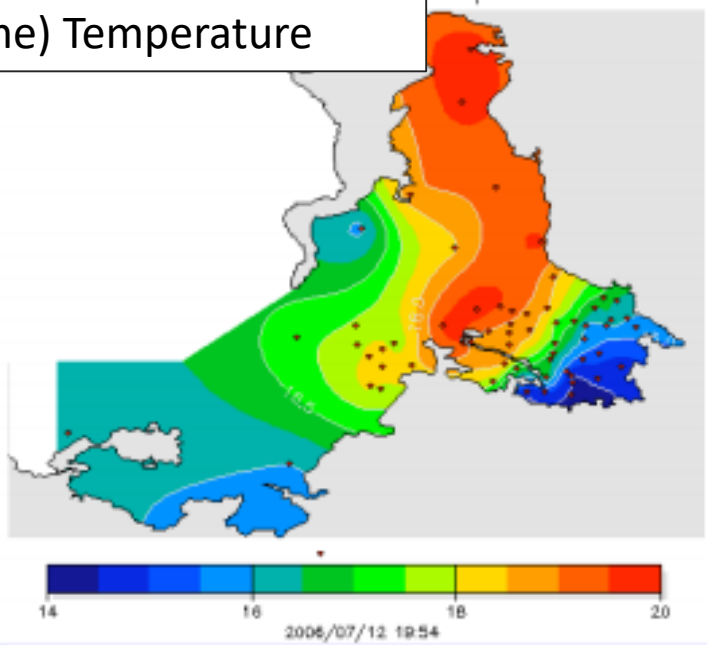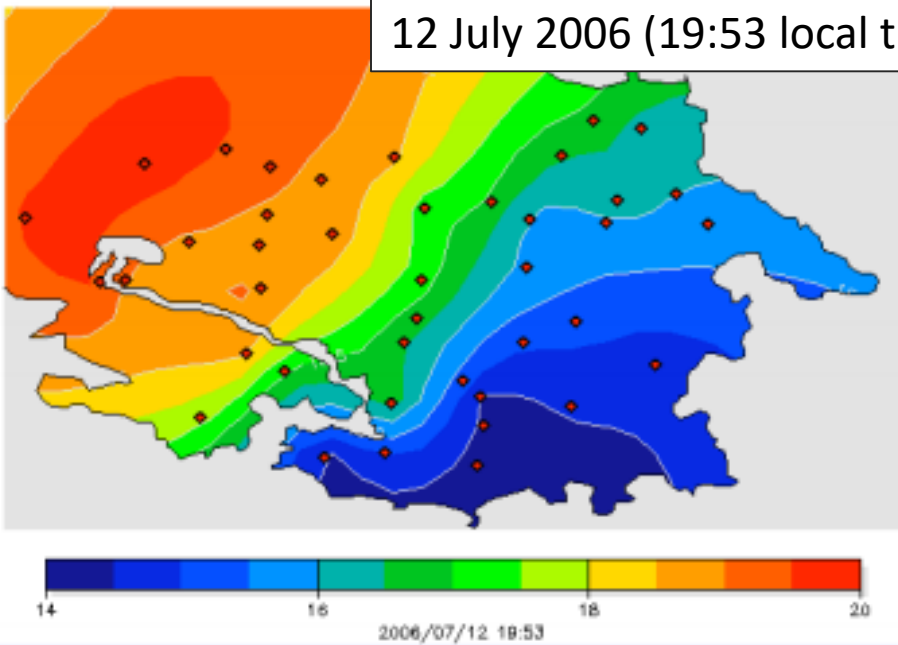
12 July 2006 (19:53 local time) Total rain

- Coherent HF air pressure oscillations along the entire network
- Periods of increased HF air pressure activity in autumn/winter

HP (3-hour) air pressure

Šepić et al., in preparation

- Coherent HF temperature oscillations along the entire network
- Periods of increased HF temperature activity in spring/summer
- HF temperature and air pressure oscillations are not synchronized

