VIrtual centre for
DIstributed atmospheric
Sensing for reduction of pollution pressures

https://vidis-project.org/

This project has received funding from the European Union's Horizon 2020 Research and Innovation programme under grant agreement No 952433.

VIDIS partners

Coordinator and partners

- Vinča Institute of Nuclear Sciences - VINCA
- Norwegian Institute of Air Research - NILU
- Italian National Agency for New Technologies, Energy and Sustainable Economic Development - ENEA
- Queensland University of Technology - QUT

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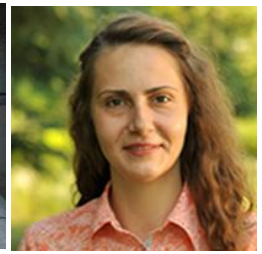
VIDIS core team

VINČA INSTITUTE OF NUCLEAR SCIENCES
University of Belgrade
NATIONAL INSTITUTE OF THE REPUBLIC OF SERBIA



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Saverio de Vito
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QUT


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VINČA overview

Today Vinca is leading institution for high-quality science in Serbia, a place where multidisciplinary approach to research is enabled by its internal organization and established practices. More than 500 researchers and Ph.D students working on multidiscplinary projects in fundamental and applied research govern by idea from innovation to commercialization through technology development projects.

Research at the Institute covers the following areas: physics, chemistry, biology, power engineering and technology, radiation and environmental protection, production of radiopharmaceuticals, accelerator science, and nanoscience.

Vinča Institute has developed international cooperation with scientific institutions all over the world. Researchers at the Institute collaborate on more then 60 international projects classified in the following programs: EU FP7, EU H2020, COST, IAEA, Bilateral, EUREKA, ERAZ, NATO.

https://www.vin.bg.ac.rs/en/science/projects/international-projects

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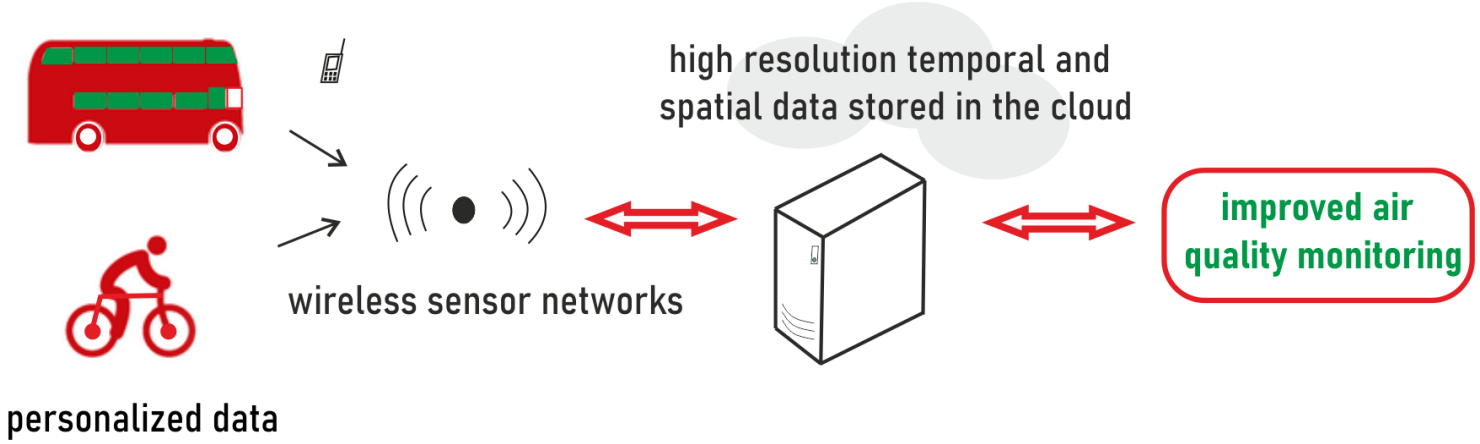
VIDIS overview

Despite decades of positive development air quality still poses a challenge to health, ecosystems and climate in Europe, ….

In last decades the remote and in-situ observing technologies have undergone major developments:

- new potent ICT infrastructures have emerged
- low-cost sensing technologies have enabled a paradigm shift in air quality monitoring, triggering new research needs and opportunities in order to underpin the new capabilities.



VIDIS will develop strategic partnership of VINCA Institute (Serbia) with leading international counterparts known for research on low-cost sensing: ENEA (Italy), NILU (Norway), QUT (Australia). VIDIS will establish scientific collaboration and networking and generate new knowledge that will allow the society to meaningfully utilize the new technologies, e.g., the emerging democratized data collection.

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VIDIS overview

VINCA is recognized in atmospheric research and in-situ monitoring including low-cost technologies.

