



Open Call Collection OC-2016-1

Proposal Reference OC-2016-1-20467

Title: International Network to promote the use of Dust Monitoring and Forecasting products

Acronym: NetDust

Summary

Airborne dust is a key atmospheric constituent and represents an important natural source of atmospheric particulate matter. North African and Arabian deserts are the most important dust sources in the world and dust is occasionally driven to America, Asia and Europe. Airborne dust particles have multi- and trans-disciplinary effects at local, regional and global scales, including impacts to the environment, human health and specific economic sectors. Over the last few years, numerical prediction and observational products from ground- and satellite platforms have become prominent at several research and operational weather centres due to growing interest from diverse stakeholders, such as solar energy plant managers, health professionals, aviation and policy makers. The coordination between measurement and modelling communities as well as research and user communities is difficult. Current attempts to transfer tailored products to end-users are not coordinated, and the same technological and social obstacles are tackled individually by all different groups, a process that makes the use of data slow and expensive. The result is that current data-model-user cooperation becomes increasingly fractured.

The overall objective of the proposed Action is to establish a network involving research institutions, service providers and potential end users of information on airborne dust. The network shall coordinate and harmonize the process of transferring dust observation and prediction data to user-oriented products. By this, the Action will coordinate the current research activities and enhance the availability of appropriate products to assist the diverse socio-economic sectors affected by the presence of high concentrations of airborne mineral dust.

Key Expertise needed for evaluation

Earth and related Environmental sciences

Atmospheric chemistry and composition

Environmental engineering

Air pollution

Environmental engineering

Remote sensing

Environmental engineering

Risk assessment, prevention and mitigation

Environmental engineering

Databases, data mining, data curation, computational modelling

Keywords

Mineral Dust

Aerosol observations

Aerosol modelling

International excellence networking

End-users tailored products



COST is supported by
the EU Framework Programme
Horizon 2020

COST Association
Avenue Louise 149 | 1050 Brussels, Belgium
t: +32 (0)2 533 3800 | f: +32 (0)2 533 3890
office@cost.eu | www.cost.eu



TECHNICAL ANNEX

International Network to promote the use of Dust Monitoring and Forecasting products (NetDust)

1. S&T EXCELLENCE

1.1. Challenge

1.1.1. Description of the Challenge (Main Aim)

When winds are strong, large amounts of sand and dust are lifted from bare, dry soils into the atmosphere. Through this process of deflation, dust particles are transported downwind affecting regions hundreds to thousands kilometers away. The most important dust source areas are located in the North Hemisphere in an area called “dust belt” (i.e. North Africa, Middle East, East Asia and North America), while other minor sources are in Australia, South America, and South Africa. North African and Arabian deserts are the most important dust sources in the world and dust from these sources is frequently driven to America, Asia and Europe. Wind-blown mineral dust aerosol accounts for one third to one half of the mass of the total aerosol burden. It is estimated that between 1000 and 3000 Tg of mineral dust is uplifted into the atmosphere annually with Saharan desert being the largest global contributor. In addition, human activities, such as improper agricultural and grazing practices, may contribute up to 20-50% of the atmospheric loadings. Improper agricultural and grazing practices or inadequate water management leading to desertification have resulted in the desertification of land throughout the globe. The estimated budget of mineral dust is therefore likely to increase due to the predicted increase of human activities as well as the expansion of arid regions due to global warming.

Due to its multi- and trans-disciplinary effects at local, regional and global scales, dust includes impacts to the environment, human health and specific economic sectors (as agriculture, solar energy and transportation). Over the last few years, numerical prediction of dust concentration and observational products from ground- and satellite platforms have become prominent at several research and operational weather centres due to growing interest from diverse stakeholders, such as solar power plant managers, health professionals, aviation authorities and policymakers. However, the coordination between measurement and modelling groups as well as between scientific research and user communities is difficult. On the one hand, measurement products, lack of harmonized quality indicators, as well as harmonized data formats and measurement schedules. On the other hand, current attempts to transfer tailored products to end-users are not coordinated, and the same technological and social obstacles are tackled individually by different groups, a process that makes the use of data slow and expensive. The flow of information and knowledge between measurement, models, and society requires translation across disciplinary and cultural boundaries. The result is that current data-model-user cooperation becomes increasingly fractured and a potentially immense benefit for Europe’s end users remains unexplored.

The overall objective of the proposed Action is to establish a network involving research institutions, commercial service providers and potential end users of information on airborne dust. The network shall coordinate and harmonize the transforming process of dust observation and prediction data into user-oriented products. By this, the Action will coordinate the current research activities as well as will enhance the availability of appropriate products to assist the diverse socio-economic sectors





affected by the presence of high concentrations of airborne mineral dust. The information will enable mitigation of the negative impacts of this atmospheric component and adaptation both to current dust events and to potential increased occurrence due to climate change and modification of land use.

1.1.2. Relevance and timeliness

Atmospheric dust strongly interacts with the Earth system through direct and indirect impacts (IPCC, 2013). Mineral dust influences the Earth's direct radiative budget by affecting the processes of absorption and scattering at solar and infrared wavelengths. Indirect effects include changes in the number of cloud condensation nuclei and ice nuclei, which in turn affect the optical properties and lifetime of clouds. In this sense, the prescription of an improved dust climatology or, more accurately, the use of online models to predict airborne dust quantities for radiation calculations and cloud formation in numerical weather prediction models is being increasingly recognized as important to improve the accuracy of short-range weather forecasts (Baklanov et al., 2014) and, consequently, air quality forecasts. Dust particles also have effects on atmospheric chemistry, acting as a sink for condensable gases and thus facilitating formation of secondary aerosols, which in turn contribute to PM concentrations. Dust sedimentation and deposition at the surface causes changes in the biogeochemical processes of terrestrial and marine ecosystems through delivery of primary nutrients (Jickells et al., 2005; Nickovic et al., 2012). It has been demonstrated that the Amazon rainforest is fertilized significantly by Saharan dust (Yu et al., 2015). Sand and dust storms have many negative impacts on the agricultural sector (Stefanski and Sivakumar, 2009). Human exposure to airborne mineral dust may adversely affect human health, causing or aggravating allergies, respiratory diseases and eyes infections (Gyan et al., 2005; Griffin, 2007; Mallone et al., 2011). Dust events strongly affect the air quality conditions in Asia, where the background situation is often already heavy (e.g. Wang et al., 2014). Desert dust outbreaks over southern Europe frequently exceed daily and annual safety thresholds of particulate matter (PM) set by the European Union directive on ambient air quality and cleaner air (e.g. Basart et al., 2012; Pey et al., 2013). High dust concentrations significantly reduce visibility through increased light extinction and may affect aircraft operations and ground transportation. They also can deteriorate the aircraft engines. In addition, airborne dust is a serious problem for solar energy power plants (Schroedter-Homscheidt et al. 2012). The need for precise dust observation and prediction products is particularly important for plants built in desert areas of Northern Africa (e.g. Morocco) and Middle East, where European companies have designed ambitious projects. Substantial impacts of dust on climate and environment have increased needs to better understand and predict the atmospheric dust cycle.