HP (3-hour) temperature

Šepić et al., in preparation
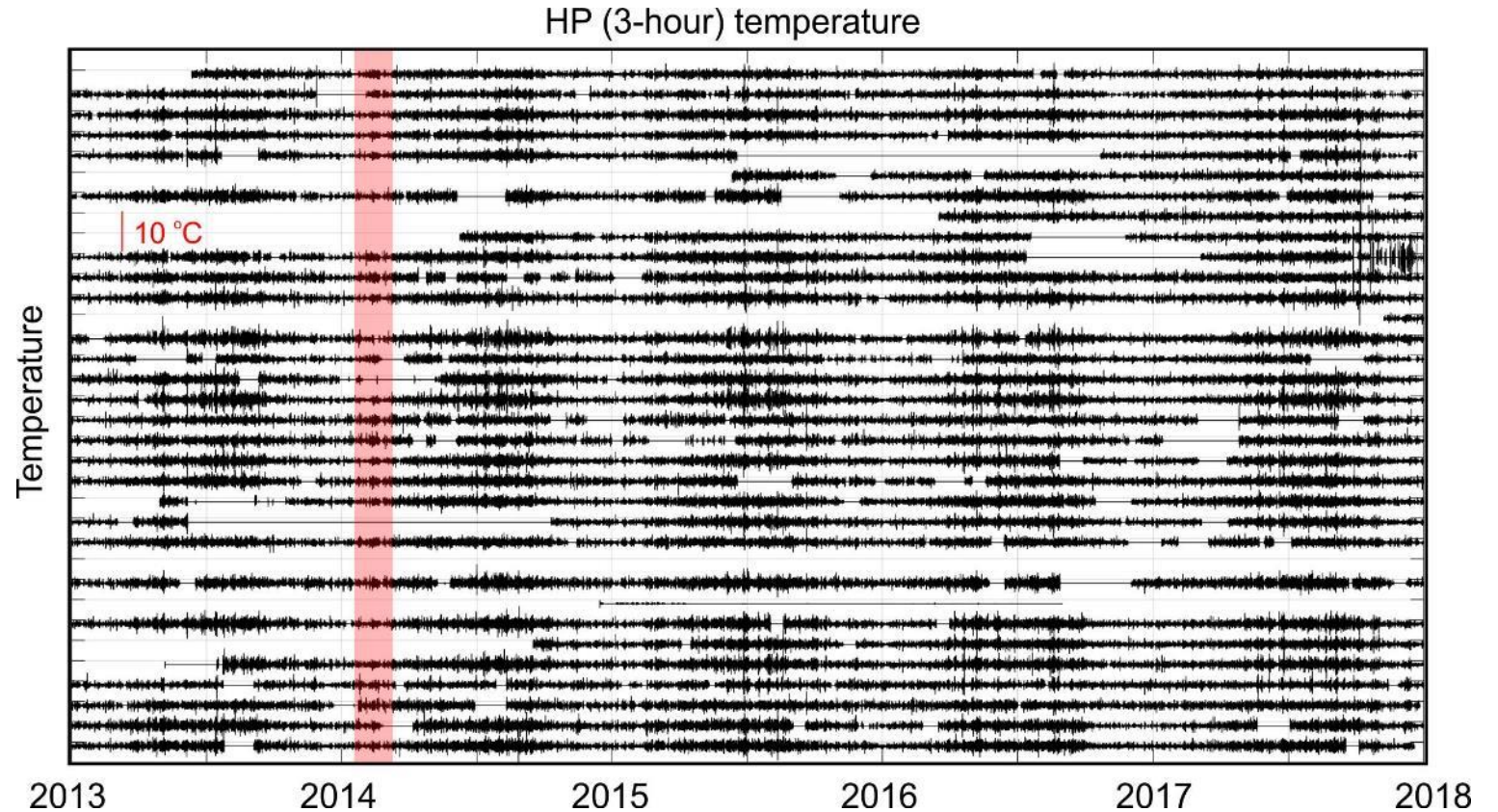
