CopHack 2019 Challenges

Contents

Challenge #1 – Agriculture Pasture Management

Title

Agriculture Pasture Management

Category

Agriculture

Short Description

Your challenge is to design a mission to extract the eligibility coefficient of the pastures!

(sub-)Tasks

Use Earth Observation data to:

- identify/detect pastures,
- determine a new methodology using automatic coefficients or indices to measure or evaluate the eligibility of permanent pastures, and
- figure out suitable mechanisms for the renewal of Land-Parcel Identification System (LPIS).

Background

Pasture management is defined as the practice of growing healthy grass and related plants to profitably sustain forage availability and livestock production while ensuring ecological health. Pasture management practices provide strategies for conserving and enhancing native grass, improving forage production, restoring soil quality and quantity, improving plant communities and reducing overall operational costs.

Well-managed pastures contribute significantly to the sustainability of a farm operation and the health of surrounding ecosystems. Moreover, a well-managed pasture is one of the most cost-effective and high value feeds that can be produced and utilized. Pasture management can provide significant benefits including improved forage yields, lower feed costs and improve livestock performance.

More information related to the challenge (such as definitions regarding “pastures”, LPIS and other terms) can be found in the following links:

- http://www.minagric.gr/index.php/el/for-farmer-2/animal-production/voskotopoi-menu/2529-nomothesia-boskotopoi
- https://opekepe.gr/images/olddata/doc/documents/egkuklios_diad_xorhghshs_osdae2018.pdf
- https://www.copernicus.eu/sites/default/files/Info%20Bari/volpe%20pom.pdf
- https://marswiki.jrc.ec.europa.eu/wikicap/index.php/LPIS
- https://www.eca.europa.eu/Lists/News/NEWS1610_25/SR_LPIS_EN.pdf
- https://ec.europa.eu/jrc/en/event/workshop/control-agricultural-land-iacs
- https://ec.europa.eu/jrc/sites/jrcsh/files/25_S9_Rodriguez_PR.pdf
- https://www.esa.int/Applications/Observing_the_Earth/Copernicus/Sentinels_in_the_fields/(print)

Potential Considerations	
For a more detailed and complete mission design, ensure that you consider effective ways to reach your target destination, as well as methods to ensure a sufficient mission "lifetime". Additionally attempt to use an automatic approach, as far as possible.	
Indicative Data Sources	
Pasture productivity	https://ec.europa.eu/jrc/en/science-update/jrc-mars-bulletin-update-pasture-conditions
Soil Biomass Productivity maps of grasslands and pasture	https://esdac.jrc.ec.europa.eu/content/soil-biomass-productivity-maps-grasslands-and-pasture-coplands-and-forest-areas-european
Land Use	https://www.eea.europa.eu/themes/landuse
Data and Maps	https://www.eea.europa.eu/data-and-maps
Agriculture and rural development	https://ec.europa.eu/agriculture/
Sentinel data	https://scihub.copernicus.eu/
Satellite and Digital Elevation Data	https://earthexplorer.usgs.gov/
Corine Land Cover	https://www.eea.europa.eu/data-and-maps/data
Recommended Tools	
• GIS/ image processing	