Although today the relevance of mineral dust particles in all these fields is clear and there are several national and international scientific initiatives for studying the dust-related problems, tailored products for the user communities are not yet available. Dust observations and models have nowadays reached a level of maturity to be ready for the translation into user-oriented products. For example, easy-to-use prediction of direct and diffuse solar radiation can help industry to optimize the installation of photovoltaic and thermal solar systems. However, this translation is delayed by the rapid increase of available observations, modelling approaches and user communities. If no action is taken to harmonize data and coordinate the information exchange between the involved communities, the benefit of EU-funded research to users and society as a



whole will remain largely unexploited. This Action is therefore timely and will increase the impact of dust research on policy makers, public decision makers and the private sector, and will contribute to the strengthening of European research and innovation capabilities.

1.2. Objectives

1.2.1. Research Coordination Objectives

The overall objective of the proposed Action is to establish a network involving research institutions in observation, modelling and social sciences, service providers, and end users of information on airborne dust. The network shall coordinate and harmonize the process of transferring dust observation and prediction data into user-oriented products. The Action will coordinate the current research activities and enhance the availability of appropriate products to assist the diverse socio-economic sectors affected by the presence of airborne mineral dust. This will be achieved through a) identification of the needs of different end-user groups and b) coordination of existing and new scientific and technical services to achieve a routine delivery of tailored products. As shown in Figure 1.2.1 the aim of this Action is to enhance cooperation between the various dust scientific communities involved in R&D and to connect them to user groups. For example, an archive of dust products could be used in the relationship of sand and dust storms to disease outbreaks and in developing improved soil erosion and land degradation models, among others.

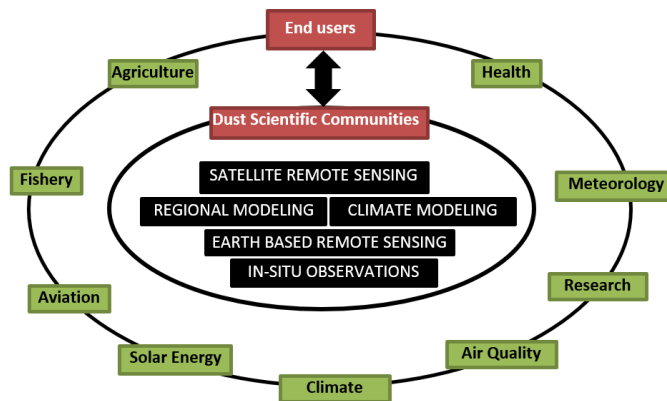


Figure 1.2.1. Schematic plot of the links between scientific and user communities.

Major components of this core objective are to:

- Identify existing and potential user groups (research and commercial organizations) from each participating country that could benefit from specific dust products.
- Identify and exploit observations for dust monitoring (from ground-based and satellite platforms) and forecast products best suited to be transferred/tailored to the needs of end-users.
- Coordinate collaboration between data producers and users.
- Build capacity of end-users to promote the use of the delivered products.
- Involve North Africa and Middle East in the European-driven climate change science and mitigation/adaptation strategies.



1.2.2. Capacity-building Objectives

The training of policy-makers, managers and technicians from the different socio-economic sectors affected by airborne dust is essential. First, they must gain awareness of the negative impacts of airborne dust and understand in depth the mechanisms associated with them. Then, they must be able to properly use the available observational and forecast products in order to design and implement preparedness and mitigation measures. These objectives shall be achieved through high-level teaching (through seminars and workshops as well as printed and online training material) and will require the involvement of the stakeholders.

Observational networks perform systematic measurements with high spatial density in developed countries (as EMEP and Airbase networks at European level) but very sparse, discontinuous and rarely near-real-time measurements are available close to the sources. Availability of observational data from dust source regions is fundamental to both dust monitoring and forecasting. Nevertheless, the location of the main dust sources in remote and unpopulated areas, often in developing countries with political instability, complicates the establishment of adequate observing networks. A number of monitoring stations have been set in Africa and Middle East by European institutions (as the French network AMMA in Sahel). However, attendance and basic maintenance must often be in charge of local institutions. Furthermore, there is not any protocol for routine international exchange of air quality data, so their use is often limited to the national level. Thus, building capacity of countries and training technical staff are among the primary objectives of the Action. Cooperation with institutions from near-neighbouring and international partner countries in Northern Africa and Middle East will be essential and of mutual benefit, because dust concentrations are generally much higher and the adverse effects more severe near the sources than far downwind. Moreover, the participation in the Action of American and importantly Asian partners brings the possibility of extending the application of the developed products, protocols and tools well beyond the European borders, including areas like Asian regions where dust particles play a major role in the air quality and meteorological processes.

1.3. Progress beyond the state-of-the-art and Innovation Potential

1.3.1. Description of the state-of-the-art

Aerosol particles are emitted from Earth's surface both naturally (e.g., dust, sea-salt, biogenic emissions), and as a result of human activities. Key aerosol species include sulphates, organic carbon, black carbon, nitrates, mineral dust, and sea salt. In the atmosphere, these aerosols rarely occur as individual species, but rather clumped together to form complex mixtures. It is common, for example, for particles of black carbon from soot or smoke to mix with nitrates and sulphates, or to coat the surface of dust, creating hybrid particles. The bulk of aerosols—about 90 percent by mass at global scale—have natural origins. Sea salt and dust are two of the most abundant aerosols. Mineral aerosols are highly variable in space and time. Much of the desert dust mass transported in the atmosphere occurs during a few events. Globally averaged, mineral aerosols have varied by a factor of 2–3 between glacial and interglacial time periods (Mahowald et al., 2006), and on the regional and decadal time scale can change by a factor of 2–4 depending on climate variability and/or anthropogenic land use change (Ginoux et al., 2012).

Various ground-based observational systems have been established to monitor aerosols over Europe (e.g., EMEP, Airbase, AERONET, CARAGA, EARLINET). Satellite remote sensing is the





most convenient tool for providing spatial and temporal distribution of aerosols. In last years, a number of new advanced sensors (like SEVIRI, AIRS, IASI, CALIOP and MODIS) have been launched allowing dust detection (e.g. Klüser et al., 2015). Despite the number of available observations, there are still some gaps, especially at the early phase of dust transport or in the proximity of desert sources. Dust modelling partly fills gaps in observations, and, more importantly, can predict (potential) dust episodes and thus facilitate the preparation of dust management's measures. Since the early 1990s, models have significantly improved their skills to predict the major features of the dust cycle. A number of dust forecast systems have been developed in Europe, such as the global model for atmospheric composition of the Copernicus project (Morcrette et al., 2009), MetUMTM (Woodward, 2001), BSC-DREAM8b (Basart et al., 2012), NMME-DREAM8 (Pejanovic et al., 2010) and NMMB/BSC-Dust (Pérez et al.; 2011). While the meteorological community has developed protocols and near real-time observing systems to support forecasting, the aerosol community is only beginning to organize. It is necessary an international forum for bringing together atmospheric dust forecast centers and remote sensing data providers, and for leading data systems developers to share best practices and discuss pressing issues facing the operational dust community. On the other hand, despite the relevance of desert dust particles in climate, weather, energy, transport, air quality, health and agriculture is clear and there are several national and international scientific initiatives for studying the dust-related problems, there is no specific 'dust-product' tailored to the potential user communities available yet. Knowledge and technology transfer, via tailored services, is essential to bridge the gap between science and its end users.