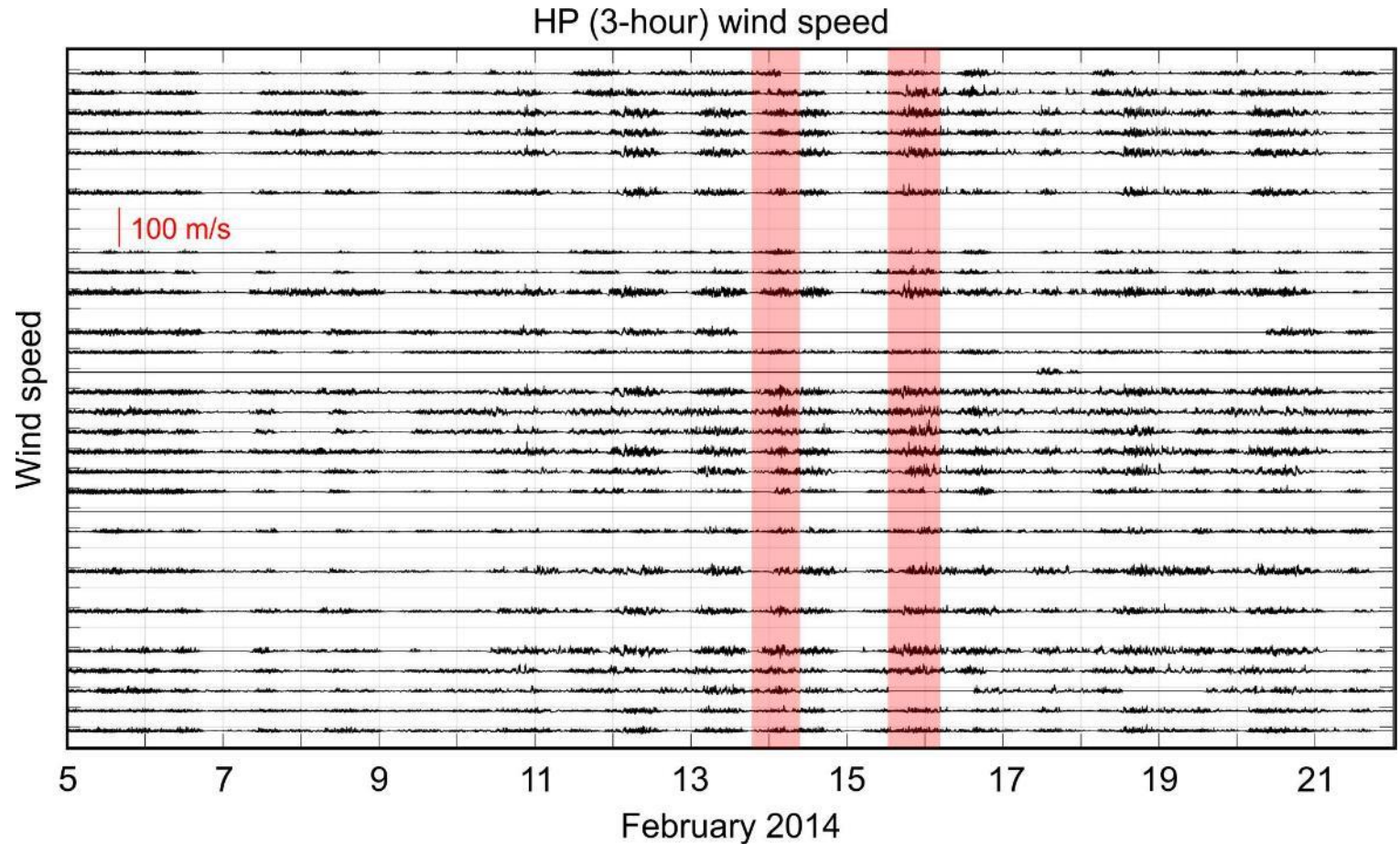- Zoom-in to high activity periods reveals numerous atmospheric pressure oscillations

