GEO-CRADLE Workshops

Refining the scope of the pilots towards regional challenges (WP4) in light of WP3 outcomes

16 November 2016
Limassol, Cyprus

Hosted by:

Coordinator:

www.geocradle.eu

GEO-CRADLE: Coordinating and integrating state-of-the-art Earth Observation Activities in the regions of North Africa, Middle East, and Balkans and Developing Links with GEO related initiatives towards GEOSS

MINUTES

The GEO-CRADLE project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 690133.

Objective & Outline:

GEO-CRADLE has proactively engaged and keeps engaging with the relevant regional stakeholders (data/service providers, decision makers, and SMEs) in a series of consultation activities including surveys, interviews, workshops and bilateral exchanges, in order to identify the regional needs. After a first in-depth analysis of their feedback which was presented in the GEO-CRADLE meeting in Novisad, Serbia, GEO-CRADLE is now going to make a concrete first step through the 4 pilot/feasibility studies towards addressing the identified gaps and needs in relation to common regional challenges by creating the appropriate ecosystem, building the necessary toolbox, and providing a first tangible outcome.

The objective of the pilot activities is not to develop new science, but to build on the integration of existing capacities (infrastructure, datasets, models, etc.) and skills within the relevant group of project partners that are involved towards the provision of improved EO Services in the Region of Interest (RoI). The pilots will span a period of 15 months, and the final results will be presented to relevant stakeholders (especially decision makers) in a dedicated workshop.

The GEO-CRADLE pilot activities are the following:

1) Adaptation to Climate Change (T4.1, Leader: NOA)
2) Improved Food Security – Water Extremes Management (T4.2, Leader: IBEC)
3) Access to Raw Material (T4.3, Leader: EGS)
4) Access to Energy (T4.4, Leader: PMOD/WRC)

The objective of the GEO-CRADLE Workshops which took place on 16 November 2016 in Limassol, Cyprus, was to analyse and discuss in detail the proposed refined scope of the pilot activities (WP4), on the basis of the gap analysis (WP3) and other inputs from partners; thus preparing the ground for the final decisions on their refined scope during the Project Meeting.

Therefore a dedicated workshop was organised for each pilot, with the exception of the Access to Raw Materials pilot, which had already taken place on 17 October 2016 in Rabat, Morocco:

I) PARALLEL SESSION ON WATER EXTREMES MANAGEMENT (part of T4.2)
II) PARALLEL SESSION ON ACCESS TO SOLAR ENERGY (T4.4)
III) PARALLEL SESSION ON ADAPTATION TO CLIMATE CHANGE (T4.1)
IV) PARALLEL SESSION ON SOIL SPECTRAL DATA (part of T4.2)

The objective of the **Session of the Workshop on Soil Spectral Data (SSD) and on Water Extremes Management (WEM)** was to establish a common agreement and understanding among the partners on the specific content, methodology and expected outputs of the T4.2 pilot. Food security depends on many aspects such as water abundance and extremes (flooding and drought), vegetation stresses, yield monitoring, soil quality and sustainability. Guaranteeing food security requires:

- the systematic mapping of soils and minerals which are beneficial for agricultural production;
- the monitoring of mining waste sites for the prevention of acid mine drainage impacting the quality and quantity levels of food;
- the systematic assessment of meteorological aspects and climatic forecasts;
- the derivation of knowledge in the RoI for specific risks relating to floods and droughts.

Such actions will allow the soil and water resources to be preserved from further degradation, and the agro technical activities to be adapted accordingly to microclimatic conditions, securing the abundance of healthy crops and yield production yearly.

The objective of the **Session of the Workshop on Access to Solar Energy (ASE)** was to establish a common agreement and understanding among the partners on the specific content, methodology and expected outputs for the T4.4 pilot. Solar energy depends on many atmospheric parameters that play the main role on real time solar energy calculation and mapping. Products related with the need of using real time or short term forecast solar energy outputs require:

- the use of high temporal and spatial resolution real time validated atmospheric data that are required for accurate solar energy calculations;
- the synergy of various earth observation satellite products and respective databases in real time;
- a system that provides rapid (real time) calculations of solar energy for large areas (high number of earth pixels).

The specific action will allow producing real time products of various solar energy related products that could help to the optimum use of solar energy for national or private energy regulating grids.

The objective of the **Session of the Workshop on Adaptation to Climate Change (ACC)** was to discuss the recommendations for the pilot activities of T2.4 User Need Analysis on climate change and establish a common agreement and understanding among the partners on the specific content, methodology and expected outputs of the T4.1 pilot. The pilot activities aim to support the sustainability of regional EO infrastructures and trigger needed synergies, to contribute to the achievement of GEOSS targets and the uptake of relevant EO based Copernicus services in the RoI and provide the necessary support and coordination to existing infrastructures in order to deliver consolidated information and knowledge for long term strategic planning on adaptation and mitigation to climate change and air quality which are of high importance for the RoI.

The RoI has been recognized by the Intergovernmental Panel on Climate Change (IPCC) as one of the most sensitive and vulnerable to climate change regions on Earth. In this context, continuous atmospheric monitoring from space and ground in the RoI needs to be well distributed and coordinated in order to be utilized in an optimal way for future climate projections and forecasts of atmospheric components and climate driven natural hazards.