1.3.2. Progress beyond the state-of-the-art

The present Action will create a synergy among communities that provide dust prediction/observation data, and those, which should use these products in their professional routines, turning the initially scattered groups into one transnational and multi-disciplinary team.

Observational and forecast products that can eventually be transferred to end users are diverse and often not easily intelligible to users lacking of specific training. The search and identification of the most suitable products for this process will require an effort to generate a comprehensive catalogue of products. Throughout the Action, it is also expected to reach agreements, establish protocols and define formats for the near-real-time (NRT) exchange of products as well as develop catalogues of dust-related products for long-term/climatic studies. It is also expected to build capacity of potential users. The availability of suitable products and training of managers and technicians in their use will facilitate mitigation of the adverse impacts of airborne dust and exploitation of positive effects of dust deposition, leading to a notable progress in those socio-economic sectors affected by the presence of airborne dust.

As an example, the Action could be as well the platform for providing to the governmental stakeholders (Environmental Agencies) the means for an appropriate assessment of the contributions of desert dust to ambient PM10 and PM2.5 levels over Europe and other affected areas during dust outbreaks. In fact, within the EC-LIFE+ DIAPASON Project (in which proposers of this Action were involved), an automatic, user-friendly software was developed to quantify the daily dust contribution to ambient PM10. Within the proposed Action this software will be further improved, tested and disseminated at the European level. The ultimate goal is to provide to European member States the tools for a harmonized assessment of desert dust contribution to the





air quality metrics regulated by the relevant European Directive 2008/50/EC. The solar energy community could benefit from specifically-designed end-user dust products to improve solar resource assessment and plant operation especially in arid regions where soiling and aging of plant components and solar radiation attenuation due to dust is an issue. For aviation, specifically-designed end-user dust products can be used for air traffic management (pre-flight planning done by pilots/airlines and in-flight plan adjustment) or for investigating how the dust exposure can affect the aircraft engines.

Moreover, the combination of observation products and model simulations is expected to provide reliable climatological reference values describing the spatial and temporal (monthly, seasonal and annual) distribution of airborne dust both near the Earth's surface and in upper levels. These reference values will constitute an element for long-term planning in areas affected by dust. At the same time, they will facilitate the definition of thresholds for future early-warning systems.

1.3.3. Innovation in tackling the challenge

The Action will work with an interdisciplinary approach on knowledge and technology transfer. It will facilitate the cross-fertilization of scientific research and efforts to advance sustainable development in key sectors such as energy, transport and air quality. The overall aim is to demonstrate the value of airborne dust research to society and economy. End-users will remain at the centre of the Action to ensure that outcomes are both useful and usable through the following main ideas:

- Advance and guide state-of-the-art research on mineral dust.
- Ensure fast availability of products.
- Develop platforms to tailor and disseminate knowledge, products and technology with emphasis to deliver end-user products in remote areas afflicted by dust events (e.g. via mobile phone apps).
- Bring innovation to both institutions and commercial organizations in order to improve efficiency of work processes (e.g. air traffic management, aircraft maintenance issues, power plants operation and air quality assessment).
- Assess the user and societal benefits in order to evaluate the service value, by establishing engagement, co-production and feedback from users to providers.

1.4. Added value of networking

1.4.1. In relation to the Challenge

The process of transferring dust observation and prediction information via user-oriented products cannot be performed without a constant dialogue between producers and users. The planning of the process, the study of the impacts, the transfer of products and knowledge, and the evaluation of the results are not possible without participation of the stakeholders. Networking will likely benefit all parties. Besides the link with users, it is however important to highlight here the scientific progress expected from this multidisciplinary network. The Action will put together different scientific communities looking at different aspects of research on desert dust. The envisaged benefits on the user side are as follows:

- For health stakeholders: to better understand the dust impact on human health, especially on pulmonary and cardiovascular diseases. Availability of tailored monitoring and forecast





products shall enable optimizing health care services and alerting the population during the most serious episodes.

- For meteorological and climate services: to better understand the dust-cloud-radiation interaction allowing improved radiation and clouds parameterizations in NWP and climate models.
- For aviation operators: to have access to precise forecasts of visibility reduction by dust particles, which can improve air traffic management and safety; dust is also an issue for aircraft (engines and airframe) maintenance scheduling.
- For the solar power generation sector: to better plan and assess investments in new infrastructures, predict the impact of reduced radiation on the output from operational plants and to plan maintenance and clean-up tasks.
- For fishery industry and agriculture: to receive estimates of deposited dust as nutrient responsible for increasing marine productivity in specific areas.
- For air quality assessment and management agencies, to better estimate the contribution of natural dust to the overall aerosol concentration, and during pollution episodes in particular, and formulate ad hoc mitigation/adaptation strategies.

The envisaged benefits on the data/model producers' side are:

- Better knowledge of end-users' real needs, optimization of the data definition for each observation type and harmonization with the other platforms.
- The exchange of expertise and communication inside the Action will permit identification of critical gaps in current observational networks and model developments.
- Acceleration in model and data-product improvements, focused especially on the derivation of new user-oriented products.
- Coordinated work is also expected to lead to better understanding of the interactions between aerosols and atmospheric processes and thus contribute to reduce the uncertainties in modelling the chemical composition of atmosphere and in the quantification of the direct and indirect radiative forcing attributed to natural aerosols. Such advances will contribute to the definition of mitigation and adaptation measures to face the challenges posed by climate change.

1.4.2. **Description of the Action in relation to existing efforts at European and/or international level**

Several research collaborative European and international initiatives and projects have been set to better understand, monitor and predict the dust (and/or aerosol in general) cycle. These programmes cover specific aspects:

- Models: WMO Sand and Dust Storm Warning Advisory and Assessment System (SDS WAS), MACC and MACC-II-III, AEROCOM, ICAP and EuMetChem
- Observations: EMEP, ACTRIS and ACTRIS2; EARLINET, LALINET, AERONET, AEROSAT, AEROSOL-CCI and GEO-CRADLE
- Dust effects on air quality (EU Life+ DIAPASON, EU Life+ AIRUSE), health (EU Life+ MED-particles), solar energy (DNIcast, WASCOP, IE SHC and SolarPACES) and aviation (Daedalus)





Additionally to these research activities, some other initiatives are focused at providing products to end-users:

- The Barcelona Dust Forecast Center (**BDFC**, <http://dust.aemet.es/>) is designated by the WMO as the first Regional Specialized Meteorological Centre with activity specialization on Atmospheric Sand and Dust Forecast. It generates and distributes operational dust forecasts for Northern Africa (north of equator), Middle East and Europe.
- **Copernicus** (<http://www.copernicus.eu/>) is a European Union (EU) programme aimed at developing European information services based on satellite and ground Earth observation and data analysis.

Even if some examples of interactions occurred, there is not yet a common platform for addressing dust related issues. The current Action is designed as a cross-sector platform that could act as a link among these pre-existing projects promoting important synergies of different communities and it is expected to provide innovative and affordable technologies to environmental agencies for assessing the contribution of African dust to air quality levels in Europe following a similar scheme as EMEP, DIAPASON, MED-Particles and ACTRIS-2. For example, ACTRIS is chosen to be in the ESFRI roadmap (see <http://www.actris.eu/Projects/ACTRISonESFRIroadmap.aspx>). It will be very important if this Action can provide guidance and input on the needed data formats and measurement schedules, in a way that it is useful to modellers and users. This will help ACTRIS prepare for the transition to operations.