School network, Victoria, BC, Canada

Šepić et al., in preparation
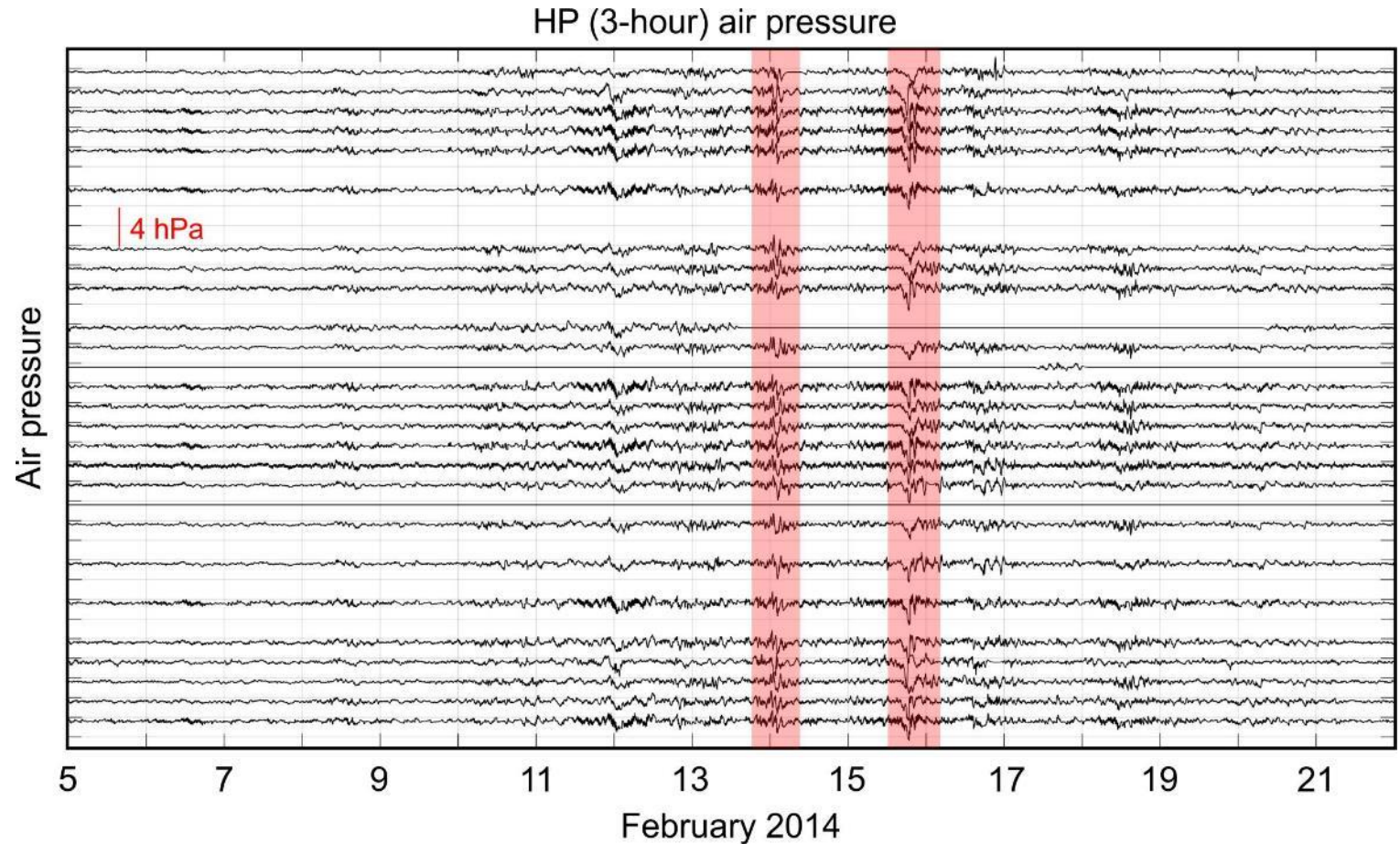