WELCOME

Welcome by hosting partner Prof. **Diofantos Hadjimitsis**, Cyprus University of Technology (CUT), Cyprus

Introduction by Project Coordinator Dr **Haris Kontoes**, National Observatory of Athens (NOA), Greece

I) PARALLEL SESSION ON WATER EXTREMES MANAGEMENT

Water extremes mapping and modelling using earth observation (12:00-13:15)

The session on Water Extremes Management focused on the contribution of the earth observation to the water extremes management (floods and droughts) in order to improve food security. It included both the water extremes mapping and modelling using earth observation.

Water extremes mapping with EO: the FloodHub service of the BEYOND Center of Excellence

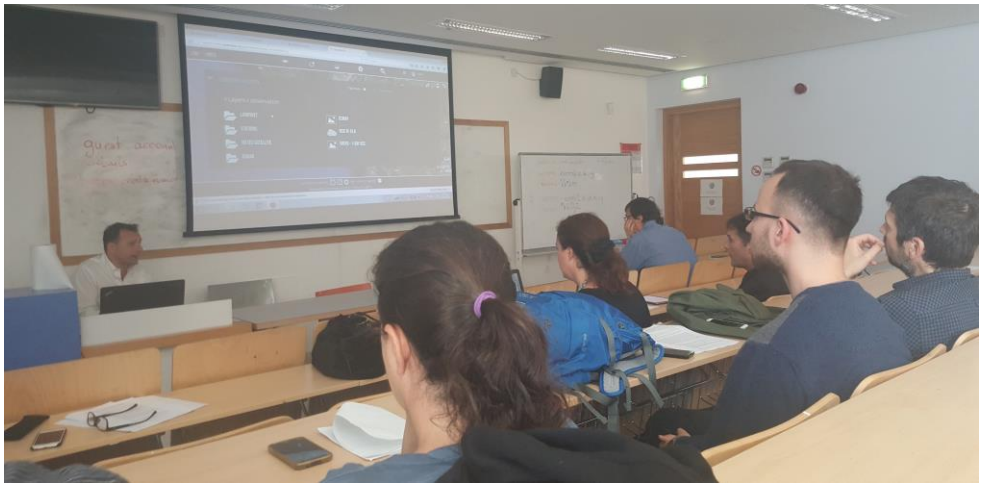
Speaker: **Alexia Tsouni**, National Observatory of Athens (NOA), Greece

Based on the outcomes of the project so far, Ms Tsouni presented the relevant needs registered in the User Need Analysis Report I (D2.5) in the domain of floods. These needs concerned all the countries of the RoI apart from Saudi Arabia and the United Arab Emirates, and included information needs, current data sources and data access, regulations driving geo-information use, and funding schemes that have allowed users to obtain geoinformation. It was found that in the Balkans, Middle East and North Africa a common predominant topic is climate change - and in its water management aspects (the use of water for irrigation, or in risk management and coastal zone management). The geo-information needs referred to natural risks, notably drought and floods. Recommendations for further exploration of end-user needs were made for the food security and water extremes management, as well as for the climate change and water management. Ms Tsouni also examined the relevant EC initiatives and focused on the PRIMA initiative, which is a proposal of the Commission for a €400 million Partnership for Research and Innovation in the Mediterranean Area, set to develop much-needed novel solutions for sustainable water management and food production. Therefore, there is good ground for a relevant GEO-CRADLE pilot, so Ms Tsouni presented the two core capacities of NOA in this field. First, BEYOND's Floods Observatory for Greece & South-Eastern Europe, where major flood events are registered and the flood mapping results produced following the processing and photo-interpretation of satellite Optical and SAR images are published. And second, FloodHub, BEYOND's Floods Monitoring Service, where NOA monitors all the flood events in Arachthos & Acheloos river basins and publishes the flood mapping results produced following the processing of Sentinel-1 images from the Hellenic National Sentinel Data Mirror Site.

Water extremes modelling with EO: risk forecasting, monitoring and prevention by DEWETRA platform

Speaker: **Giorgio Boni**, CIMA Research Foundation, Italy

Prof. Boni focused on the water extremes modelling with Earth Observation and presented the DEWETRA platform for risk forecasting, monitoring and prevention. DEWETRA is a real-time integrated system for hydro-meteorological and wildfire risk forecasting, monitoring and prevention. The system is based on the rapid availability of different data which help establish up-to-date and reliable risk scenarios. The integration of all relevant data for risk management can significantly increase the value of available information and the level of knowledge of forecasters and disaster managers. Different sources of information are ingested and managed within the platform, taking into account their diverse space-time scales and degrees of uncertainty and reliability. The DEWETRA platform uses a three-tiers software architecture: a strong middle-ware ensures robustness and computational load balancing, whereas a Web-GIS interface facilitates the information distribution. DEWETRA is fully operational at the Italian Prime Minister Office – National Department for Civil Protection – "Centro Funzionale Centrale".