The proposers of this Action are involved in many of these activities and projects and thus links to those communities are expected to be facilitated. Networking is expected to strongly cooperate with the **WMO SDS-WAS** and to lead to improvements in the products delivered by the **Barcelona Dust Forecast Center**, which is the Centre designated by the WMO to generate and distribute operational dust forecasts to the National Meteorological and Hydrological Services of the NA-ME-E region. Similarly, it will likely improve the dust component of the products delivered by the future Copernicus services. The first users of **Copernicus** services are policymakers and public authorities, who need the information to develop environmental legislation and policies or to take critical decisions in the event of an emergency, such as a natural disaster or a humanitarian crisis. Other users are private companies (i.e. solar power industry) who need the products for planning investments and managing operations.

2. IMPACT

2.1. Expected Impact

2.1.1. Short-term and long-term scientific, technological, and/or socioeconomic impacts

The justification of the present Action is based on the efforts directed to improve the air quality and the citizens health and to protect ecosystems through a more precise scientific knowledge of the physical processes involving atmospheric dust. In fact, the Action will contribute to a more accurate assessment of dust (and other aerosols) influence on air quality, natural environment and climate, and consequently help formulating more adequate policies, strategies and measures to mitigate the negative impacts caused by desert dust particles. This will have both social (improved quality of life) and economical (decrease of health expenses) impacts.

As a short-term impact, the Action will contribute to establish a network for supporting the process of transferring dust products to end-users, where health, aviation, solar power generation sectors





and fishery industry will benefit from the outset. Additionally, the Action will work on the development of high-quality training material to promote the use of dust products and to address the risks associated to airborne dust. In the long term, the open observers/users cooperation and discussion platform will be the backbone for a continuous exchange of ideas and information leading to the design of more efficient tailored tools and to strengthen the resilience to the dust impacts. On the other side, tailored tools will help the users in exploiting the positive impacts of dust presence (e.g. nutrients provision to the ecosystems can be beneficial for fishery industry and agriculture). The Action output concerning the impact of dust on solar plants could foster strategies for improving their efficiency. This will have both social (improved quality of life) and economical (decrease of production expenses) impacts.

2.1.2. Plan for involving the most relevant stakeholders

The Action will be open to all potential stakeholders. The Scientific Committee will invite a list of stakeholders to join the first technical meeting of the Action. The link between the consortium and ongoing projects and initiatives at national, regional and global level provides a good opportunity to reach the most relevant stakeholders. In order to reach and involve stakeholders, a call will be published on the dedicated web page to suggest/request participation of potential users. Also, a selection of the Action objectives and plans will be prepared and presented on the web site and at international conferences and national/international meetings.

The results of the Action will be shared within the WMO Global Atmosphere Watch (GAW) Programme, as an international body. Among others, one of the proposed actions will be the identification of government stakeholders in regions affected by dust outbreaks (mainly Northern Africa, Middle East and Europe) and professional associations (energy engineers, healthcare professionals).

2.1.3. Dissemination and/or Exploitation Plan

To reach the expected impact of the Network, the dissemination activities must reach the four main target audiences:

- The scientific community (members participating in this Action and other scientific communities and research bodies interested in dust and its atmospheric impacts/feedbacks).
- Governmental stakeholders (National and/or Regional, e.g. National weather services, Environmental Agencies, and in general EU policy makers and decision-making bodies at national and/or regional levels).
- Industrial stakeholders (technical non-academic professionals of diverse sectors such as health, aviation, solar energy and fishery industries)
- Non-governmental organizations (NGOs) in the sector.

The communication measures will be adapted to the target audience:

- Scientific results will be published in refereed international journals and/or presented in lectures and conferences.
- The Action outcomes that could be exploited by stakeholders (e.g. access to dust observations and predictions, tailored products/services developed by consortium partners, etc.) will be made available on the project website, which will be built upon the already existing SDS-WAS website. This will ensure the open access to the network's outcomes during and after the Action's lifetime.





- Multimedia and printed material (videos, factsheets, brochures, etc.) will be tailored to the information needs of the different industrial sectors and governmental stakeholders. A multimedia approach will be taken ensuring the use of multiple platforms and formats to enhance the Action's dissemination among stakeholders. This will be also linked to training activities.
- Social networks will inform the general public through the Facebook and Twitter accounts (the twitter account of the BDFC that already have 553 followers). Mainstream press releases will be prepared and circulated into general and specialized media.

The list of activities will be defined in the “Dissemination and exploitation strategy document” that will be a constantly in progress document revised and adapted according to the evolution of the network. Where possible and appropriate, the Action may use the additional dissemination channels of the various projects and initiatives the proposers are part of to disseminate results and outcomes of this Action and raise awareness of its presence. All activities will be evaluated afterwards with quantitative indicators to assess the direct impact on the target audiences and improve them in the future. Furthermore, it is worth emphasizing that the Action will collect and improve open-source tools that will help users to access, read, and visually inspect the results. This will be important e.g. for start-ups and other small and medium-sized enterprises (SMEs).

2.2. Potential for Innovation versus Risk Level

2.2.1. Potential for scientific, technological and/or socioeconomic innovation breakthroughs

At present, many socio-economic sectors consider airborne dust as a random hazard that can only be statistically accounted for. Therefore, knowledge of the physical processes, information on the occurrence of individual episodes and more reliable statistical information can lead to improvement in planning and operations without any apparent risk. The Action will positively impact the scientific community through a better awareness of the end-users' real needs, an optimization of the data definition for each observation type and harmonization with the other platforms. The exchange of expertise and communication inside the Action will also permit the identification of critical gaps in current models and observations. In a long-term perspective, the Action will accelerate work on improving dust models further, focusing especially on promising outcomes related to derivation of new user-oriented products.

Current efforts to bring together dust observations and modelling communities are mainly focused on climate studies with historical satellite data and climate model runs. Dust forecast models assimilate total aerosol optical depth from satellites, if at all, and mostly no specific dust product. As in recent years the dust observation capabilities from satellite have significantly improved, the proposed Action has high potential to bridge the gap between the dust modelling communities and the providers of satellite dust observations, steadily improving data quality and ensuring data standards compliance. Consequently, there is a good chance that the Action will facilitate the use of such observation data in dust forecasting as well as communicating the need for timely delivery of satellite dust observations to user communities other than climate researchers. It can be expected that all subsequent user groups of combined tailored dust products and/or dust forecasts will benefit from a stronger link between the model community and the satellite data providers.

One of the most important innovative factors of the Action is the aim to engage the scientific and user communities in a continuous exchange. To this innovative factor corresponds however a high risk level: the user community interest should be kept high. Typically, scientists are more efficient





in communicating with other scientists. Problems start already with scientists of different fields and the situation is definitively worse for non-scientific audience. As actions for reducing the risk of lack of interest from the users, multimedia informative materials and communication through social network are foreseen. Moreover, a partner from the social scientist-communication field and PMI partners with expertise in science-to-users presentations are involved.