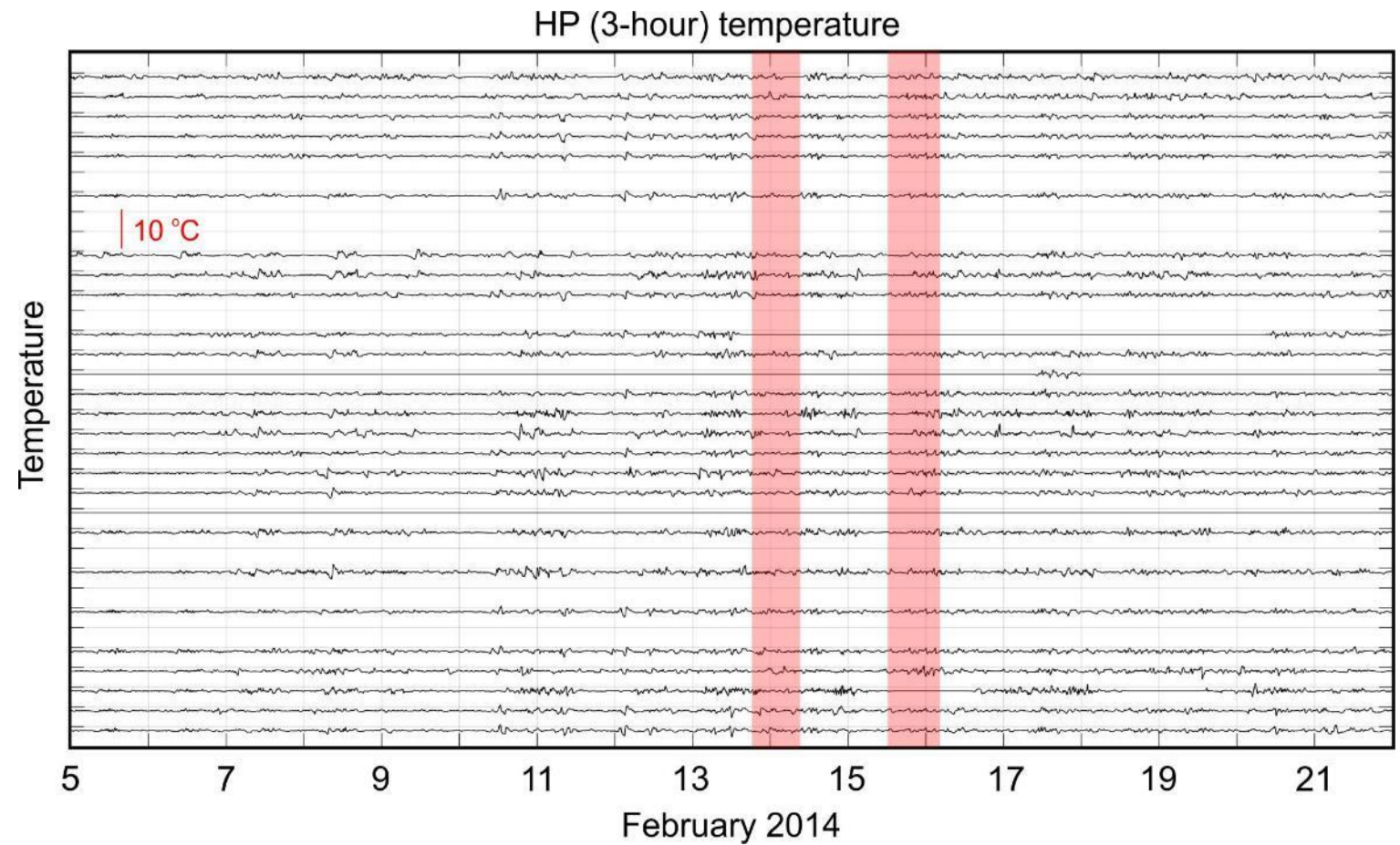
- HF air pressure oscillations expectedly synchronized to HF wind oscillation