Challenge #2 – DEMETRA

Title
DEMETRA
Category
Agriculture
Short Description
The goal of this challenge is to develop a process (partially or, ideally, totally automated) that would use Earth observation satellite data and data from other sources to identify land that, currently, is unused or underutilized and has the potential to be put into agricultural production or, if that is already the case, to be classified as land that has higher potential for production. The quest of the challenge, therefore, is to discover land for extra agricultural production and, ideally, the type of cultivation that is promising.
(sub-)Tasks
The challenge involves (indicatively): • Classification of (mainly non-urban) areas according to their current land use • Determination of the optimum (maximum economic yield) vegetation types per area taking into consideration climate, soil, topography and other relevant factors • Identification of the areas of maximum potential for intervention based on the outcomes of the previous two subtasks.
Background
As the population of Earth grows and its living standards are rising, the demand for food increases on a global scale. Agricultural land, as the most critical resource in the food production process, is becoming scarce and would become scarcer as future demand for food increases and, in addition, already heavily used agricultural land is depleted. There is an essential motivation, therefore, to have a process that, on a regular basis, would monitor Earth, assess existing land uses (particularly those related to agriculture), and determine the locations of (mainly abandoned) land that is suitable for cultivation or improved agricultural utilization. Related (indicative) background literature: • https://publications.jrc.ec.europa.eu/repository/bitstream/JRC80540/lb-na-26500-en-n%20.pdf • https://www.gatesnotes.com/Development/Tuning-up-photosynthesis-to-feed-the-world?WT.mc_id=10_18_2019_10_RIPE_BG-LI_&WT.tsrc=BGLI
Potential Considerations
The challenge, at the beginning, may be restrained at a local scale in order to simplify the task and maximize the chances for developing a prototype that would prove the concept.

Indicative Data Sources	
Data and Maps	https://www.eea.europa.eu/data-and-maps
Agriculture and rural development	https://ec.europa.eu/agriculture/
Sentinel data	https://scihub.copernicus.eu/
Corine Land Cover	https://www.eea.europa.eu/data-and-maps/data
Land Use	https://www.eea.europa.eu/themes/landuse
Digital elevation data (EU-DEM)	https://www.eea.europa.eu/data-and-maps/data/copernicus-land-monitoring-service-eu-dem
Edaphological (soil) data	http://www.digital-geography.com/free-global-soil-grids-1km-resolution/
Climate data	http://www.gisresources.com/weather-climate/

Recommended Tools

- Any available GIS (e.g. QGIS) or Remote Sensing program
  - https://gisgeography.com/free-gis-software/
  - https://gisgeography.com/open-source-remote-sensing-software-packages/

Challenge #3 – ARTEMIS

Title

ARTEMIS

Category

Agriculture

Short Description

This challenge aims at developing prototype applications that would use Copernicus satellite data, in addition to other auxiliary data (e.g. geological), in order to identify areas that have a high potential for afforestation or reforestation. Those areas are either arid or barren or, alternatively, have sparse short forest vegetation and have the potential, with appropriate human intervention, to obtain richer and denser vegetation in order to enhance the absorption of greenhouse gases from the atmosphere. The outcome each time would be a map of the area of interest showing the sub-areas in which afforestation or reforestation with specific types of vegetation is recommended.

(sub-)Tasks

The challenge involves (indicatively):

- Classification of areas according to their current vegetation coverage
- Determination of the optimum (maximum) vegetation types per area taking into consideration climate, soil, topography and other relevant factors
- Identification of the areas of maximum potential for intervention based on the outcomes of the previous two subtasks.

Background

Recent research has shown that the effects of global warming might be mitigated or even reversed, if proper policies for reforestation or afforestation of land were adopted. Although certain countries (e.g. Canada, USA, Russia etc) have a higher potential to contribute towards this goal, yet the contribution of other smaller countries could be significant, particularly if they are taken jointly. This is particularly promising for Greece, where a large portion of the land (~perhaps 40%) does not have heavy forest vegetation (arid, rocky, etc.) and, thus, afforestation of unused land that is not suitable for agriculture with wild vegetation is quite appealing, particularly taking into consideration that the desertification risk of the country is quite high.

Indicative related articles:

- https://www.nature.com/articles/s41597-019-0196-1?fbclid=IwAR3qHf_8-G1V8yxNyyFnD0PKC8HhEpiIJVKuuTl7I8V6axvrw5K5aKWV9_8
- https://ethz.ch/en/news-and-events/eth-news/news/2019/07/how-trees-could-save-the-climate.html

Potential Considerations

Computation of various indices that show the impact of the proposed intervention would be a plus.