Disaster Management in Albania with the web-based platform DEWETRA

Speaker: **Lilljana Lata**, Institute of Geosciences, Energy, Water and Environment (IGEWE) / Tirana Polytechnic University (UPT), Albania.

Ms Lata explained that Albania is a disaster-prone country, exposed to most hazards, and focused on the flood risk, which in Albania is related to the large flooding potential of west plains lowlands, as well as the flooding potential associated with smaller rivers and torrents. She made a special reference to the catastrophic floods in February 2015, which caused damages, losses and immediate needs of EUR 110 millions, and she presented the actions taken by all relevant stakeholders, on European, national and local level. Ms Lata referred to the main activities of the National Centre for Forecast and Monitoring of Natural Risks, which was established at the Institute of Geosciences, Energy, Water and Environment (IGEWE) in the framework of the International cooperation between the Civil Protection of Italy and

Albania. A Technical Agreement is in place with the Italian Civil Protection, CIMA Foundation and the support of World Bank for the forecasting, prevention and mitigation program against floods and forest fires in Albania. Ms Lata presented the Hydro and Meteo stations network in Albania, the Web-GIS application DEWETRA, which is used as operational forecasting system for wildfire and flood risk in Albania, and relevant projects implemented in the country (World Bank project on Disaster Risk Mitigation and Adaptation in Albania, and AdriaRadNet project). She concluded with recommendations on risk analysis, early warning, awareness, prevention, preparedness and response, as well as proposals for the improvement of DEWETRA's results in Albania.

II) PARALLEL SESSION ON ACCESS TO SOLAR ENERGY

Support and improvement of the regional EO infrastructures through the Solar Energy Nowcasting SystEm (SENSE) (12:00-13:15)

The session on Access to Solar Energy focused on the contribution of the earth observation to the calculation of solar energy related products in order to improve their accuracy and their spatial and temporal information. This session served as an introductory roadmap for the utilization of the produced solar energy products, and also served to its participants both the technical requirements of the methodology, as well as the potential as a commercialized service for end users.

Energy application for GEO-CRADLE, overview of the pilot activity

Speaker: **Stelios Kazadzis**, Physical Meteorological Observatory Davos / World Radiation Center (PMOD/WRC), Switzerland

Dr Kazadzis underlined that North Africa, Middle East and Balkans are places with a serious amount of solar energy potential, and its exploitation is critical for their national sustainable development through an efficient energy planning and a gradual independence from fossil fuels. The currents solar energy EO

capacities in the RoI are degraded, and as a result this field needs a complete and comprehensive revision and promotion in order to be established as a main contributor to national portfolios. The proposed Solar Energy Nowcasting SystEm (SENSE) pilot comes to fulfill these regional needs for optimum solar energy exploitation and for active and effective integration of the nowadays available capacities and state-of-the-art technologies to the national sustainable development economies and strategies. The purpose is on the one hand to demonstrate ways to maximize value and benefits at the RoI, and on the other hand to create synergies with public and private sector (solar plants, energy distributors, solar energy related end-users). This pilot includes the provision of tailored to end-user: 1) Now-casting of solar radiation and solar energy; 2) Long term solar energy atlases for various areas with high temporal and spatial detail; and 3) Solar radiation related products (real time and forecasts) related with: health (UV Index / melanoma, DNA damage, cataract, Vitamin D efficiency), agriculture (photosynthesis), scientific domain. With the use of developed and improved EO and CAMS real time and climatology services, products and data bases, the SENSE pilot aims to stimulate the interest of relevant stakeholders and decision makers like Ministries of Electricity and Renewable Energies (Egypt), Electric Power Transmission Operators (Greece) and Solar Energy investors from the private sector.

Update on the use of EO and Copernicus related products for the energy pilot

Speaker: **Panagiotis Kosmopoulos**, National Observatory of Athens (NOA), Greece

Dr Kosmopoulos said that the SENSE pilot will be a starting point for energy-related short-future investments towards and beyond the implementation of GEO, GEOSS and Copernicus energy-related products and activities and visioning innovative high-end applications and technologies. Towards this direction, the SENSE's refined objectives are: 1) Effective dissemination of the high precision and resolution nowcasting and forecasting solar energy services for the fulfillment of the regional needs taking advantage of the nowadays satellite data and integration (GEOSS), efficient envision of new but crucial model inputs (CAMS) and state-of-the-art real time solar energy calculating system capabilities (SENSE); 2) Development of reliable, high resolution solar Atlases and broader climatology studies

(EUMETSAT) for the RoI; and 3) Engraving strategy methods of how to integrate such a solar energy nowcasting system into a wider GEOSS driven system in the international scale, making the whole effort of the participating partners "a possession for all time". Dr Kosmopoulos highlighted the major applications and the important contribution of the SENSE pilot to emerging technology, using EO and Copernicus data: 1) Location studies for the placement of CSP plants and CPV installations; 2) Large-scale and precise solar energy calculations to assist Public Authorities in energy planning policy; 3) Supporting the work of various scientific communities; and 4) Provision of specialized data of high spectral precision for private and public sectors dealing with health protection, energy consumption and solar energy exploitation.