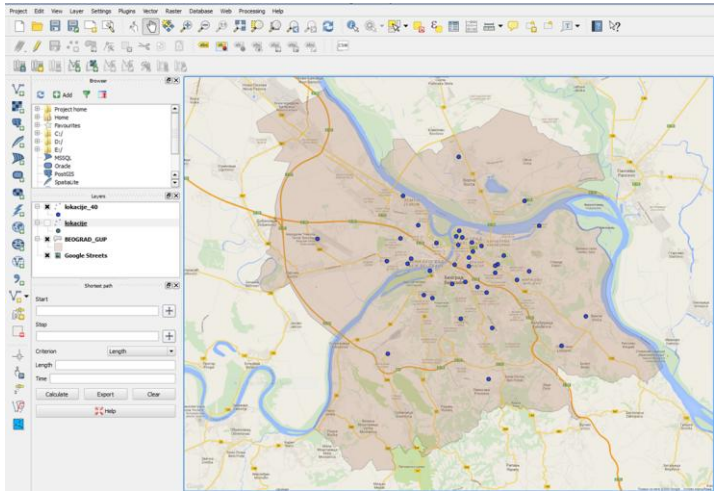
In order to fully capitalize on and improve this expertise, there is a need to establish a strategic partnership with institutions excellent in areas VINCA has been pursuing. VIDIS will improve **observing capabilities** and **develop quality systems needed to ensure meaningful data integration**. It will develop **artificial intelligence and machine learning methods** allowing to integrate the new types of data into existing information systems.

Building on methods and data collected **from ongoing projects of all partners**, VIDIS will establish collaborative research, education, training and dissemination activities, **early stage researcher training and mobility, and support early stage researcher career development** also in research administration and stakeholder contact.

This will increase the innovation capacities of VINCA and partners, improve VINCA's collaborative potential, and contribute to excellence of European research and innovation.

FP7 CITI-SENSE project (2012-2016): Campaigns in Belgrade

Zeleno brdo-SEPA,2015



Placement of static sensor nodes in a location, Belgrade, 2016

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VIDIS aim and objectives

Overall aim	Develop and implement VIDIS as an **internationally recognized research and innovation centre** that **serves as a research hub and support to society on air quality monitoring**, assessment and management, enabled by innovative observing technologies.
Specific objectives	- **Develop long-term strategy** and recognition for the VIDIS centre, - **Secure funding for the VIDIS centre**, especially for activities in the Widening country, - **Enhance research and scientific skills of partners** and in general by training activities, **targeting scientific staff and primarily, early stage researchers.** - **Enhance skills in scientific and administrative management**, primarily of the Widening country, - **Enhance the scientific visibility of partners** through scientific publishing and dissemination, - **Enhance societal uptake of the latest research and innovation** outcomes by outreach activities targeting civil society and administrations on all levels

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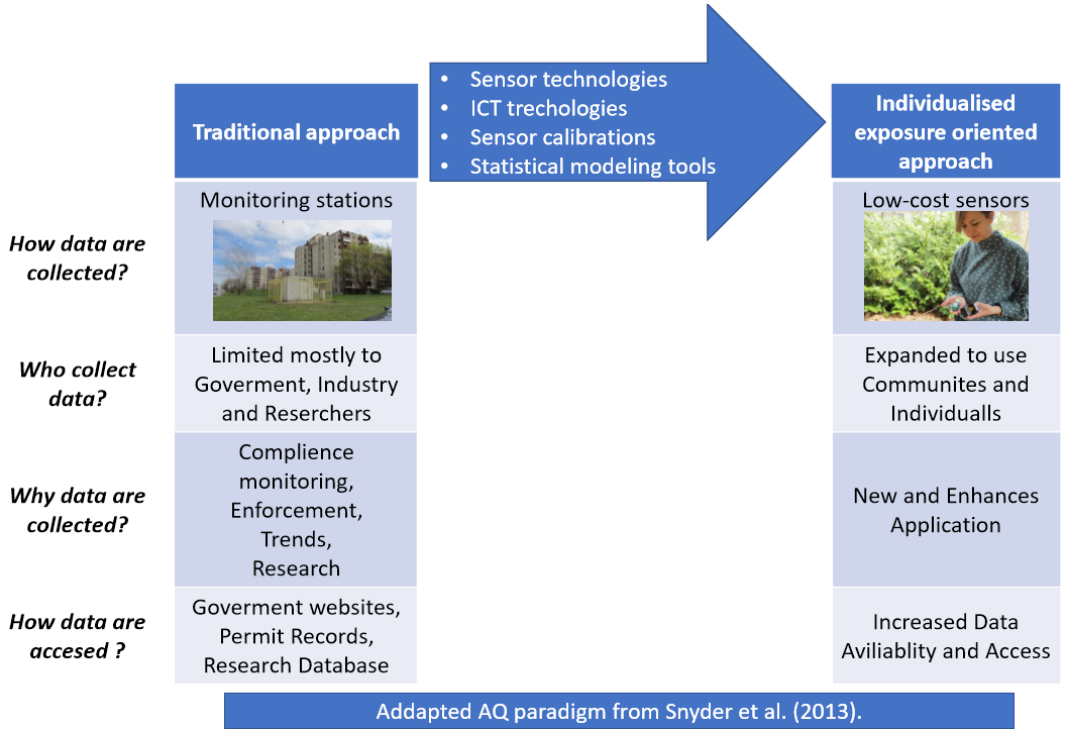
VIDIS project concept



VIDIS will work in a multidisciplinary nexus of research areas required to underpin air quality management, exploiting the possibilities provided by the new monitoring paradigm enabled by the emergence of low- cost sensors for ambient air quality.