Indicative Data Sources	
Data and Maps	https://www.eea.europa.eu/data-and-maps
Agriculture and rural development	https://ec.europa.eu/agriculture/
Sentinel data	https://scihub.copernicus.eu/
Corine Land Cover	https://www.eea.europa.eu/data-and-maps/data
Land Use	https://www.eea.europa.eu/themes/landuse
Digital elevation data (EU-DEM)	https://www.eea.europa.eu/data-and-maps/data/copernicus-land-monitoring-service-eu-dem
Edaphological (soil) data	http://www.digital-geography.com/free-global-soil-grids-1km-resolution/
Climate data	http://www.gisresources.com/weather-climate/

Recommended Tools

- Any available GIS (e.g. QGIS) or Remote Sensing program
  - https://gisgeography.com/free-gis-software/
  - https://gisgeography.com/open-source-remote-sensing-software-packages/

Challenge #4 – i4SEA Maritime Management

Title
i4SEA Maritime Management
Category
Maritime, Tourism
Short Description
This challenge involves innovative ideas and applications combining and processing marine-related data with earth observation data available by Copernicus, in ways that could support sea area monitoring and observation for maritime or tourism purposes. The data may include vessel traffic data, fisheries data, marine environment and meteorological data, geospatial data, etc.
(sub-)Tasks

The challenge involves (indicatively):
 	
• Identification of fishing behaviour of interest
    ○ Clustering of vessel trajectories and detection of outliers based on vessel characteristics (e.g. speed variation, continuous change of direction)
    ○ Prediction of future vessel position
    ○ Vessel accident detection
    ○ Identifying areas of interest (e.g. fishing zones, moorings, ports)
• Fishing fleet dynamics modelling
    ○ Estimation of fishing pressure
    ○ Spatial distribution of fishery production
• Exploitation of marine data for tourist purposes
    ○ Characterization of marine areas based on a combination of fishing and tourist traffic
    ○ Estimation of tourist load based on marine traffic

Background
The i4SEA project is focusing on the design and development of an innovative ICT platform for the collection and analysis of big traffic data, spatial data, environmental data and meteorological data, to support sea area monitoring and observation. The vision is to provide effective and efficient data integration, processing and analysis technologies with the aim to deliver (a) a "Combined Real-time Operational Snapshot", and (b) a "Combined Historical Snapshot" of sea areas. Modelling of the fishing fleet dynamics will also be implemented, under the further exploration of fishing pressure and fisheries production. The project will exploit state-of-the-art IT, and design and develop innovative IT based on in-memory database algorithms, models and methods for parallel computation, and methods for big data analytics. Surveillance of marine areas, in particular to determine the exact position and activity of vessels, is a main challenge for navigation. It has a direct bearing on the maritime economy and the successful implementation of relevant national and European regulatory frameworks. In maritime surveillance, the use of navigation data, which feeds decision-making systems at various levels (business,

environmental, administrative), holds a central role. Furthermore, the exploitation of AIS data in Europe in recent years has allowed for the estimation of the spatial distribution of fishing effort where areas of high fishing pressure can be identified.

Examples of such maritime data are: (a) VMS (Vessel Monitoring Systems) data transmitted by the special devices carried by the fishing vessels, (b) AIS (Automatic Identification System) data transmitted by all vessels having a relative obligation according international navigation rules; (c) data transmitted by electronic maritime surveillance systems (radar, thermal cameras).