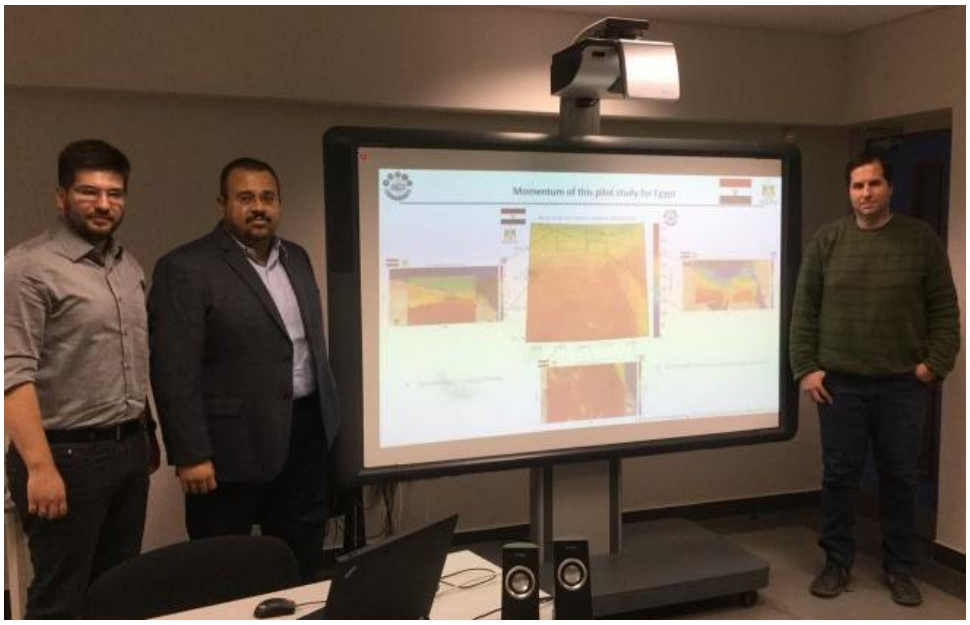
Pilot applications for Greece and Egypt related end-users

Speakers:

Panagiotis Kosmopoulos, National Observatory of Athens (NOA), Greece

Hesham El-Askary, Centre for Environment and Development for the Arab Region and Europe (CEDARE), Egypt

Dr Kosmopoulos and Prof. El-Askary underlined that the SENSE pilot comes to fulfill the regional needs for optimum solar energy exploitation. The quantification of the clouds' and aerosols' impact on the solar energy potential guarantees the reliability of the SENSE pilot. Simultaneously, the synergistic inclusion from models, ground-based and satellite-based databases can be applied to the real time pilot services as well as to the solar Atlases requested from major regional end users. Dr Kosmopoulos and Prof. El-Askary presented the initial roadmap of the SENSE pilot. After consultation with the local stakeholders in Greece and Egypt, it is proposed to provide: (i) the GHI nowcasting service to the Independent Power Transmission Operator (IPTO) of Greece; (ii) the same nowcasting service with additional the full solar Atlas of GHI and DNI to the Ministry of Electricity and Renewable Energy of Egypt; and (iii) the nowcasting UV-index service for the Bluestar and Superfast Ferries (private sector) at 13 ships which have connections to the Adriatic and Aegean Sea. From the other countries a potential collaboration could be achieved with Romania (CEZ Trade and Tractabel Engineering SA GDF SUEZ) and Saudi Arabia (ARAMCO) concerning the solar energy nowcasting and Atlas services.



III) PARALLEL SESSION ON ADAPTATION TO CLIMATE CHANGE

The session on Adaptation to Climate Change focused on the contribution of the earth observation to the delivery of consolidated information and knowledge for long term strategic planning on adaptation and mitigation to climate change and air quality which are of high importance for the RoI. This session served as an introductory roadmap for the continuous atmospheric monitoring from space and ground.

Part 1: Strengthening the interplay between the EO and modelling activities for weather, air quality and climate - Establishment of relevant regional pilot studies on ACC (13:45-15:00)

Overview and current status of T4.1 ACC activities

Speaker: **Vassilis Amiridis & Evangelos Gerasopoulos**, National Observatory of Athens (NOA), Greece

Dr Amiridis and Dr Gerasopoulos explained that the ACC pilot was refined with the inputs received from the outcome of WP2 and WP3, the available knowhow within the GEO-CRADLE consortium, the available datasets, models and capacities in the RoI, and the expression of interest from targeted end-users. They presented the link with WP2 and WP3 in terms of maturity indicators, capacities, Copernicus and GEO, user needs. Consequently, the refined ACC pilot will provide 3 services on respective thematic pillars as these were concluded by the GEOCRADLE consortium and the feedback from WP2/WP3: 1) Accurate desert dust forecasting; 2) Regional climate change services; and 3) Air quality services. Special effort will be given on: optimizing the services (which are not as

timely and accurate as required by the users); and tailoring the services to the user needs through continuous interaction with end-users from targeted ACC-representative sectors and respective end-users as already identified in WP2/WP3. The end-user engagement will include: 1) Tourism sector: TEMES and Costa Navarino for dust forecasting; 2) Meteorological agencies: Cyprus for dust forecasting; 3) Aviation: EgyptAir for dust forecasting; 4) Insurance companies: AXA for Climate Change services; 5) Agriculture sector: Ministry in Serbia for Climate Change services; and 6) Local authorities for services related to air quality services (CAMS). Regarding the input data (space/airborne/in-situ), available models will be used along with the instruments and data that will be gathered from 3 European RIs (ICOS, EUFAR, ACTRIS). As for the specific pilot sites, the Eastern Mediterranean is considered as representative RoI area for developing the services according to user needs and optimizing their accuracy through synergistic data use and evaluation against ground/air truth data.