Low cost sensor systems were recently added as an additional observing tool to already existing assessment methods such as :

- compliance/regulatory environmental monitoring
- environmental models/atmospheric dispersion models
- remote sensing
- other observing capabilities
- data mining

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VIDIS project concept

Research is required in order to develop methods how these new capabilities can enhance existing assessment and information systems:

- Development of networks of low-cost sensor systems as observing instruments for indoor and outdoor air monitoring
- **Development of ad-hoc network deployment guidelines** encompassing the novel challenges of pervasively and targeting high resolution air quality information
- Development of communication infrastructure enabling harvesting data from such networks and their further management
- **Development of scientifically based calibration and quality control methods**
- **Development of experimental capabilities** to assess performance of low-cost sensor systems, **including chamber for laboratory testing** of gases and particulate matter
- **Development of new public information products** including spatial mapping using combined information

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VIDIS project aspects

VIDIS will work around providing **actionable knowledge** for development of health relevant ambient particulate matter monitoring. **Exposure assessment is the link between human health and the environment**. We will focus on **exposure to ambient air particulate matter on both the population and the individual levels**, with special focus on urban areas. We aim to **reduce knowledge gaps** in the following aspects:

- Composition of PM in urban areas of Serbia and the Western Balkan Countries
- Monitoring and measurement technologies for improved exposure assessment (using a wide variety of technologies)
- Health risks quantification from exposure to ambient particulate matter in Western Balkan
- Development of sensor networks as observing instruments for indoor and outdoor air monitoring, radon monitoring
- Development of communication infrastructure
- Development of scientifically based calibration and QA/QC methods
- Chamber for laboratory testing of PM
- Development of new public information products including spatial mapping using combined information from various sources
- Development of methods to support management of air quality and co-benefits between air pollution abatement and climate change mitigation on municipal level.

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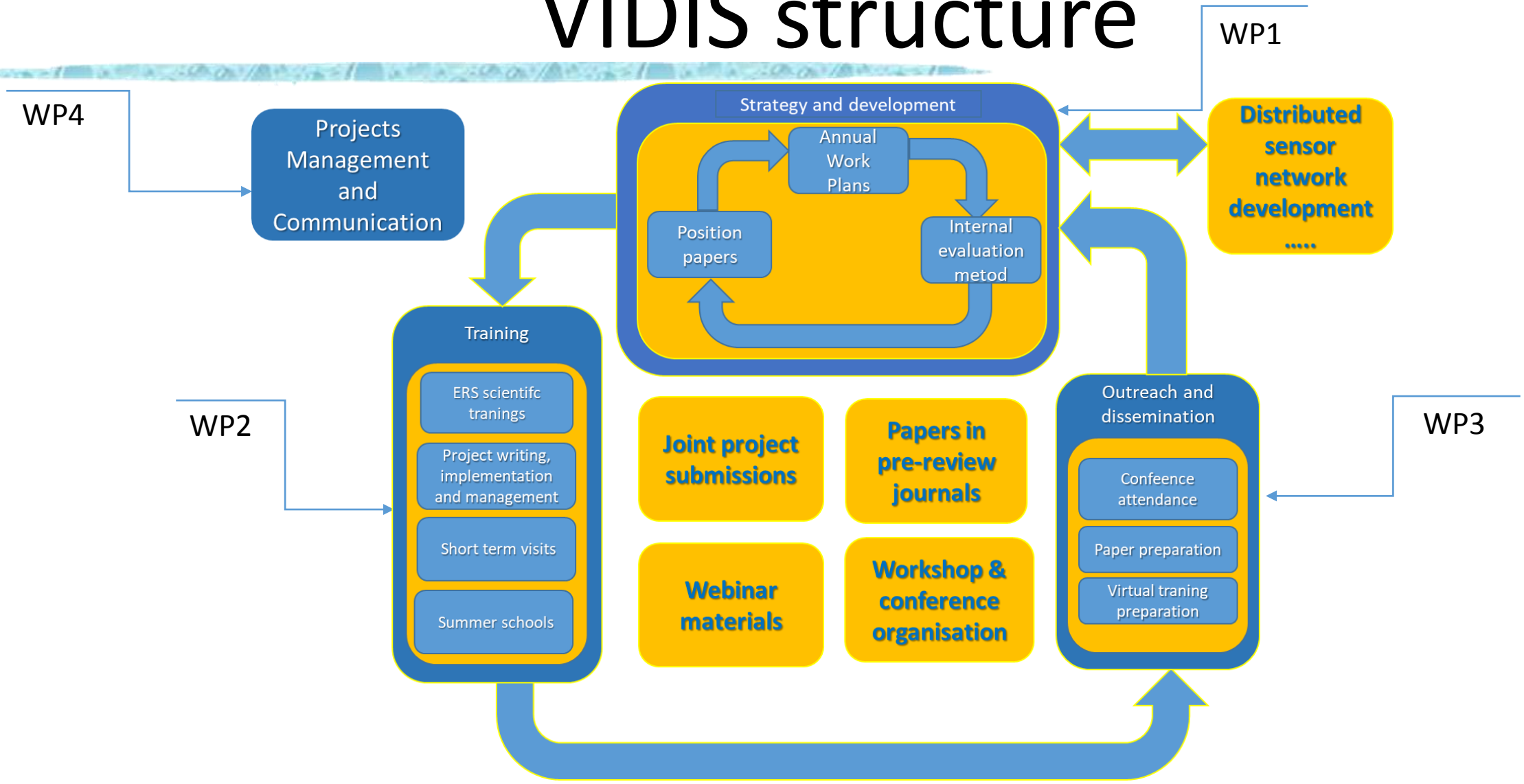
VIDIS structure