3. IMPLEMENTATION

3.1. Description of the Work Plan

3.1.1. Description of Working Groups – Provide for each WG the Objectives, Tasks, Milestones and Deliverables

The scientific program of the Action will be realized through the following working groups (WG):

- WG1: Dust observation
- WG2: Dust modelling and forecast
- WG3: Assessment of user and societal benefits to evaluate the service value
- WG4: Transfer of dust (modelled and observed) products to user-oriented applications and ex-post evaluation of the services value

WG1 shall work on the identification of ground-based and satellite observations best suited to be transferred to modelling groups and end-users. It will review existing quality assurance and communication practices and propose harmonized reporting procedures, following the guidance of the GEO's Quality Assurance for Earth Observation (**QA4EO**) initiative. Additionally, WG1 will identify critical gaps in the current observational capacity (including the availability of observational products in near-real-time) and consider the most appropriate integration of different observation practices and datasets. WG1 will also propose formats and protocols for data harmonization and NRT data exchange.

Tasks:

- Task 1.1.** Review, assess and adapt existing techniques, methodologies, and best practices for the quality assurance of dust-related observations.
- Task 1.2.** Identify and catalogue observation methods and products, and assess their suitability for different users.
- Task 1.3.** Identify observation gaps in terms of parameters and operational capabilities.
- Task 1.4.** Adapt or develop data formats and protocols for data harmonization and NRT exchange. This task will be in coordination with WG2.
- Task 1.5.** Produce recommendations to document and communicate the quality and maturity level of existing and future products.
- Task 1.6.** Interact with WG2 on the specific needs of the modelling community and on preparing joint exercises for models evaluation and inter-comparison and for showcasing the potential for data assimilation in dust forecast.

Deliverables:

- D1.1.** Report on the current needs and future directions for dust observations and applications. **D1.2.** Report on recommended protocols and formats for harmonization and NRT exchange. **D1.3.** Report on dust observational parameters and operational capabilities. **D1.4.** Report on documentation and communication of quality, validation status and uncertainty in dust observations. **D1.5.** Report on





usability and benefits of dust observations in data assimilation experiment (together with WG2). **D1.6.** Update of the dust observations in the website of project.

Milestones:

M1.1. Catalogue of existing dust-related observational products.

WG2 shall work on the identification of the most suitable forecast products for the user's communities. It will also deal with the most appropriate way to communicate the models' modelled data accuracy. The WG2 will also propose formats and protocols for data harmonization and NRT exchange.

Tasks:

Task 2.1. Consolidate state-of-the-art information and identify existing gaps in dust modelling and priorities for the development of next-generation dust models for regional and climatic applications.

Task 2.2. Identify and catalogue dust forecast products, and assess their suitability for different users.

Task 2.3. Define protocols for model evaluation to assess their suitability for different users.

Task 2.4. Define protocols and formats for NRT data exchange. This task will be in coordination with WG1.

Task 2.5. Produce recommendations to document and communicate the quality and maturity level of existing and future products.

Task 2.6. Interact with experimentalists (WG1) on the specific needs of the modelling community and on preparing joint exercises for models evaluation and inter-comparison and for showcasing the potential of data assimilation and evaluation in dust forecast.

Deliverables:

D2.1. Report on the current needs and future directions for dust model development and applications. Specific focus will be given on dust/cloud/radiation parameterizations, dust mineralogy, climate models and data assimilation. **D2.2.** Report on recommended protocols and formats for harmonization and NRT exchange. **D2.3.** Protocol for model evaluation to assess their suitability for different users. **D2.4.** Report on documentation and communication of quality and uncertainty in dust forecasts. **D2.5.** Report on usability and benefits of dust observations in data assimilation experiment (together with WG1). **D2.6.** Update of the dust forecasts in the website of project.

Milestones:

M2.1. Database of dust simulations (i.e. forecasts, hindcasts and reanalysis).

WG3 shall work on the creation of a network that enables fruitful collaborations between researchers and end-user communities. Therefore, WG3 shall work on guidance and training on provided services to public institutions and private companies as well as to increase the international visibility of services to attract new users and establish feedback mechanisms to evaluate the service value. In particular, the present Action will try to network countries from Northern Africa and Middle East.

Tasks:

Task 3.1. Identify potential user communities and contact key players (institutions, private companies, etc.) that can benefit from the use of dust products.

Task 3.2. Build capacity of end-users to promote the use of dust products and to address the risks associated to airborne dust and mainstream them.

Task 3.3. Provide guidance, training and marketing for established services to increase international visibility, and establish feedback mechanisms to evaluate their value to society and the economy.

Task 3.4. Dissemination of the project results for the scientific community.

Task 3.5. Establish a long-term discussion forum between research and user communities.

Deliverables:



D3.1. Report on dissemination and exploitation strategy. **D3.2.** Report on the capacity building strategy **D3.3.** Multimedia and printed material (videos, factsheets, brochures, etc.) **D3.4.** Report of the publications and conference participations during the project. **D3.5.** Online user guide on the provided services.

Milestones:

M3.1. List of potential users. **M3.2.** Deployment of the website of the project. **M3.3.** A workshop to build capacity of scientists, engineers and policy makers to use this information to address the risks associated with airborne dust. **M3.4.** Training School on dust forecast and observations. **M3.5.** Launch of open online discussion platform and tools for communication of scientific, commercial and user communities.

WG4 shall work on proposing the most suitable products for the application areas identified by users involved in the Action and also identified by **WG3**.

Tasks:

Task 4.1. Identify specific needs of the users not covered by existing dust products.
Task 4.2. Identify and record end-user current capacities and needs related with data handling formats.
Task 4.3. Design tailored observational and forecast products to cover specific user needs. This task will also work to bridging between research and commercial organisations, to transfer pure research/knowledge/tools to the applied domain.

Deliverables

D4.1. Report on specific need of the users not covered by existing dust products. **D4.2.** Report with specific needs regarding products, formats, etc. of the end-user community. **D4.3.** Report on recommendations to develop new observational and forecast products to cover specific user needs.

Milestones

M4.1. Survey to user’s communities

3.1.2. GANTT Diagram

PROJECT:	International Network to promote the use of Dust Monitoring and Forecasting products (NetDust)											
Duration:	4 years											
	1st year			2nd year			3rd year			4th year		
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
WG1: Dust observations												
Task 1.1				D1.1								
Task 1.2			M1.1									D1.6
Task 1.3								D1.3				
Task 1.4						D1.2						
Task 1.5									D1.4			D1.5
WG2: Dust modelling and forecast												
Task 2.1				D2.1								
Task 2.2			M2.1									D2.6
Task 2.3							D2.3					
Task 2.4					D2.2							
Task 2.5									D2.4			D2.5
WG3: Assessment of user and societal benefits to evaluate the service value												
Task 3.1		M3.1										
Task 3.2				D3.2		M3.3						
Task 3.3			M3.2				D3.3		M3.4			D3.5
Task 3.4												D3.4
Task 3.5							D3.1			M3.5		
WG4: Transfer of dust (modelled and observed) products to user-oriented applications												
Task 4.1			M4.1			D4.1						
Task 4.2								D4.2				
Task 4.3												D4.3



3.1.3. Risk and Contingency Plans

The following table summarizes the identified main risks related to the Work Plan and proposes their corresponding mitigation measures.