Strengthening the interplay between EO and modeling activities

Speaker: **Slobodan Nickovic**, Institute of Physics Belgrade (IPB), Serbia

Dr Nickovic spoke about the importance of strengthening the interplay between EO and modeling activities, and presented examples of aerosol-environment/climate interactions. He underlined that the GEO-CRADLE concept in brief is to integrate earth observations with modelling & computer resources to create products (integration at data provider level) and then to tailor the products in order to meet the users' needs (product tailoring). There are several types of integrated models, e.g. for atmosphere, ocean, air composition, soil, hydrology, soil mineralogy. Dr Nickovic focused on Model-EO interactions, and spoke about the lower boundaries in models (atmosphere-dust modelling example), and the assimilation of dust-related data. He referred to the DREAM model, a routine prediction of ice nucleation, and presented a series of case studies: 1) Aviation: Egypt Air 2002 accident with extreme dust loads, AirFrance 2009 accident with hypothesis on dust influence; 2) Energy: Solar energy plants (dust deposit and reduction of solar energy); 3) Public warnings: Warning maps (simplified warning scale); 4) Dust effects on health: more detailed modelling study needed for the GEO-CRADLE RoI, and dust storm prediction; and 5) Predicting transport of other pollutants: e.g. pollen storm and volcano ash.

ACC-relevant modelling studies

Speaker: **Vladimir Djurdjevic**, Institute of Physics Belgrade (IPB), Serbia

Dr Djurdjevic reminded the Paris Agreement for the need to significantly reduce the risks and impacts of climate change, and spoke about the regionalization of climate change scenarios with statistical and dynamical downscaling. He referred to the EU National adaptation policy processes in the European countries and the need of multi-model ensemble to access uncertainty in future changes and impacts. Dr Djurdjevic presented relevant past projects (multi model ensemble): PRUDENCE, ENSEMBLES, and WCRP CORDEX with two domains over Europe (EURO-CORDEX and MED-CORDEX), one domain for Middle East and North Africa (MNA-CORDEX), as well as domains for Africa and South Asia. He also presented data explorer – web pages, e.g. Climate4impact

(projects IS-ENES, IS-ENES2 and CLIPC) and KNMI Climate Explorer; as well as databases developed by other projects, e.g. ORIENTGATE project, the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP), and the European Climate Adaptation Platform (CLIMATE-ADAPT) partnership between the European Commission (DG CLIMA, DG Joint Research Centre and other DGs) and the European Environment Agency.

Part 2: Strengthening the interplay between the EO and modelling activities for weather, air quality and climate - Establishment of relevant regional pilot studies on ACC (15:15-16:30)

Establishing a pilot regional climate change web application tool for end-users

Speaker: **Prodromos Zanis**, Aristotle University of Thessaloniki (AUTH), Greece

Dr Zanis first of all noted that the survey analysis indicated various levels of maturity regarding climate change awareness and EO/model data needs among the partner countries; while a need for reliable open access weather and climate data was expressed by all countries of the RoI. Specific meteorological and climatic variables are requested, such as: air temperature, humidity, wind speed and direction, precipitation, cloud cover, solar radiation, water evaporation and humidity evapotranspiration. For the ACC pilot the use of future climate data from model projections is essential, as well as the use of high resolution model projections for the RoI based on Regional Climate Models (RCMs). Ensemble versus individual information is also important for uncertainty estimates. There are plenty of open access data in databases (CORDEX, ENSEMBLES, PRUDENCE), but restricted usability from non-experts. Therefore, it is necessary to establish a user friendly interactive regional climate change web application tool for end-users. The key objective is to

support end-users and decision makers on climate change mitigation and adaptation policies by allowing them to retrieve climate variables and climate change information from high resolution regional climate projections. Dr Zanis then explained the technique and strategy of the regional climate modeling. A Regional Climate Model (RCM) is "nested" within a Global Circulation Model (GCM) in order to increase the resolution of a climate simulation. The GCM is used to simulate the response of the general circulation to large scale forcings, while the RCM is used to simulate the effect of sub-GCM-grid scale forcings and to provide fine scale regional information. The Regional Climate application tool will consist of three steps: 1) Set up a regional high resolution database including climate projections for a number of climate variables from various RCMs and emission scenarios; 2) Set up a database with secondary climate indices relevant to specific sectors of interest and tailored to end-user needs; 3) Set up an interactive web application for retrieving time series of the relevant climate variables and indices following a selection tree.