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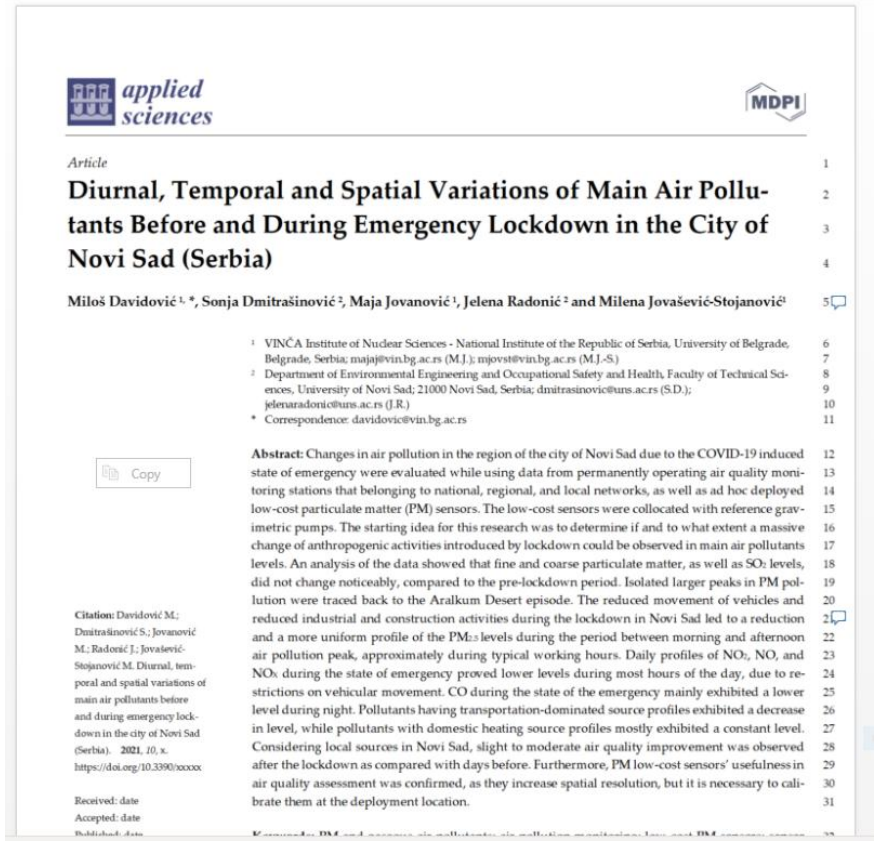
The first VIDIS project result

Recently accepted paper



applied sciences

MDPI

Article

Diurnal, Temporal and Spatial Variations of Main Air Pollutants Before and During Emergency Lockdown in the City of Novi Sad (Serbia)

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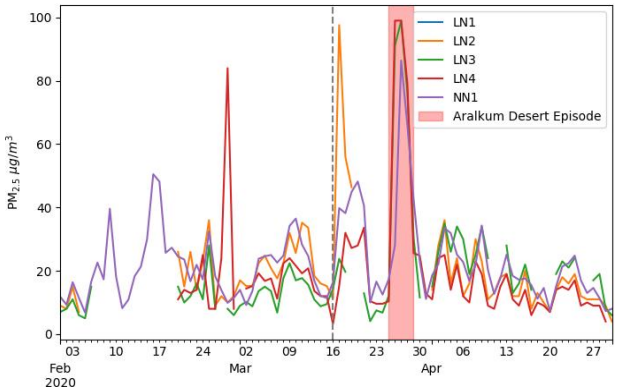
[2] Department of Environmental Engineering and Occupational Safety and Health, Faculty of Technical Sciences, University of Novi Sad; 21000 Novi Sad, Serbia; dmitrasinovic@uns.ac.rs (S.D.); jeleraradonic@uns.ac.rs (J.R.)
* Correspondence: davidovic@vin.bg.ac.rs