Potential Considerations

1. Andrienko G, Andrienko N, Wrobel S (2007) Visual analytics tools for analysis of movement data, ACM SIGKDD Explorations, 9(2): 38-46.
2. Patroumpas K, Artikis A, Katzouris N, Vodas M, Theodoridis Y, Pelekis N (2015) Event Recognition for Maritime Surveillance. In Proc. of EDBT.
3. Pelekis N, Theodoridis Y, Janssens D (2013) On the management and analysis of our lifesteps. ACM SIGKDD Explorations Newsletter.
4. Jeung H, Liu Q, Shen H T, Zhou X (2008) A hybrid prediction model for moving objects. In Proceedings of ICDE.
5. Lee JG, Han J, Li X (2008a) Trajectory outlier detection: A partition-and-detect framework. In Proceedings of ICDE.
6. Bastardie, F., Nielsen, J. R., Ulrich, C., Egekvist, J., Degel, H., 2010.Detailed mapping of fishing effort and landings by coupling fishing logbooks with satellite-recorded vessel geo-location. Fisheries Research 106, 41–53.
7. Hintzen, N.T., Bastardie, F., Beare, D., Piet, G.J., Ulrich, C., Deporte,N., Egekvist, J., Degel, H., 2012. VMStools: Open-source software for the processing, analysis and visualisation of fisheries logbook and VMS data. Fisheries Research, 115–116, 31–43. http://dx.doi.org/10.1016/j.fishres.2011.11.007
8. Kavadas, S., Maina, I., Damalas, D., Dokos, I., Pantazi, M., Vassilopoulou, V., 2015. Multi-criteria decision analysis as a tool to extract fishing footprints: Application to small scale fisheries and implications for management in the context of the maritime spatial planning directive. Mediterranean Marine Science, 16 (2), 294–304. http://dx.doi.org/10.12681/mms.1087
9. Kavadas, S., Barberá, C., Belardinelli, A., Carpi, P., Cataudella, S., Croci, C., D'Andrea, L., Dokos, J., Maina, I., Martinelli, M., Massutí, E., Moranta, J., Parisi, A., Quetglas, A., Russo, T., Santojanni, A., Vassilopoulou, V., 2014. Common methodological procedures for analysis of VMS data, including web-based GIS applications related to the spatial extent and intensity of fishing effort. PERSEUS Project report, ISBN no: 978-960-9798-14-3, pp 40 + annexes.
10. Lee, J., South, A.B., Jennings, S., 2010. Developing reliable, repeatable, and accessible methods to provide high-resolution estimates of fishing-effort distributions from vessel monitoring system (VMS) data. ICES Journal of Marine Science, 67 (6), 1260–1271. http://dx.doi.org/10.1093/icesjms/fsq010.
11. Maina, I., Kavadas, S., Katsanevakis, S., Somarakis, S., Tserpes, G., Georgakarakos, S. 2016. A methodological approach to identify fishing grounds: A case study on Greek trawlers. Fisheries Research, 183, 326–339. https://doi.org/10.1016/j.fishres.2016.06.021
12. Maina, I., Kavadas, S., Damalas, D., Pantazi, M., Katsanevakis, S. 2018. Dynamics of trawling effort in the Aegean Sea: investigating the potential of Vessel Monitoring System (VMS) data. ICES Journal of Marine Science, 75(6), 2265–2275. https://doi.org/10.1093/icesjms/fsy083

13. Russo, T., D'Andrea, L., Parisi, A., Cataudella, S., 2014. VMSbase: An R-Package for VMS and Logbook Data Management and Analysis in Fisheries Ecology. PLoS ONE, 9(6), e100195. http://dx.doi.org/10.1371/journal.pone.0100195
14. Russo, T., Parisi, A., Cataudella, S., 2013. Spatial indicators of fishing pressure: preliminary analyses and possible developments. Ecological Indicators, 26, 141–153. http://dx.doi.org/10.1016/j.ecolind.2012.11.002

Provided Data Sources	
i4sea wiki page	https://gitlab.com/i4sea-edk/i4sea-cophack2019/-/wiki_pages/home
i4sea data	https://gitlab.com/i4sea-edk/i4sea-cophack2019/
Other Indicative Data Sources	
ERS fishery production data for Greece	
AIS traffic data (raw and aggregated)	
Copernicus Satellite Data, Sentinel-5, Sentinel-2, Sentinel-3, Sentinel -1, etc.	
Copernicus Marine Environment Monitoring Service	http://marine.copernicus.eu/
SeaDataNet	https://www.seadatanet.org/
EMODnet	http://www.emodnet.eu/
HELIX Data	https://data.hellenicdataservice.gr/
Recommended Tools	
QGIS, Python, PostgreSQL/PostGIS, Excel, Java	
Special awards	
Three (3) i4SEA prizes (tablets)	