Description of risk	Proposed risk-mitigation measures
Partnership is unable to fulfil the work plan	<ul style="list-style-type: none"> - Clear definition of work plan and work package leaders. - Use of project website. - In case a delay is due to lack of readiness from a WG Leader, it will be immediately replaced by the Executive Committee.
Delay on deliverables of WG's	<ul style="list-style-type: none"> - Monitoring of work plan by the Review Committee. - Revision of the Draft Documents that support the discussion by stakeholders. If needed segmentation of the scientific community into smaller areas of interest.
Inability to produce work on time	<ul style="list-style-type: none"> - Ensure regular contact between all COST members. - Elaborate clearly defined milestones and means of verification to monitor tasks' accomplishment.
Working problems / Insufficient collaboration between partners and new participants (e.g. end-users)	<ul style="list-style-type: none"> - Establish strategies (such as periodical meetings and other COST events) - Ensure all partners know each other and create interpersonal connections. - Establish clear procedures for internal communication and reporting. - Take remedial actions in case a partner is not able to work effectively with others, promoting collaboration between partners. - Funded COST Action events will reinforce the participation of new potential end-users. - Political events in the source regions affecting the delivery of improved observations and training, will be compensate with the creation/collection of printed and online materials
Lack of interest from the users	<ul style="list-style-type: none"> - Multimedia informative materials and communication through social network. - A partner from the social scientist-communication field and PMI partners with expertise in science-to-users presentation are involved.

3.2. Management structures and procedures

The overall Action activity will be managed by the Management Committee (MC), composed of the national delegates. Efficient day-to-day management will be ensured by the Steering Committee (SC), consisting of the MC chair, the vice-chair and the WG leaders. SC will have frequent conference call meetings to secure efficient coordination of the Action. Activities requiring cooperation amongst members will be accomplished mainly through Short-Term Scientific Missions (STSMs), which will be planned and managed by a dedicated member of the MC. The Action will involve specifically or invite to its meeting experts from the United States and from countries with relevant scientific production in the area (e.g. China, Japan, and Korea). In particular, involvement of space agencies (e.g. ESA, EUMETSAT) will be encouraged. In addition, scientists and technicians coming from geographic regions containing the main dust sources affecting Europe (North Africa and Middle East) will have an important contribution.

The SC will be in charge of organizing the MC and the WG meetings and workshops. The MC will define the strategic roadmap of the Action and integrate the results of the WGs. The MC will also ensure the promotion of the Action and the dissemination of its results, and secure interactions between data producers and users as partners within the project.

3.3. Network as a whole



Atmospheric dust plays a significant role in different aspects of weather, climate, atmospheric chemistry and ecosystems as well as its impacts on life, health, economy. Understanding, managing and mitigating sand and dust storms risks and effects requires fundamental and cross-disciplinary knowledge.

Desert dust transport is a global phenomenon. For countries located in and downwind of arid regions (e.g. Northern Africa and Middle East) airborne sand and dust present serious risks to the environment, property and human health. In downwind regions (such as Europe), dust outbreaks may greatly increase the ambient air levels of PM recorded in air quality monitoring networks. This is especially relevant in Southern Europe. Due to this international and multi-regional/multi-national character of atmospheric dust transport, the present COST Action involves 23 countries: in Europe (Spain, Portugal, Greece, Italy, Germany, Serbia, Romania, United Kingdom, Belgium, Norway and France), North Africa (Morocco) and Middle East (Egypt, Turkey, Cyprus, Jordan and Saudi Arabia). Furthermore, the Action will involve specifically atmospheric aerosol experts from America (i.e. United States, Chile and Brazil), and from other countries with relevant scientific production in the area (e.g. Japan, Namibia and South Africa). The Action will continue on its expansion to cover all European geographical regions. In addition, representatives of international and European organizations, bodies and associations involved in environmental protection issues will be represented and have already expressed their interest to participate in the current Action.

Research activities are designed to make available scientifically robust information on the environmental, social, and economic risks and impacts of atmospheric dust. Because of the strong interaction atmospheric dust has with the Earth system, a multidisciplinary group of international scientific experts on aerosol measurements and aerosol modelling (from short-term to climatic scales) will be part of the present Action. Moreover, one of the main objectives of the present proposal is to provide scientific expertise and leadership within the atmospheric dust research community for supporting the development of the most suitable products for the application areas identified by users; providing continuity and guidance in overcoming knowledge and capacity gaps; and guidance and training on provided services to public administrations and companies. It is within this framework that a multidisciplinary group of international experts on aerosol measurements, aerosol regional modelling, air quality management experts and social scientists are participating. Moreover, the aim of the Action is to create a network that enables fruitful collaborations between researchers and business by providing a natural platform for them to meet and build mutual trust. It also aims at increasing impact of research in the industrial sector, by promoting the use and development of technologies, as well as the exploitation of COST Action results and outcomes through dedicated dissemination and exploitation activities targeting European small and medium-sized enterprises (SMEs) and companies.



References

- Baklanov et al. (2014): Online coupled regional meteorology chemistry models in Europe: current status and prospects. *Atmos. Chem. Phys.* 14, 317-398.
- Basart et al. (2012): Development and evaluation of the BSC-DREAM8b dust regional model over Northern Africa, the Mediterranean and the Middle East. *Tellus B* 64.
- De Leeuw et al. (2013): Evaluation of seven European aerosol optical depth retrieval algorithms for climate analysis. *Remote Sens. Environ.*
- Ginoux et al. (2012). Global-scale attribution of anthropogenic and natural dust sources and their emission rates based on MODIS Deep Blue aerosol products. *Reviews of Geophysics*, 50(3).
- Griffin (2007): Atmospheric movement of microorganisms in clouds of desert dust and implications for human health. *Clin. Microbiol. Rev.* 20 (3), 459-477.
- Gyan et al. (2005): African dust clouds are associated with increased pediatric asthma accident and emergency admissions on the Caribbean island of Trinidad. *Int. J. Biometeorol.* 49, 371-376.
- IPCC (2013): Intergovernmental Panel on Climate Change: The Physical Science Basis: Summary for Policymakers. Cambridge, UK.
- Jickells et al. (2005): Global iron connections between desert dust, ocean biogeochemistry, and climate. *Science* 308, 67-71.
- Klüser et al. (2015): Information content of space-borne hyperspectral infrared observations with respect to mineral dust properties. *Remote Sens. Environ.* 156, 294-309.
- Mahowald et al. (2006). Climate response and radiative forcing from mineral aerosols during the last glacial maximum, pre-industrial, current and doubled-carbon dioxide climates. *Geophysical Research Letters*, 33(20).
- Mallone et al. (2011): Saharan Dust and Associations between Particulate Matter and Daily Mortality in Rome, Italy. *Environ Health Perspect.* 119(10).
- Menut et al. (2009): Previsibility of mineral dust concentrations: The CHIMERE-DUST forecast during the first AMMA experiment dry season. *J. Geophys. Res.* 114, D07202.
- Morcrette et al. (2009): Aerosol analysis and forecast in the European Centre for Medium-Range Weather Forecasts Integrated Forecast System: Forward modeling. *J. Geophys. Res.* 114, D06206.
- Nickovic et al. (2012): Technical Note: High-resolution mineralogical database of dust-productive soils for atmospheric dust modeling. *Atmos. Chem. Phys.* 12, 845-855.
- Pappalardo et al. (2014): EARLINET: towards an advanced sustainable European aerosol lidar network. *Atmos. Meas. Tech. Discuss.* 7, 2929-2980.
- Pejanovic et al. (2010): Assimilation of satellite information on mineral dust using dynamic relaxation approach. *Geophys. Res. Abstracts* 12, EGU2010-7353.
- Pérez et al. (2011): Atmospheric dust modeling from meso to global scales with the online NMMB/BSCDust model – Part 1: Model description, annual simulations and evaluation. *Atmos. Chem. Phys.* 11, 13001-13027.
- Pey et al. (2013): African dust outbreaks over the Mediterranean Basin during 2001-2011: PM10 concentrations, phenomenology and trends, and its relation with synoptic and mesoscale meteorology. *Atmos. Chem. Phys.* 13(3), 1395-1410.
- Schroedter-Homscheidt et al. (2013): Aerosols for Concentrating Solar Electricity Production Forecasts: Requirement Quantification and ECMWF/MACC Aerosol Forecast Assessment. *Bull. Amer. Meteor. Soc.* 94, 903-914.
- Stefanski and Sivakumar (2009): Impacts of sand and dust storms on agriculture and potential agricultural applications of a SDSWS. *IOP Conf. Ser. Earth Environ. Sci.* 7, 012016.
- Wang et al. (2013): Consecutive transport of anthropogenic air masses and dust storm plume: Two case events at Shanghai, China. *Atmospheric Research*, 127, 22-33.
- Woodward (2001): Modeling the atmospheric life cycle and radiative impact of mineral dust in the Hadley Centre climate model. *J. Geophys. Res.* 106, D16, 18155-18166.
- Yu et al. (2015): The Fertilizing Role of African Dust in the Amazon Rainforest: A First Multiyear Assessment Based on CALIPSO Lidar Observations. *Geophys. Res. Lett.* 42, 10-1002.