Abstract: Changes in air pollution in the region of the city of Novi Sad due to the COVID-19 induced state of emergency were evaluated while using data from permanently operating air quality monitoring stations that belonging to national, regional, and local networks, as well as ad hoc deployed low-cost particulate matter (PM) sensors. The low-cost sensors were collocated with reference gravimetric pumps. The starting idea for this research was to determine if and to what extent a massive change of anthropogenic activities introduced by lockdown could be observed in main air pollutants levels. An analysis of the data showed that fine and coarse particulate matter, as well as SO_2 levels, did not change noticeably, compared to the pre-lockdown period. Isolated larger peaks in PM pollution were traced back to the Aralkum Desert episode. The reduced movement of vehicles and reduced industrial and construction activities during the lockdown in Novi Sad led to a reduction and a more uniform profile of the $PM_{2.5}$ levels during the period between morning and afternoon air pollution peak, approximately during typical working hours. Daily profiles of NO_2, NO, and NO_x during the state of emergency proved lower levels during most hours of the day, due to restrictions on vehicular movement. CO during the state of the emergency mainly exhibited a lower level during night. Pollutants having transportation-dominated source profiles exhibited a decrease in level, while pollutants with domestic heating source profiles mostly exhibited a constant level. Considering local sources in Novi Sad, slight to moderate air quality improvement was observed after the lockdown as compared with days before. Furthermore, PM low-cost sensors' usefulness in air quality assessment was confirmed, as they increase spatial resolution, but it is necessary to calibrate them at the deployment location.

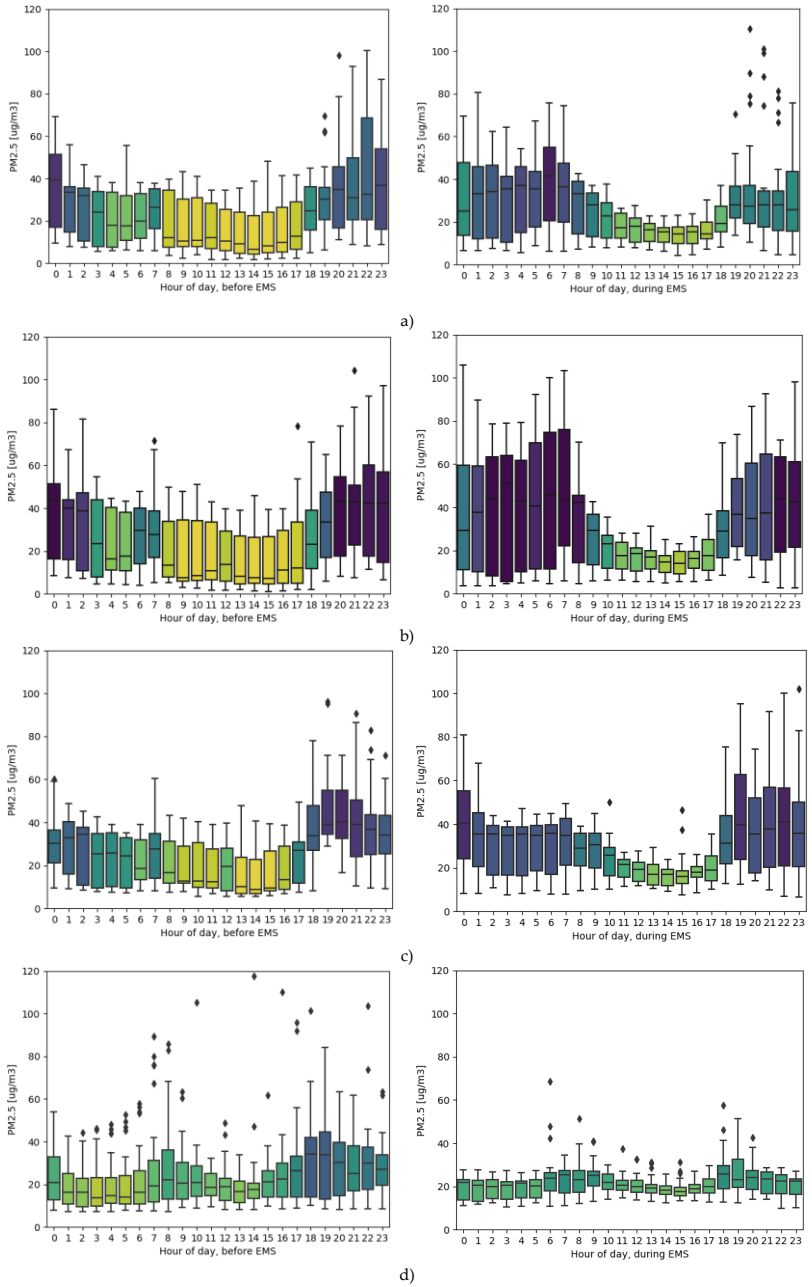
Citation: Davidović M.; Dmitrašinović S.; Jovanović M.; Radonić J.; Jovašević-Stojanović M. Diurnal, temporal and spatial variations of main air pollutants before and during emergency lockdown in the city of Novi Sad (Serbia). **2021**, *10*, x. https://doi.org/10.3390/xxxxx

Received: date
Accepted: date



Daily concentrations at sites belonging to national and local monitoring networks before and after entering the state of emergency (dashed gray line PM2.5

Daily profile of PM2.5 measured with low-cost sensors before measures of the state of emergency (left) and during measures of the state of emergency (right) at a) MS1 b) MS2 c) MS3 d) MS5.