Challenge #5 – THETIS: Watching over our seas and waters

Title
THETIS: Watching over our seas and waters
Category
Maritime, Disasters Risk Management
Short Description
Sustainable management and protection of aquatic ecosystems, both freshwater and marine, are considered essential for preserving and enhancing water quality as well as for mitigating harmful impacts. The aim of this challenge is to propose and design tools and methods for early detection followed by delineation of (potential) disturbances occurring in aquatic ecosystems.
(sub-)Tasks
Exploit and combine modern technologies and satellite datasets and products aiming at: • Early detection of potential hazards (oil spills, cyanosis, thermal anomalies, toxic blooms) in inland and/or coastal waters • Accurate mapping of the resulting 'aesthetic' pollution and disorder. Aesthetic deterioration can be caused by changes in the colour of waters, coastline damage, solid wastes, etc. • The development of an alert (early warning) system (this can be an online or mobile application or any other system proposed by the participants)
Background
Monitoring and protection of aquatic ecosystems, both inland (freshwater) and coastal (marine) are of primary importance according to the EU official policies and directives (e.g. the Marine Strategy Framework Directive-MSFD or the Water Framework Directive-WDF). Recent evidence shows that human-induced changes in marine ecosystems have greatly increased in the past 60 years. Coastal areas are threatened by water pollution and eutrophication, loss of biological diversity, urban development, landscape deterioration and coastal erosion. Regarding inland water bodies, these face their own specific threats, such as eutrophication, pollution and hydromorphological deterioration, due to both natural and anthropogenic activities. The main goal of EU water policy is to ensure an adequate quantity of good quality water for human and environmental needs. These constant threats to aquatic ecosystems require constant measurements and reliable methods for monitoring their ecological status in order to prevent and mitigate harmful disturbances in a timely manner. The use of satellite measurements by sensors with different characteristics and resolutions has contributed in recent years to a more integrated approach in water management. Multi-temporal data from optical and non-optical (radar) satellite systems are considered very valuable for detecting changes in aquatic ecosystems and as such are utilized by organizations and initiatives at a global scale (NASA, UNESCO). For more information:

- https://landsat.gsfc.nasa.gov/nasa-helps-warn-of-harmful-algal-blooms-in-lakes-reservoirs/?fbclid=IwAR312ZcIekYdYe1nHc-_9t1vXdq4kOvrzWvkgJsly9TdZ-DHotvnAP8LN2w
- https://www.eomap.com/world-water-quality/
- https://www.eea.europa.eu/themes/water
- Pahlevan N et al. (2019) Sentinel-2/Landsat-8 product consistency and implications for monitoring aquatic systems. Remote Sensing of Environment 220, 19‑29. https://doi.org/10.1016/j.rse.2018.10.027

Potential Considerations

Satellite data and products with various spatial resolutions can be exploited or combined. Official EU downstream services are mainly providing low resolution products but Sentinel-2 and Landsat-8 images can provide alternatives for downscaling the required information. The participants are free to choose if their application will focus on a specific aquatic environment (inland or coastal) and threat or if it will serve broader needs.

Regarding potential data usage: the satellite standard marine products (see below) are provided in NetCDF format.

Indicative Data Sources

Sentinel-2, Sentinel-3	
Landsat-8	
Biochemical data	http://marine.copernicus.eu/ *(registration needed – python api is alternatively provided for data downloading and subsetting)*
Surface optical	http://hermes.acri.fr/ *(user email is required. Order processing and delivery may take some time)*

Recommended Tools

- Copernicus products
- QGIS, Python, R, NetCDF and GDAL libraries

Challenge #6 – SYBILLA: Wildfire risk estimation for peri-urban areas

Title
SYBILLA: Wildfire risk estimation for peri-urban areas
Category
Disasters Risk Management
Short Description
This challenge aims at developing a prototype system that would take as input the topography, land cover, vegetation and other relevant characteristics in a peri-urban area and, taking into consideration past statistical data, estimate on a regular basis (e.g. daily) the wildfire risk in that area at a disaggregate geographical scale. The output of the system would be a map that shows the risk of wildfire, as well as, its hazardous potential, at a given day and time for each location in the area of interest.
(sub-)Tasks