ACC user needs in North Africa and Middle East

Speaker: **Hesham Al Askary**, Centre for Environment and Development for the Arab Region and Europe (CEDARE), Egypt

Prof Al Askary noted that a joint mission of NASA and the German space agency found drought in Eastern Mediterranean and North Africa worst of past 900 Years (March 1st 2016). He also underlined that the Sahara Desert is the largest source of mineral dust aerosol and contributes 50-70 % of the dust emitted worldwide. For countries in and downwind of the Saharan Desert, airborne sand and dust present serious risks to the environment, property and human health. Saharan dust also plays an important role in climate and weather due to their direct (radiative forcing) and indirect (clouds, precipitation) impacts on the atmosphere. Dust storms cause serious environmental impacts, considerable hardships, loss of income, disrupt communications, affect human health and can cause death in extreme cases, destroy livestock and crops in affected areas. Prof Al Askary also presented the radiative forcing of the climate between 1750 and 2011 and the climate sensitivity, as well as the long range transport of high altitude dust over Nile Delta and surrounding region, and

spoke about the current possibilities of modeling and forecasting of desert dust transports and storms. He highlighted the fact that fifteen countries in the region have shown interest in improving their capabilities to forecast and understand the dust process resulting in launching the Sand and Dust Storm Warning, Advisory and Assessment System (SDS-WAS) as a joint project of the World Weather Research Programme (WWRP) and the Global Atmospheric Watch (GAW) under the WMO Commission for Atmospheric Sciences. In terms of the climate variability it is more relevant to the application of remotely sensed data and models for understanding the aerosols and its relation with the air quality that negatively impact the human health.

CAMS activities for air quality monitoring and forecasting in Mediterranean

Speaker: **Ioannis Kapsomenakis**, Academy of Athens (AOA), Greece

Dr Kapsomenakis presented the information, products and services that the Copernicus Atmosphere Monitoring Service (CAMS) will provide. The available fields include meteorology (T, RH, Pre, Psl, Cloud Cover …), reactive gases (O3, Nox, CO …), greenhouse gases (CO2, CH4), aerosols (Dust, Sea Salt, Sulfate, Black Carbon), radiation, and AOD. The in situ networks used for the CAMS validation over the Mediterranean are: GAW, AirBase (Classes 1-2), Aeronet, Department of Labour Inspection - Ministry of Labour and Social Insurance of Cyprus, as well as other stations (NEO, Finokalia). The AoA air quality data platform uses and validates CAMS data over the Mediterranean (the development of East Mediterranean web platform is under way). Dr Kapsomenakis also presented the European Air Quality products from the CAMS Regional Air Quality: the available chemical species are O3, NO2, SO2, CO, PM10, PM2.5, NH3, NO, NMVOC, PANs, Birch pollen; each day 96h model forecasts are provided with hourly resolution; the spatial resolution is 0.1x0.1; the products are available at 8 vertical levels (surface, 50, 250, 500, 1000, 2000, 3000, 5000 m); and the ensemble mean is the median of 7 regional air quality models (MOCAGE, LOTOS-EUROS, EMEP, MATCH, EURAD-IM, CHIMERE and SILAM). Dr Kapsomenakis concluded that CAMS products are strongly linked with thematic areas such as: Air Quality, Climate Change and adaptation, Energy, Bioclimatology, Tourism, and Health.

IV) PARALLEL SESSION ON SOIL SPECTRAL DATA

The session on Soil Spectral Data served as an introductory roadmap for the utilization of Soil Spectral Libraries (SSLs) as a tool for management of soil resources in the sector of food security. It served to its participants both the technical requirements of the methodology, as well as the SSLs potential as a commercialized service for end users.

Part 1: Technical Requirements of Building SSLs: Tools & Methodology (13:45-14:45)