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VINČA in H2020 and FP7

VINCA IN HORIZON 2020	VINCA IN FP7
1. NanoTBTech Nanoparticles-based 2D thermal bioimaging technologies ID: 801305, Coordinated in: Portugal, Programme: H2020-EU.1.2.1. 2. NCPs CaRE National Contact Points for Climate action, Raw materials, Environment and Resource Efficiency ID: 642025, Coordinated in: Germany, Programme: H2020-EU.3.5. 3. KeepWarm Improving the performance of district heating systems in Central and East Europe ID: 784966, Coordinated in: Germany, Programme: H2020-EU.3.3.7., H2020-EU.3.3.1. 4. VIDIS VIRTUAL CENTRE FOR DISTRIBUTED ATMOSPHERIC SENSING FOR REDUCTION OF POLLUTION PRESSURES ID: 952433, Coordinated in: Serbia, Programme: H2020-EU.4.b. 5. E-JADE Europe-Japan Accelerator Development Exchange Programme ID: 645479, Coordinated in: Switzerland, Programme: H2020-EU.1.3.3.	1. FIBONACCI The FIBONACCI Project - Large scale dissemination of inquiry based science and mathematics education ID: 244684, Coordinated in: France, Programme: FP7-SIS 2. PURGE Public health impacts in URban environments of Greenhouse gas Emissions reduction strategies ID: 265325. Coordinated in: United Kingdom, Programme: FP7-ENVIRONMENT 3. FUNCFOOD IMPACT OF AGENTS WITH POTENTIAL USE IN FUNCTIONAL FOODS ON BIOMARKERS FOR INDUCTION OF AGE RELATED DISEASES ID: 245030, Coordinated in: Sweden, Programme: FP7-KBBE 4. MAGBIOVIN Strengthening of the MagBioVin Research and Innovation Team for Development of Novel Approaches for Tumour Therapy based on Nanostructured Materials ID: 621375, Coordinated in: Serbia, Programme: FP7-REGPOT 5. OPERRA Open Project for the European Radiation Research Area ID: 604984, Coordinated in: France, Programme: FP7-EURATOM-FISSION 6. CITI-SENSE Development of sensor-based Citizens' Observatory Community for improving quality of life in cities ID: 308524, Coordinated in: Norway, Programme: FP7-ENVIRONMENT

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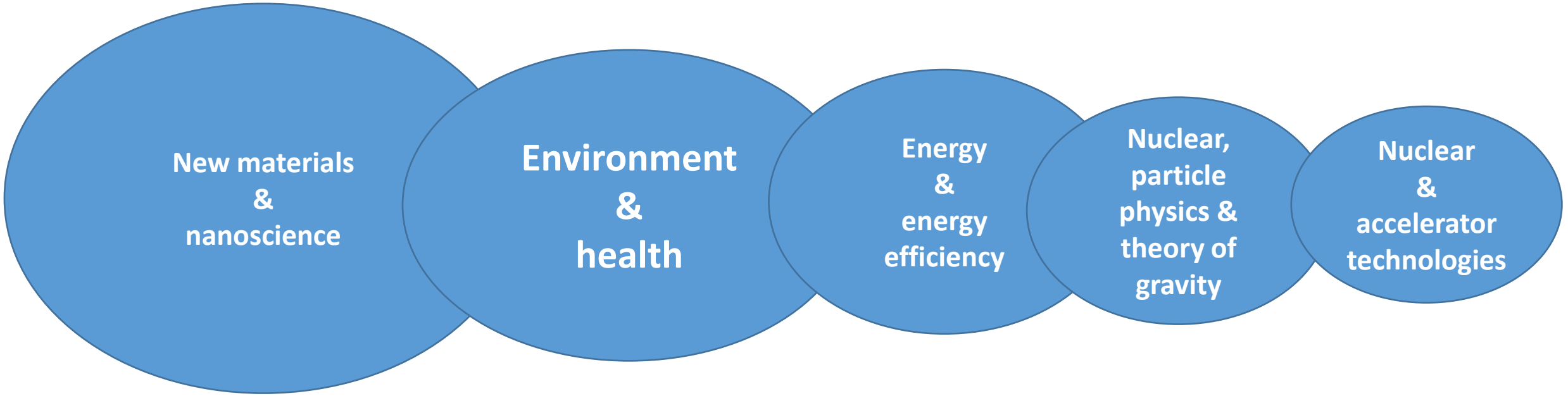
Current research programs



VIDIS main goal	Develop and implement an internationally recognized research and innovation centre through strengthening existing and build new research capabilities in atmospheric monitoring and exposure assessment in the participating institutions, in particular the coordinating institute, VINCA, activities.