The major (indicative)sub-tasks of the challenge are:
• Development of database that contains:
    ○ the wildfire related information (vegetation, biomass size, susceptibility of vegetation for wildfire ignition, accumulation of vegetation fuelling material, fire prone activities and uses, etc.)
    ○ the topography of the area
    ○ weather data
    ○ any other initial conditions data (e.g. time of the year, whether it has rained recently etc.)
• Development/selection/fine tuning of the model that links input data to the output (risk and hazard estimation)
• Implementation of the model for the given setting of interest (area, scale, temporal granularity).

Background
Wildfires, particularly in peri-urban areas that have a Mediterranian type of climate, have been a major concern. This situation is exacerbated through time and is expected to worsen in the near future as global warming becomes more prominent. Each year, a sizeable amount of human life, livestock, and animal wildlife is put at risk (often resulting in deaths), properties are destroyed and forests and other kinds of wildlife are damaged due to wildfires that take place very often in such areas. The cost to society due to such hazzard is immense and a lot of effort and resources are put into effect to prevent the hazardous event and/or mitigate its adverse impacts. Civil protection agencies, often, issue warnings of excessive fire risks on certain days and take precautionary measures to cope with the event if it happens. Those warnings, however, although very useful, are made at a gross geographical scale (mostly at the prefectural level) and lack the geographical (at each disaggregate location) and temporal (e.g. by hour) granularity that would make them more targeted and effective. It is important, therefore, to develop tools that, on a regular basis (e.g. by day) would estimate the risk of fire at each location of an area and its potential hazardous impact. This capability, in essence would be the equivalent of the "accurate weather maps" that tell us the weather forecasts for each location each hour of the day.

Indicative background material:

- http://www.apdthest.gov.gr/Intro/Data/Sites/1/documents/entipa/politikiprostasia/st2-a2_ekdosi_xarti_problepsis_kindinou_pirkagias_2013.pdf
- https://www.civilprotection.gr/el/daily-fire-prediction-map
- https://www.fs.usda.gov/treesearch/pubs/56265
- http://beyond-eocenter.eu/
- https://www.ncei.noaa.gov/news/estimating-wildfire-risk-new-tool
- https://issuu.com/aeolian73/docs/risk_assessment_prediction_fire_behavior
- https://www.arcgis.com/home/item.html?id=fc0ccb504be142b59eb16a7ef44669a3
- https://storymaps.arcgis.com/stories/cb987be2818a4013a66977b6b3900444

Potential Considerations

To bring the challenge to a manageable scale, it might be beneficial to develop the system for a particular target area (e.g. East Attica, Greece).

Indicative Data Sources

Data and Maps	https://www.eea.europa.eu/data-and-maps
Sentinel data	https://scihub.copernicus.eu/
Corine Land Cover	https://www.eea.europa.eu/data-and-maps/data
Land Use	https://www.eea.europa.eu/themes/landuse
Digital elevation data (EU-DEM)	https://www.eea.europa.eu/data-and-maps/data/copernicus-land-monitoring-service-eu-dem
Edaphological (soil) data	http://www.digital-geography.com/free-global-soil-grids-1km-resolution/
Climate data	http://www.gisresources.com/weather-climate/
Meteorological data	https://www.helppost.gr/kairos/meteorologika-dedomena-meteodata/ http://meteosearch.meteo.gr/

Recommended Tools

- Any available GIS (e.g. QGIS) or Remote Sensing program
    - https://gisgeography.com/free-gis-software/
    - https://gisgeography.com/open-source-remote-sensing-software-packages/
- Wildfire risk estimation and assessment tools

Challenge #7 – Air quality monitoring and forecasting

Title

Air quality monitoring and forecasting

Category

Tourism

Short Description

In several cities and megacities of the world, the air quality is a crucial factor that, among daily life and citizens' health, it also affects significantly tourism. This challenge exploits current Copernicus data along with other types of in-situ measurements and observations towards the development of a monitoring and forecasting air quality service at local spatial scales.