The role of soil spectroscopy for food security & tools to create a SSL

Speaker: **Eyal Ben Dor**, Tel Aviv Univeristy (TAU), Israel

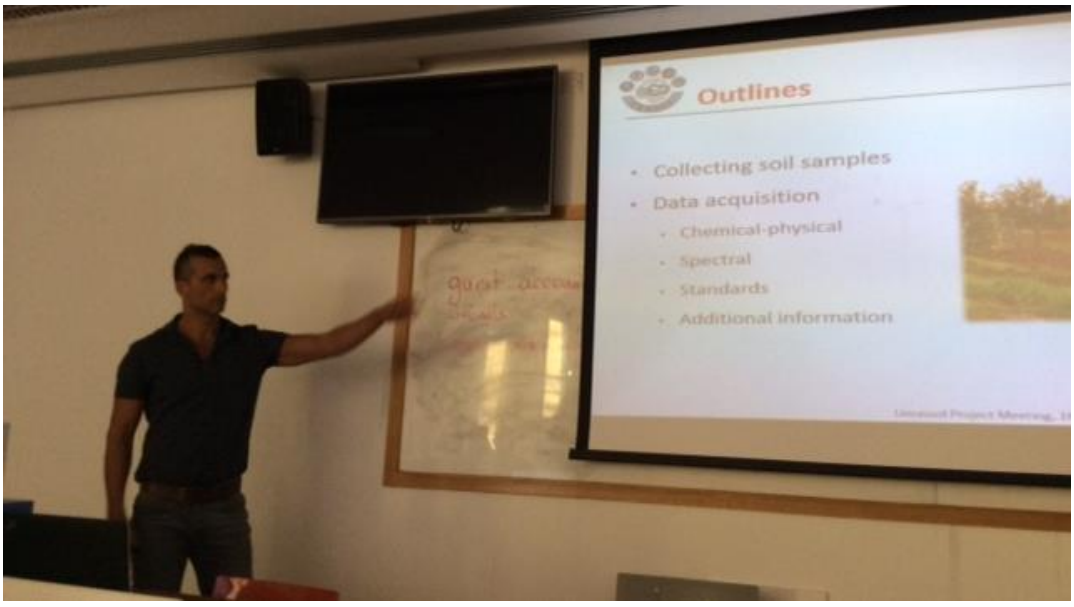
Prof Ben Dor explained why soils are important, what the soil spectroscopy is, and the strong link between point and image spectroscopy. Reflectance spectroscopy of soils is an important property for food security issues worldwide. Soil is a complex system characterized by chemical and physical attributes that provide an overview on the agricultural functions of the soil as a food producer. Quantitative information on soil attributes can be extracted from soil spectral information. Prof Ben Dor presented examples of some of the soil attributes that can be extracted from spectral library and highlighted the need and the commercial value of a Soil Spectral Library, which can provide rapid and massive analyses of soil samples without the need for “wet” laboratories. For quantitative applications

many soil samples are needed (soil data mining of a "model" requires hundreds of spectra samples in order to provide reliable results). Users are gathering many soil samples mostly under local scale; therefore a need for regional and global scales' library is essential. Spectral libraries are generated under regional, national, continental and global scales; but gathering local and regional spectral data (soil spectral library) needs agreed "standard and protocols". Prof Ben Dor underlined that such standard and protocols are existing and should be used for the GEO-CRADLE's Regional SSL pilot. SSLs from North Africa, Mediterranean and Balkan countries should be extended in order to be a database for modern precision agriculture activities. In this direction Prof Ben Dor presented the European Soil Spectral Library (LUCAS) as well as the Global Soil Spectral Library initiative, which paves the road to accumulate libraries from all scales and resources global wide.

The role of soil spectral information for precision agriculture & practices and procedures to build SSLs at national level

Speaker: **Yaron Ogen**, Tel Aviv University (TAU), Israel

Mr Ogen focused on the collection of soil samples, the data acquisition (chemical-physical properties, spectral measurement, standards, additional information) and the storage. For the collection of soil samples a national soil map is used for the field sampling and the collection includes different soil types, diverse locations, various land uses, and varied depths. Soil samples which have been collected by the Ministry of Agriculture, research institutes, laboratories, and surveyors are used. Regarding the data acquisition, the chemical-physical properties include obligatory properties (Organic Matter, CaCO3, texture) and prospective properties (pH, EC, SSA, Fe-oxides, heavy metals). The spectral measurement is performed and specific standards are applied. There is also additional information which can be obligatory (date of sampling, lat/long, elevation, depth, stills photo, spectrometer used and resolution) or prospective (surface description, vegetation description, profile description, climate zone). As for the storage it is necessary to have glass jars with the sample name, the scanning code and categorization.



Intervention by Mr **Daniel Barok**, Israel Space Agency (ISA), Israel: reference to the VENUS project, a cooperative program by ISA and France Space Agency (CNES), and the SHALOM project, a joint mission by ISA and the Italy Space Agency (ASI).

Part 2: Commercialization of SSLs: Services & Products (15:00-16:30)

Soil Spectral information in the era of commercial hyperspectral sensor in orbit: PRISMA project

Speaker: **Stefano Pignatti**, CNR IMAA, Italy

Dr. Pignatti presented the next IS spaceborne missions focusing on PRISMA, the impact of hyperspectral sensor (HYS) missions for soil sciences (texture, percentage of soil organic carbon, soil moisture, soil contamination, soil vigour), and the related agronomical proxi variables related to food security issues. He underlined that from 2018 PRISMA & ENMAP hyperspectral 30m/pixel images will be available to the community. The advent of HYS will allow the mapping of the physical and chemical characteristics of agricultural soils (in the first 30 cm of soil) like: texture (percentage of clay, silt and sand) percentage of soil organic carbon, soil moisture and soil contamination. The availability of new HYS imagery will impact on the retrieval accuracy of parameters pertaining to the agronomical management, as well as agronomical proxi variables (e.g. yield, nitrogen content in grain, nitrate nitrogen in the soil at the end of crop cycle etc.) related to food security issues. Dr. Pignatti noted that the future HYS missions should assure a higher spatial resolution, and a wider swath to fulfill the tight requirements of the precision agriculture applications. HyspIRI and SHALOM will start to fill these gaps providing high spatial resolution and a full spectral coverage covering from the VSWIR to the LWIR. Synergy with the Sentinels (wide swath and temporal frequency) is still an important issue.