School network, Victoria, BC, Canada

HP (3-hour) wind speed

100 m/s

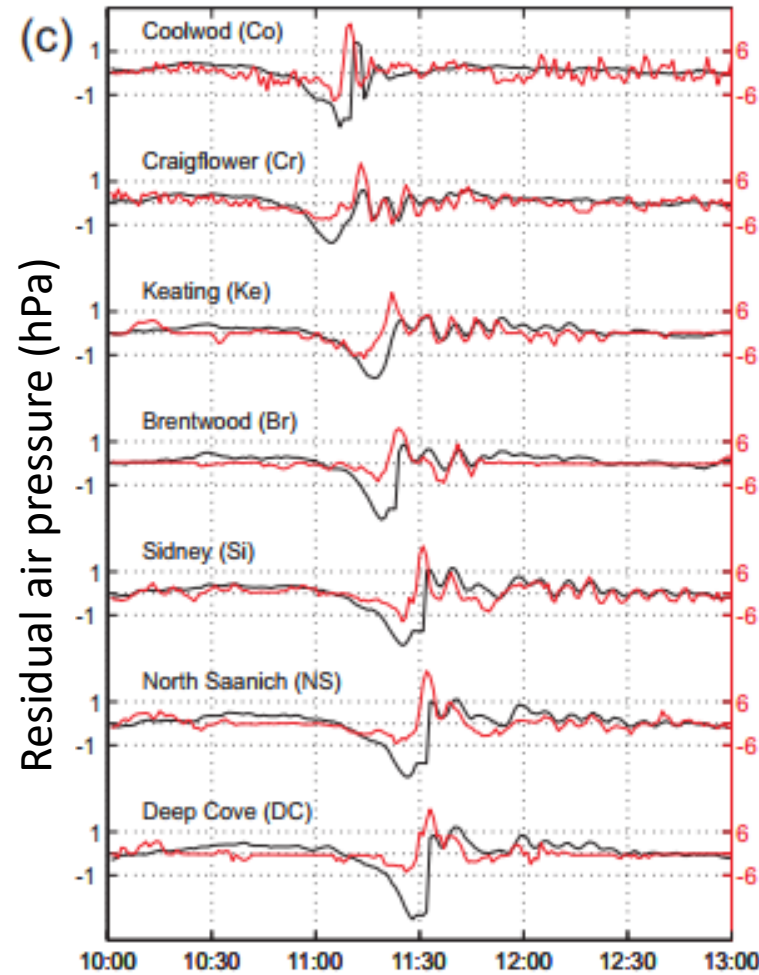Wind speed

5   7   9   11   13   15   17   19   21

February 2014

Šepić et al., in preparation

- But not necessarily to temperature oscillations…

School network, Victoria, BC, Canada