(sub-)Tasks

Participants are expected to address the following subtasks, however other processing types and pipelines can be considered as well:

- Business Case development ("air - quality" city applications)
- novel cloud-based solutions providing crucial information and products to urban/ city authorities and relative governmental authorities.

Background

For tourists, perfect climate conditions are one of the main attractions for many destinations. Empirical studies have identified various climate-related attributes influencing tourists' travel decisions. Among these attributes, air quality is particularly interesting for policymakers, because it can be controlled to some extent through regulations or incentives to decrease air pollutant emissions. Thus, appropriate environmental policies might be implemented in order to address negative aspects, to preserve the appeal of the destination and hence the sustainability of the tourism industry.

Predicting air quality, just like the way we rely on weather forecasts, is now an essential tool as evidence increases on the multi-faceted adverse health effects of exposure to air pollution, particularly in our cities. As we inhale air and vital oxygen, we also breathe in small amounts of harmful gases and fine particles, which affects our health and well-being.

The Copernicus Atmosphere Monitoring Service (CAMS), implemented by the European Centre for Medium-Range Weather Forecasts on behalf of the European Union, provides a wealth of information to millions of people on the air we breathe. CAMS provides consistent and quality-controlled information related to air pollution and health, solar energy, greenhouse gases and climate forcing, everywhere in the world. However, not yet efficiently at local spatial scales.

The challenge is supported by the EU - H2020 research and innovation project NEANIAS, under Grant Agreement No. 863448. NEANIAS focuses on 'Novel EOSC services for Emerging Atmosphere, Underwater and Space Challenges'.

Potential Considerations

- Dong et al., 2019. The Impact of Air Pollution on Domestic Tourism in China: A Spatial Econometric Analysis. Sustainability 2019, 11, 4148.
- Ruiz-Guerra et al., 2019. Prediction of the impact on air quality of the cities receiving cruise tourism: the case of the Port of Barcelona, Heliyon, Volume 5, Issue 3, https://doi.org/10.1016/j.heliyon.2019.e01280
- Pinder et al., 2019. Opportunities and challenges for filling the air quality data gap in low- and middle-income countries, Atmospheric Environment, Volume 215, https://doi.org/10.1016/j.atmosenv.2019.06.032
- Ajtai et al., 2019. Support tools for land use policies based on high resolution regional air quality modelling, Land Use Policy, https://doi.org/10.1016/j.landusepol.2019.03.022
- Wang et al., 2018. Effect of air quality in the place of origin on outbound tourism demand: Disposable income as a moderator, Tourism Management, Volume 68, Pages 152-161, https://doi.org/10.1016/j.tourman.2018.03.007
- Rapsomanikis et al, 2014. Vertical Energy and Momentum Fluxes in the Centre of Athens, Greece During a Heatwave Period (Thermopolis 2009 Campaign), Vol. 154, Issue 3, Pages 497-512.
- Veefkind et al., 2012. TROPOMI on the ESA Sentinel-5 Precursor: A GMES mission for global observations of the atmospheric composition for climate, air quality and ozone layer applications, Remote Sensing of Environment, Volume 120, Pages 70-83
- Satellite and Ancillary Data ingestion and pre-processing
- Statistical and Machine Learning Tools and Modelling
- Integrated Geospatial System and Web Services
- Quantitative and Qualitative Validation

Indicative Data Sources

Copernicus Satellite Data, Sentinel-5, Sentinel-2, Sentinel-3, etc.	
Copernicus in-situ	https://insitu.copernicus.eu/
Copernicus CAMS	https://atmosphere.copernicus.eu/air-quality
HELIX Data	https://data.hellenicdataservice.gr/
Best practices	https://insitu.copernicus.eu/news/how-in-situ-data-brings-air-quality-and-greenhouse-gas-emissions-into-focus

Recommended Tools

GDAL, Python, PyTorch, TensorFlow, QGIS, PostGIS, OGC Services, etc.