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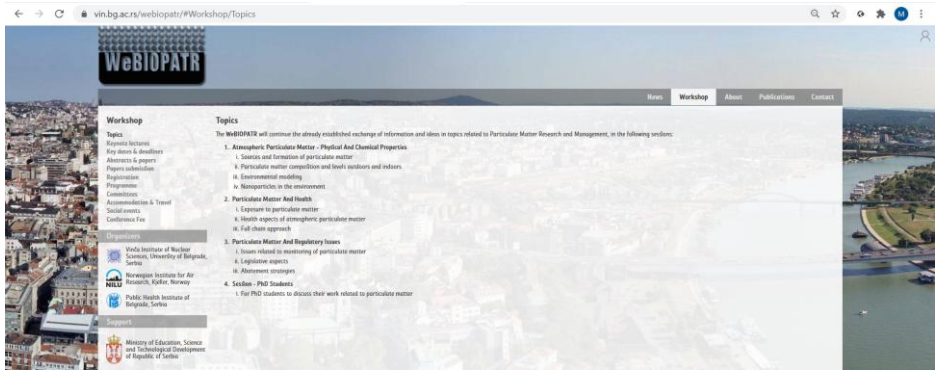
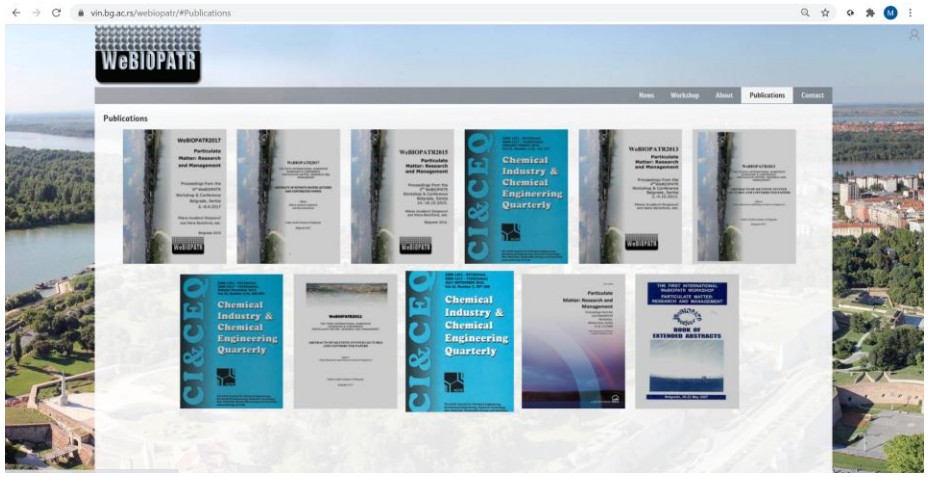
Previous research related to VIDIS

Project title	*Outdoor concentration, size distribution and composition of respirable particles in WB urban areas - WeBIOPATR*
Duration	2006-2009
Funding agency	Research Council of Norway through Norwegian Cooperation Programme on Research and Higher Education with countries in the Western Balkans in 2006-2009.
Partner(s)	NILU, VINCA
Description	In the framework of WeBIOPATR project it was established monitoring methods and procedures for respirable PM (metals, cations and anions, PAHs) for measurements of PM10, PM2.5 according to relevant international standards (EN, EPA) as well as appropriate gravimetric measurements of PM1. Eight measuring campaigns were performed at one site in Belgrade located next to AMS that belong to local network. Statistical analyses was attempted for sources identification and attribution, source apportionment, based on data collected from campaigns in heating and non-heating season. It was start with organization international workshops in the aim of dissemination up-to-date information both to scientific community in Serbia and to the authorities about PM research and management.
VIDIS relevance	**Establishment of the WeBIOPATR international conference series running now every second year (latest in 2019).**





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Previous research related to VIDIS

Project title	*Characterization of respirable particulate matter in outdoor and indoor environment in Serbia*
Duration	2008-2010
Funding agency	Ministry of Education, Science and Technological Development of Republic of Serbia
Partner(s)	VINCA
Description	The main aim of project was to analyse PM pollution in indoor and outdoor ambient in selected cities in Serbia (Bor, Nis and Belgrade). Seasonal campaigns of collecting PM in town of Bor located in vicinity of copper smelter were done. Beside that there were performed campaigns of collecting PMs in indoor and outdoor of kindergartens in Bor and Belgrade and at faculty in Nis.
VIDIS relevance	• Source identification using positive matrix factorization (PMF), diagnostic ratios for priority PAHs, for indoor and outdoor environment in urban areas with dominant traffic pollution. • The project provides necessary background data for selecting strategies for personal exposure monitoring in hot spot areas

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Previous research related to VIDIS

Project title	*An integral study to identify regional genetic and environmental risk factors for the common non-communicable diseases in human population in Serbia-INGEMA_S*
Duration	2011-2019
Funding agency	Ministry of Education, Science and Technological Development of Republic of Serbia.
Partner(s)	VINCA
Description	This project in multidisciplinary and regional genetic and environmental risk factors for the common non-communicable diseases in human population in Serbia. Thus, the project is organized as complex one with working groups divided by topics related to type of both disease and environmental exposure, followed by ethical and life style aspect too. The questions are: a) if the environmental exposure is equal for individuals within some population group why they suffered different diseases or if they are from different population groups why frequency of same disease is different, and b) if the genomic structure of certain either individuals or population groups is a very similar, why they suffered different diseases?
VIDIS relevance	• Source identification using positive matrix factorisation (PMF), diagnostic ratios for priority PAHs, in 3 different sites in Belgrade Metropolitan • Benzo[a]pyrene toxicity equivalent level and lifetime lung cancer risk used for HIA • Reactive Oxidative Species analyses • Respirable PM in wide range of fraction data collecting