The role of precision agriculture in vineyard monitoring

Speaker: **Noa Maoz**, Golan Heights Winery, Israel

Ms Maoz introduced the Golan Heights Winery and explained that precision viticulture is precision farming applied to optimize vineyard performance, meaning maximizing yield and quality, while minimizing environmental impacts. This is accomplished by measuring local variation different factors, like soil, topography, microclimate, vine health, vegetation etc. and then applying appropriate viticulture management practices. High in-field variability will need more detailed and precise management. Precision viticulture depends on new and emerging technologies such as environmental sensors, satellite and airborne remote sensing, and Geographic Information Systems (GIS) to assess and respond to variability. The difference in vegetation results to difference in ripening, so, when wine-growing uniformity is required. Therefore a vineyard needs to be designed for uniformity, and in this direction the soil is mapped based on electric conductivity, and the Normalized Difference Vegetation Index (NDVI) is used (correlation between NDVI and shoot growth, different methods and resolutions). Ms Maoz concluded highlighting the importance of investing in designing the vineyard ahead using all tools available, both ground soil mapping and satellite images (soil reflectance, NDVI), and, after establishment, using remote sensing tools to define the variability and monitor improvement.

New imaging sensors for field, drone and airborne applications for soil mapping

Speaker: **Petri Nygrén**, Spectral Imaging Ltd (SPECIM), Finland

Mr Nygrén introduced SPECIM Oy and presented the new sensor family and some hyperspectral imaging application examples. The new AISA family includes FENIX, FENIX 1K, OWL, IBIS, and KESTREL. The SPECIM FX10 / 17 offers free wavelength selection from 220 bands within the camera coverage at very high collection speeds. The new features in the sensor family are the smaller SWaP (Size, Weight and Power requirements), the simplified operation, and the full calibrations provided for each AISA sensor, radiometric, spectral and geometric, providing improved support for atmospheric correction routines, as

well as improved georeferencing and spectral accuracy. The sensor is the same for flying, field and lab use. Mr Nygrén presented application examples of FENIX for vegetation / pollution / material detection, OWL for geological mapping / geothermal / emissivity measurement / hot spring, IBIS for direct measurement of plant growth / sun-induced chlorophyll fluorescence, and KESTREL in tree species classification. Mr Nygrén concluded with the processing stages, which are the following: raw data from flight (non-georectified DN numbers), preprocessing (georectified radiances), atmospheric correction (georectified reflectances), analysis, and delivery.

The application of spectral information for operational soil monitoring in Europe and in the world

Speaker: **Luca Montanarella**, Intergovernmental Technical Panel on Soils (ITPS) / Food and Agriculture Organization (FAO), Italy

Dr Montanarella presented the steps from raw data to policy relevant soil data and information to Commission Services: raw data, derived data, information, assessment, reporting, through soil spatial inference system, soilscape inference system and scenario testing / risk assessment which finally leads to policies / management. He then referred to the main soil related EU policy areas served by the JRC SOIL Activities. Focusing on LUCAS, he presented the European land use / cover area frame statistical survey, the training, support material, data and results, as well as the methodology. The LUCAS spectral library currently includes 23 European countries, around 20,000 high quality spectral readings, metadata (clay, silt, sand, OC, pH, CEC, $CaCO_3$, geographical coordinates, land use, etc), while four subsets have been created: Cropland, Grassland, Woodland, and Organic soils. Dr Montanarella underlined that local approach is based on spectral similarities, and attempts to create meaningful partitions of the spectral library. The combined use of other covariates and spectra in the selection procedure of the predicting neighbours produces more accurate results than using only spectra. The prediction accuracy (RMSE) ranges between soils and it is important to work with wide and homogenous spectral libraries. As for the soil sample collection 2015, samples have been taken in LUCAS points already sampled in 2009/2012 (altitude <1000 m) as well as new LUCAS points located at altitude >1000 m, with the same sampling methodology as in 2009/2012, and planned start date of analysis: December 2016.

V) PARALLEL WORKING GROUPS ON PILOTS' REFINEMENT (T4.1, T4.2, T4.4)

Collection and elaboration on the feedback from the sessions in order to draft a proposal about the refinement of the pilots (16:30-18:00)

Moderators: Pilot Leaders.

- **Vassilis Amiridis**, National Observatory of Athens (NOA), for T4.1 pilot "Adaptation to Climate Change"
- **Nikos Tsakiridis & Elli Kalopesa**, inter-Balkan Environment Center (i-BEC), for T4.2 pilot "Improved Food Security - Water Extremes Management"
- **Stelios Kazadzis**, Physical Meteorological Observatory Davos / World Radiation Center (PMOD/WRC), for T4.4 pilot "Access to Energy"

Working Groups: Pilot team members/partners.

This session concluded on the following items which were presented and discussed in the Project Meeting the following day, where the final decisions were taken:

- the specific content, concrete objectives and expected outcome of each pilot, following the fusion of the feedback received during the previous sessions;
- the input data sets (space/airborne/in-situ), and the relevant satellite missions and sensors to be used, which are available currently and in the future (e.g. future Copernicus missions);
- the definition of the specific pilot sites where the pilots will be implemented in the three regions (North Africa, Middle East and Balkans), so that the pilot sites are representative in terms of societal importance and the variety of climatic, soil, and weather conditions existing in the RoI.