Challenge #8 – Social Media Filtering for Emergency Situations

Title
Social Media Filtering for Emergency Situations
Category
Tourism, Disasters Risk Management
Short Description
The target of this challenge is to combine emergency data from Copernicus EMS Data and related Twitter Data to extract diffusion patterns that will be used for assessing and evaluating information about emergency situations.
(sub-)Tasks
Participants are expected to address the following subtasks, however other processing types and pipelines can be considered as well: • Keyword and metadata extraction on Copernicus EMS Data • Tweet broadening by scraping news websites • Tweet indexing and filtering based on keywords and metadata • Propagation trees extraction
Background
Crisis situations, such as disasters brought on by natural hazards, generate a situation that is rife with questions, uncertainties, and the need to make quick decisions, often with minimal information research in recent years, have uncovered the increasingly important role of social media in disaster situations. Social media platforms provide active communication channels during emergency events such as disasters caused by natural hazards. As a result, first responders, decision makers, and the public can use this information to gain insight into the situation as it unfolds. The development of efficient algorithmic solutions for monitoring emergency events through online social networks requires complete and up-to-date datasets.
Potential Considerations
This challenge can be exploited in two ways: • The first concerns users such as researchers or emergency authorities who want to better understand the evolution of an emerging phenomenon from the past. In this case, both the historical data from Copernicus and the diffusion trees from Twitter can be exploited after the end of the phenomenon. • Real-time monitoring emerging events through Twitter, could help authorities to evaluate the course of evolution of a disaster, and the timely planning for managing its effects. Information extracted from Twitter can be evaluated by examining the propagation footprints on the Social Network.

Both on-demand analysis and real-time monitoring of emerging events through Twitter have special and unique challenges. Other considerations can be extracted from the following publications: • Imran, M.K., Castillo, C., Diaz, F., & Vieweg, S. (2014). Processing Social Media Messages in Mass Emergency: A Survey. ArXiv, abs/1407.7071 • Lu, Y., Hu, X., Wang, F., Kumar, S., Liu, H., & Maciejewski, R. (2015). Visualizing Social Media Sentiment in Disaster Scenarios. WWW • Gao, H., Barbier, G., & Goolsby, R. (2011). Harnessing the Crowdsourcing Power of Social Media for Disaster Relief. IEEE Intelligent Systems, 26, 10-14 • Agichtein, E., Castillo, C., Donato, D., Gionis, A., & Mishne, G. (2008). Finding high-quality content in social media. WSDM • Power, R., Robinson, B., Colton, J., & Cameron, M.A. (2014). Emergency Situation Awareness: Twitter Case Studies. ISCRAM-med • Rogstadius, J., Vukovic, M., Teixeira, C.A., Kostakos, V., Karapanos, E., & Laredo, J. (2013). CrisisTracker: Crowdsourced social media curation for disaster awareness. IBM Journal of Research and Development, 57 • Abel, F., Hauff, C., Houben, G., Stronkman, R., & Tao, K. (2012). Semantics + filtering + search = twitcident. exploring information in social web streams. HT • MacEachren, A.M., Jaiswal, A.R., Robinson, A.C., Pezanowski, S., Savelyev, A., Mitra, P., Zhang, X., & Blanford, J.I. (2011). SensePlace2: GeoTwitter analytics support for situational awareness. 2011 IEEE Conference on Visual Analytics Science and Technology (VAST), 181-190

Indicative Data Sources	
Copernicus Emergency Management Service (Copernicus EMS)	https://emergency.copernicus.eu/
Greek Twittersphere Data	

Recommended Tools
GDAL, Python, PyTorch, TensorFlow, QGIS, PostGIS, OGC Services, etc.