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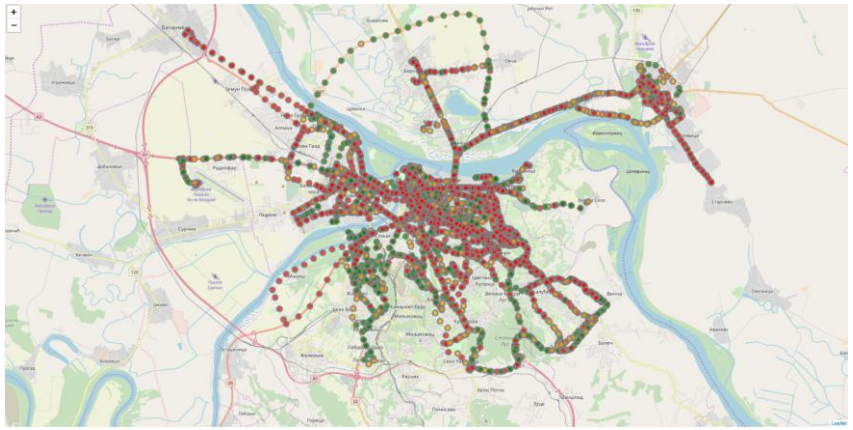
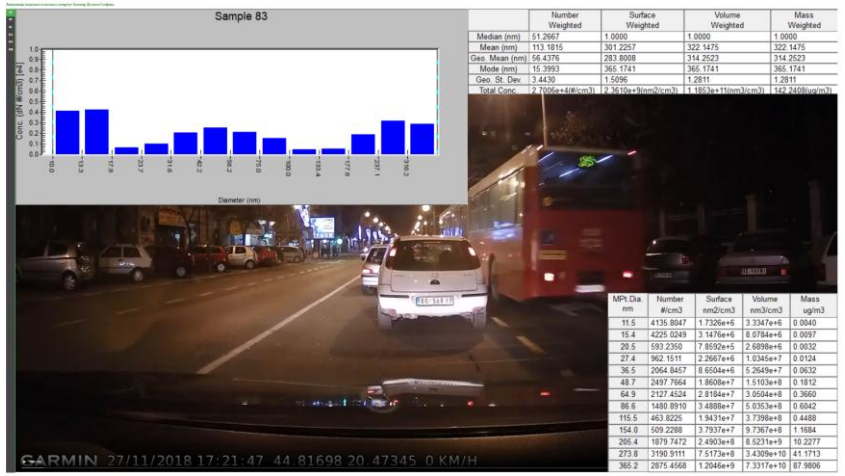
Previous research related to VIDIS

Project title	*Temporal variations and spatial characteristics of the presence of volatile organic compounds and atmospheric particles in the wider Belgrade area* *- Realization of a campaign of fixed and mobile data collection during the heating season with analytical instruments of minute resolution-BeoAirDATA*
Duration	2018
Funding agency	Ministry of Environmental Protection of the Republic of Serbia

Partner(s)	VINCA
Description	With the cooperation of partner institutions, in the beginning of 2018, a two-month campaign for measuring a large number of volatile organic compounds and atmospheric particles over a wide diameter range (5-10000 nm) was carried out at a fixed measuring site. This campaign was focus on beginning of the heating season 2018/2019. with the aim of completing a database on the presence of these specific pollutants in the wider Belgrade area. The measurements are carried out over one month, at three representative fixed locations, influenced by different sources of pollution, and by collecting data from moving vehicles. Data on concentrations of a large number of pollutants in the air and meteorological parameters will enable modeling and creation of air pollution maps in Belgrade, https://vin.bg.ac.rs/beoairdata/.
VIDIS relevance	• Experience in mobile monitoring with state of the art PM monitors and gathering of large amounts of time and position stamped air pollution data • Clearly identified existing shortcomings in large scale data acquisition and need for standardized data postprocessing and methods of calibration, such as on-the-fly calibration





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Experiences in project execution, coping with Covid-19

- Regarding administrative tasks, Vinca promptly assigned Data Protection Officer, as required by EU and H2020 GDPR rules
- Change of REA project officer happened after 5 months
- Organization of upcoming Webiopatr Conference will be influenced by Covid-19 pandemics and imposed restrictions. Currently discussed solution is to organize the conference partly online, partly face-to-face, with a number of prerecorded lectures/presentations.
    - We hope that in this way interest for conference will remain high as prerecorded lectures will enable conference participants to follow presented work more thoroughly.
    - We are considering several possibilities for improvement of dissemination of the Webiopatr and project results

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Thank You for Your Attention!

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