COST Mission and Policies

The aim of this Action is to enhance cooperation between the various dust scientific communities involved in R&D and to connect them, hence covering the existing gap between science, policy makers and society through the support of the process of transferring dust observation and prediction capabilities to user-oriented products. The present Action also searches to create provider and user groups capable of sharing experiences, making new policies, and working in transparency, where trust, leadership and cooperation are key success factors.

Airborne dust transport is a global phenomenon. For countries in and downwind of arid regions (e.g. Northern Africa and Middle East) airborne sand and dust presents serious risks to the environment, property and human health. In long-ranged dust transported regions (such as Europe), dust outbreaks may greatly increase the ambient air levels of particulate matter recorded in air quality monitoring networks. Due to this international and multi-regional character of atmospheric dust transport, the proposal has 53 partners, from 23 countries in Europe, Africa, Asia and America, assuring the cross-border networking researchers. Following the Mission and Policies of the COST Action, the 38% of the countries involved in the Action are COST Inclusiveness target countries in addition to a COST Near Neighbour Country (i.e. Egypt, Jordan and Morocco) and COST International Partners (i.e. Saudi Arabia, Namibia, South Africa, Brazil, Japan, and United States). The Action will continue on its expansion to cover all European geographical regions and Near Neighbour Countries. In addition representatives of international and European organizations, bodies and associations involved in environmental protection issues will be represented and have expressed their interest to participate in the current COST.

As it is said in the bases of the call, promoting geographical, age and gender balance throughout the activities and operations is mandatory for the COST Action, and the proposal has been working for accomplishing this goal. Thus, the gender distribution includes a 23% of females which should be considered a relatively high percentage, considering the low number of women working in this particular research field. There are also 23 Early Career Investigators, where the main proposer is included (she also happens to be a woman) stressing the fact that a next generation of young researchers will be formed within the Action. The aim of the Action is to create a network at enable fruitful collaborations between researchers, policy makers and business by providing a platform for them to meet and build mutual trust. It is within this framework that a multidisciplinary group of international experts on aerosol measurements, aerosol regional modelling, air quality management experts and social scientists are participating. Additionally, the consortium includes proposers from the private sector that will provide their expertise to promote the transfer and use of technologies, as well as the exploitation of Action results.

Network of Proposers - Features

COST Inclusiveness target countries

38.46 %

Number of Proposers

53

Gender Distribution of Proposers

77.4% Males

22.6% Females

Average Number of years elapsed since PhD graduation of Proposers with a doctoral degree

13.5

Number of Early Career Investigators

23

Core Expertise of Proposers: Distribution by Sub-Field of Science

71.7% Earth and related Environmental sciences

11.3% Environmental engineering

3.8% Other humanities

1.9% Basic medicine

1.9% Chemical engineering

5.7% Other

3.8% Unspecified

Institutional distribution of Network of Proposers

56.3% Higher Education & Associated Organisations

34.4% Government/Intergovernmental Organisations except Higher Education

7.8% Business enterprise

1.6% Private Non-Profit without market revenues, NGO

Government/Intergovernmental Organisations except Higher Education:66

- Number by Level
 - Central and Federal Government:19
 - Local government:3
- Number by Type
 - Other Public Non-Profit Institution:4
 - Government department or government-run general public services:11
 - Non-R&D executive agencies, including sector specific regulatory bodies:1
 - R&D Funding and/or R&D Performing bodies:6

Business enterprise:15

- Number by Market sector of unit of affiliation
 - Professional, Scientific And Technical Activities:2
 - Information And Communication:1
- Number by Type
 - Private enterprises:3



- Number by Ownership and International Status
Independent Enterprise:3
- Number by Size
SME (EU Definition provided underneath after selection):3

Higher Education & Associated Organisations:108

- Number by Field of Science of Department/Faculty of Affiliation
Earth and related Environmental sciences:16
Chemical sciences:1
Environmental engineering:1
Agriculture, Forestry, and Fisheries:1
Health Sciences:1
Physical Sciences:3
Other engineering and technologies:1
Other humanities:2
- Number by Type
Research Oriented:17
Education Oriented:10
- Number by Ownership
Fully or mostly private:6
Fully or mostly public:20
50-50 Public and Private:1

Private Non-Profit without market revenues, NGO:3

- Number by Type
Charity:1
- Number by Level
National:1

COST Country Institutions(13) : Belgium , Cyprus , France , Germany , Greece , Italy , Norway , Portugal , Romania , Serbia , Spain , Turkey , United Kingdom

Near-Neighbour Country Institutions(3) : Egypt , Jordan , Morocco

COST International Partners(7) : Brazil , Chile , Japan , Namibia , Saudi Arabia , South Africa , United States

European Commission and EU Agencies(0)

European RTD Organisations(0)

International Organisations(0)

Network of Proposers - Details

Main Proposer's Details

Title:	Dr	Gender:	F
First Name:	Sara	Year of birth:	13/05/1978
Last Name:	Basart	Years from PhD:	4.00
Email:	sara.basart@bsc.es	Telephone Number:	+34934134038
Institution:	Barcelona Supercomputing Center - Centro Nacional de Supercomputación	Type of Institution:	Government/Inter governmental Organisations except Higher Education
Address of the Institution:	c/Jordi Girona, 29, 08034 Barcelona, Spain		
Sub-field of Science of Department:		Core Area of Expertise:	Environmental engineering (Air pollution)