HP (3-hour) temperature

Šepić et al., in preparation
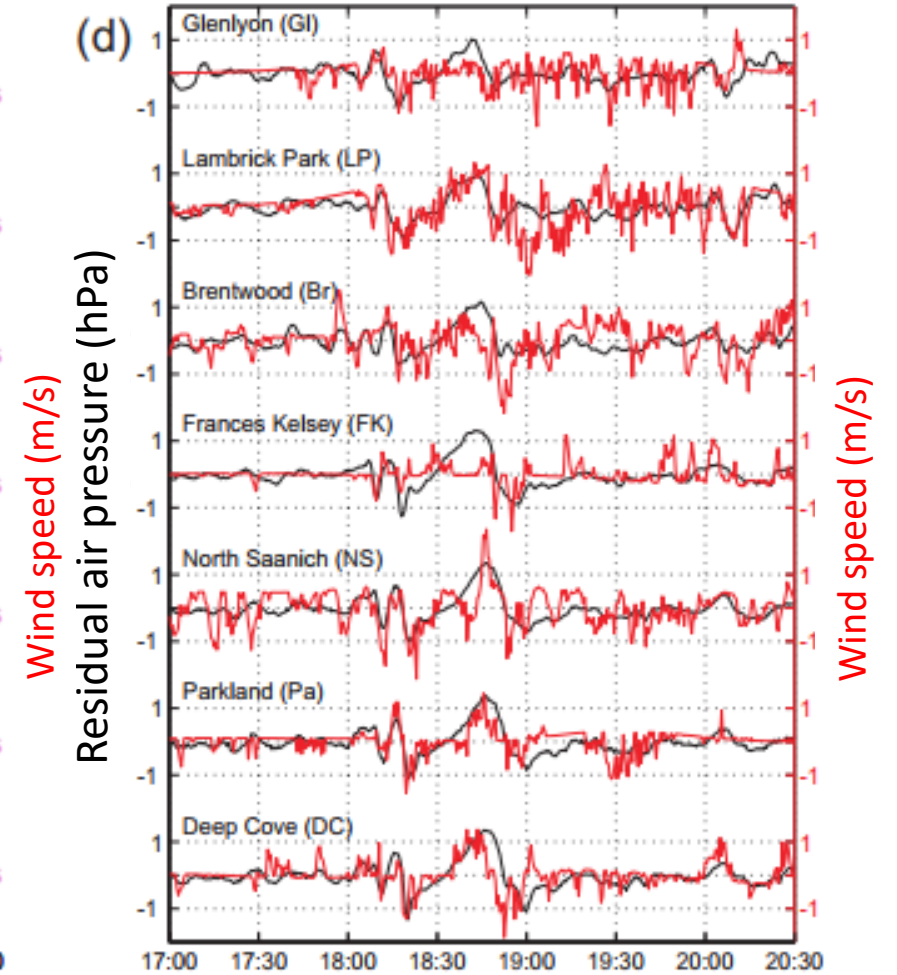
Focus to two meteotsunami generating air pressure disturbances, 13 July 2017 & 17 October 2009
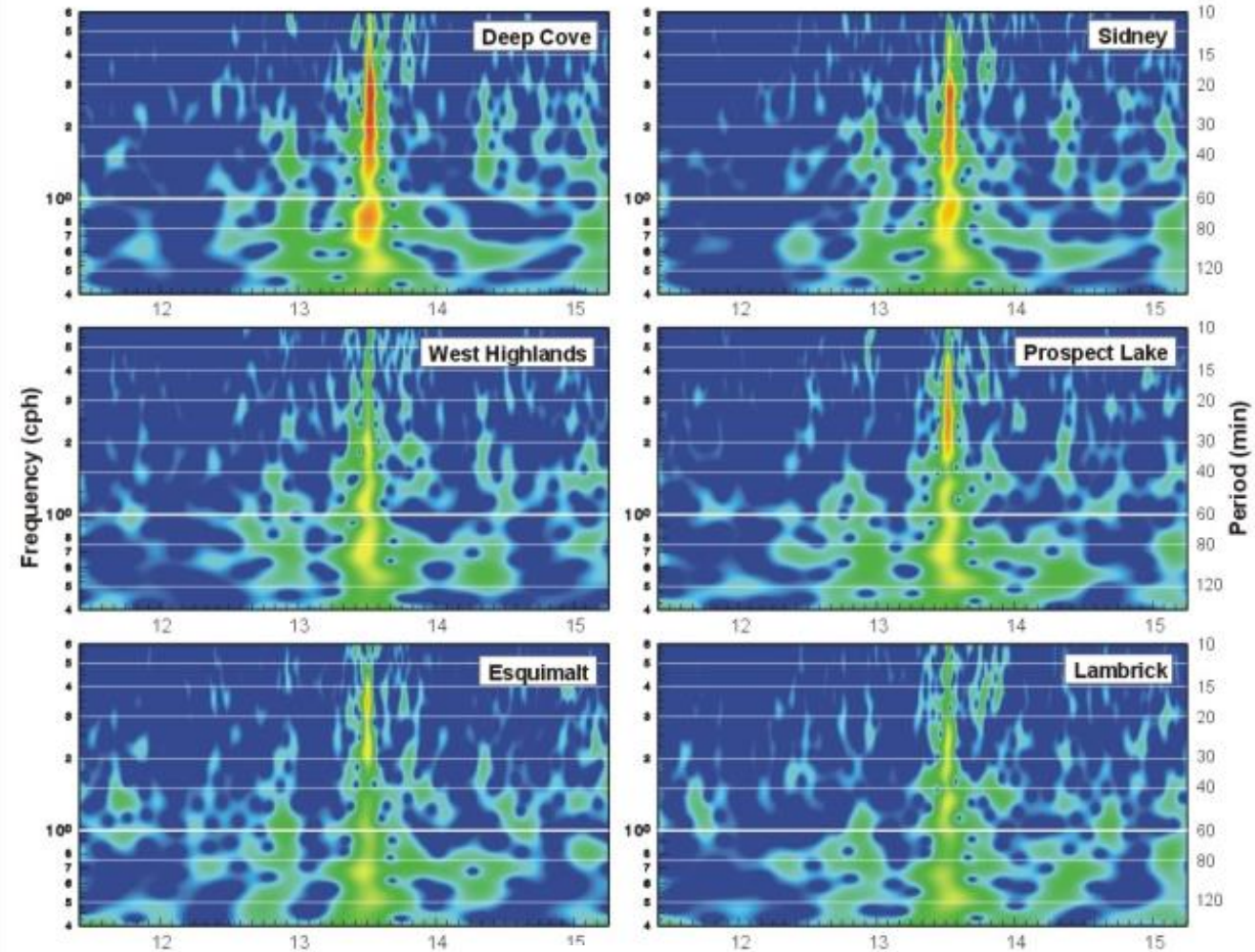
School network, Victoria, BC, Canada

Šepić et al., in preparation

High-quality data which allows for fine measuring and capturing of atmospheric pressure disturbances.

School network, Victoria, BC, Canada

July 2007
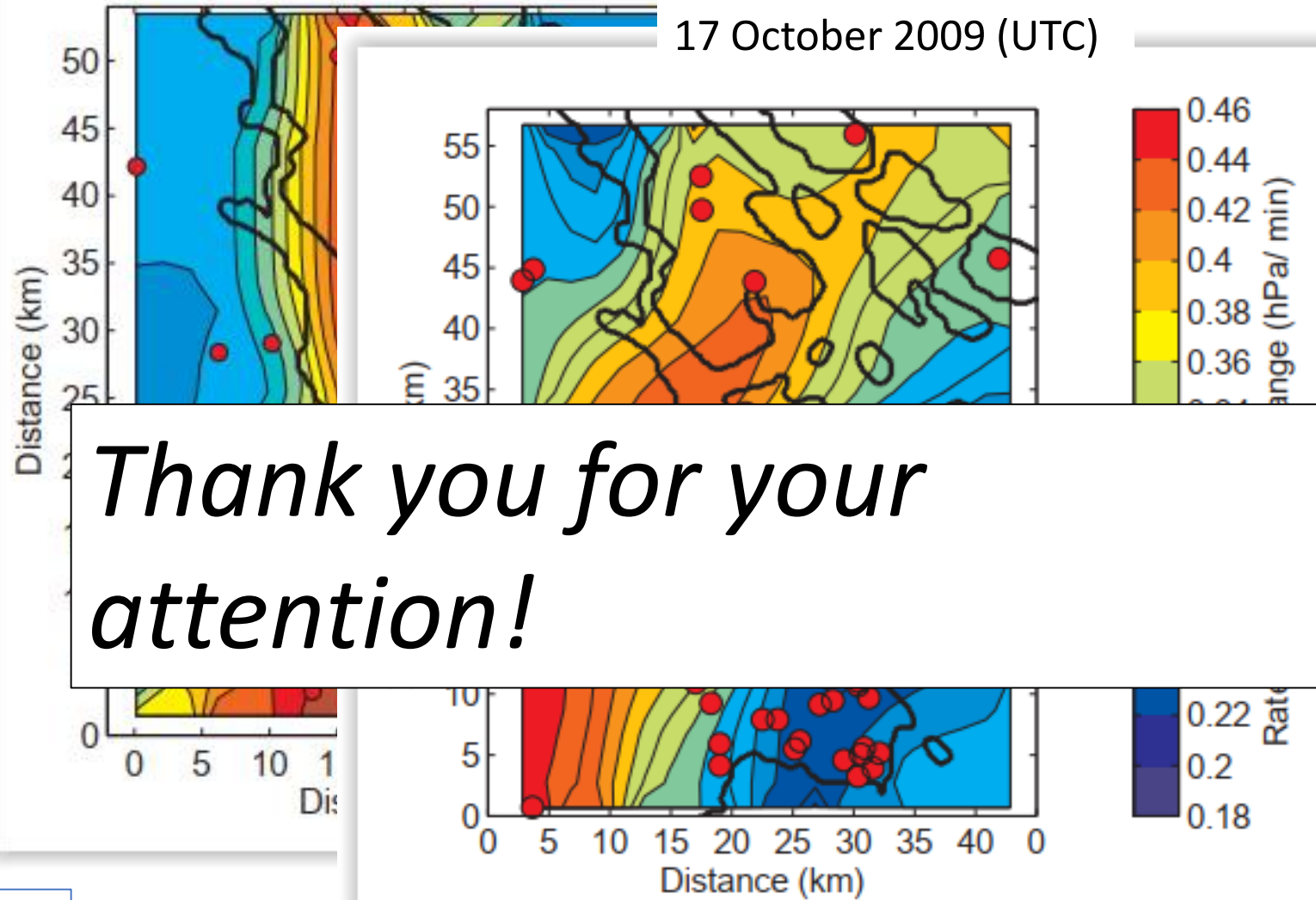
Maximum rates of air pressure change reveal high spatial variability of air pressure disturbances.

13 July 2007 (UTC)

17 October 2009 (UTC)

School network, Victoria, BC, Canada

Thank you for your attention!

Šepić et al., in preparation

The First World Conference on Meteotsunamis

- Split, 8 – 11 May 2019

- www.izor.hr/mts2019

- Programme:

  1. Meteotsunami observations
  2. **Atmosphere-ocean modelling for meteotsunamis**
  3. **Physics of meteotsunamigenic disturbances**
  4. **Atmosphere-ocean interactions and ocean processes**
  5. **Climatology of meteotsunamis**
  6. Meteotsunamis forecasting and developing early warning systems
  7. Hazard and risk assessment and socio-econmic aspects

Vela Luka, 21 June 1978

Doktorand u Splitu

- Traži se doktorand za rad na Institutu za oceanografiju i ribarstvo

- Projekt ADIOS (The Adriatic decadal and interannual oscillations: observations, modelling and consequences)

- Tema: Analiza dugoročne atmosfersko-oceanske simulacije združenim modelarskim sustavom AdriSC (WRF + ROMS) (1987 – 2017)

- Mentor: Ivica Vilibić (vilibic@izor.hr)