Secondary Proposers' Details

Belgium

[Dr Yves Govaerts](#) (Rayference - Yves Govaerts)

Participating as Secondary Proposer

E-mail: yves.govaerts@rayference.eu

Telephone: +32487398554

Core Expertise: Earth and related Environmental sciences: Atmospheric chemistry and composition

Gender: M

Years from PhD: 20.00

Cyprus

[Dr Mihalis Vrekoussis](#) (The Cyprus Institute)

Participating as Secondary Proposer

E-mail: vrekoussis@cyi.ac.cy

Telephone: +35722208698

Core Expertise: Earth and related Environmental sciences: Atmospheric chemistry and composition

Gender: M

Years from PhD: 11.00

[Dr Michael Pikridas](#) (The Cyprus Institute)

Participating as Secondary Proposer

E-mail: mpikridas@gmail.com

Telephone: +35799303496

Core Expertise: Earth and related Environmental sciences: Atmospheric chemistry and composition

Gender: M

Years from PhD: 4.00

[Dr Jean Sciare](#) (the cyprus institute [EEWRC])

Participating as Secondary Proposer

E-mail: j.sciare@cyi.ac.cy

Telephone: +35722260161

Core Expertise: Environmental engineering: Air pollution

Gender: M

Years from PhD: 16.00

Germany

[Prof Ina Tegen](#) (Leibniz Institute for Tropospheric Research)

Participating as Secondary Proposer

E-mail: itegen@tropos.de

Telephone: +4934127177041

Core Expertise: Earth and related Environmental sciences: Atmospheric chemistry and composition

Gender: F

Years from PhD: 24.00

[Dr Lars Klüser](#) (German Aerospace Center (DLR) - German Remote Sensing Datacenter (DFD))

Participating as Secondary Proposer



E-mail: lars.klueser@dlr.de

Telephone: +498153281334

Core Expertise: Earth and related Environmental sciences: Atmospheric chemistry and composition

Gender: M

Years from PhD: 2.00

Dr Stefan Wilbert (DLR [Institute of Solar Research])

Participating as Secondary Proposer

E-mail: stefan.wilbert@dlr.de

Telephone: +34950277619

Core Expertise:

Gender: M

Years from PhD: 2.00

 **Spain**

Mr Enric Terradellas (State Meteorological Agency (AEMET) - Barcelona Dust Forecast Center)

Participating as Secondary Proposer

E-mail: eterradellasj@aemet.es

Telephone: +34938823056

Core Expertise: Earth and related Environmental sciences: Atmospheric chemistry and composition

Gender: M

Years from PhD: 0.00

Dr Emilio Cuevas (Agencia Estatal de Meteorología (AEMET) - AEMET)

Participating as Secondary Proposer

E-mail: ecuevasa@aemet.es

Telephone: +34922151718

Core Expertise: Earth and related Environmental sciences: Atmospheric chemistry and composition

Gender: M

Years from PhD: 20.00

Dr Isadora Christel Jiménez (Barcelona Supercomputing Center (BSC-CNS) [Earth Sciences Department])

Participating as Secondary Proposer

E-mail: isadora.jimenez@bsc.es

Telephone: +34934134076

Core Expertise: Media and communications: Science communication: dissemination and user-engagement

Gender: F

Years from PhD: 4.00

Ms Natalie Marie Hanrieder (German Aerospace Center DLR - Institute for Solar Research)

Participating as Secondary Proposer

E-mail: natalie.hanrieder@dlr.de

Telephone: +34950362935

Core Expertise: Earth and related Environmental sciences: Meteorology, atmospheric physics and dynamics

Gender: F

Years from PhD: 0.00

Egypt

[Dr Ashraf Zakey](#) (The Egyptian Meteorological Authority)

Participating as Secondary Proposer

E-mail: ashzakey@gmail.com

Telephone: +201152655113

Core Expertise: Earth and related Environmental sciences: Meteorology, atmospheric physics and dynamics

Gender: M

Years from PhD: 15.00

[Prof Osama El-Tawil](#) (Cairo University)

Participating as Secondary Proposer

E-mail: osamaeltawil@yahoo.com

Telephone: +225260755

Core Expertise: Basic medicine: Environmental toxicology, environmental stress

Gender: M

Years from PhD: 19.00

France

[Dr Paola Formenti](#) (Centre national de la recherche scientifique - LISA)

Participating as Secondary Proposer

E-mail: paola.formenti@lisa.u-pec.fr

Telephone: +33145171522

Core Expertise: Earth and related Environmental sciences: Atmospheric chemistry and composition

Gender: F

Years from PhD: 16.00

[Dr Benoit Laurent](#) (University Paris Diderot)

Participating as Secondary Proposer

E-mail: benoit.laurent@lisa.u-pec.fr

Telephone: +0145177055

Core Expertise: Earth and related Environmental sciences: Atmospheric chemistry and composition

Gender: M

Years from PhD: 11.00

[Prof Goloub Philippe](#) (University of Lille / CNRS - University of Lille)

Participating as Secondary Proposer

E-mail: philippe.goloub@univ-lille1.fr

Telephone: +33320436708

Core Expertise: Earth and related Environmental sciences: Meteorology, atmospheric physics and dynamics

Gender: M

Years from PhD: 24.00

United Kingdom

[Dr Malcolm Brooks](#) (Met Office)

Participating as Secondary Proposer

E-mail: malcolm.e.brooks@metoffice.gov.uk

Telephone: +441392886194

Core Expertise: Earth and related Environmental sciences: Meteorology, atmospheric physics and dynamics



Gender: M
Years from PhD: 11.00

Dr Adam Durant (Aeroanaytica Ltd.)

Participating as Secondary Proposer
E-mail: adam.durant@aeroanalytica.com
Telephone: +447972151454
Core Expertise: Earth and related Environmental sciences: Meteorology, atmospheric physics and dynamics
Gender: M
Years from PhD: 9.00

 **Greece**

Dr Vassilis Amiridis (National Observatory of Athens [IAASARS])

Participating as Secondary Proposer
E-mail: vamoir@noa.gr
Telephone: +302108109116
Core Expertise:
Gender: M
Years from PhD: 10.00

Dr Stavros Solomos (National Observatory of Athens - Greece)

Participating as Secondary Proposer
E-mail: stavros@noa.gr
Telephone: +302108109183
Core Expertise: Earth and related Environmental sciences: Meteorology, atmospheric physics and dynamics
Gender: M
Years from PhD: 5.00

Dr Ioannis Binietoglou (National Observatory of Athens - Institute for Astronomy, Astrophysics, Space Applications, and Remote Sensing)

Participating as Secondary Proposer
E-mail: ioannis@inoe.ro
Telephone: +40734630153
Core Expertise: Earth and related Environmental sciences: Atmospheric chemistry and composition
Gender: M
Years from PhD: 2.00

Dr STATHIS ARAPOSTATHIS (NATIONAL AND KAPODISTRIAN UNIVERSITY OF ATHENS)

Participating as Secondary Proposer
E-mail: arapost@phs.uoa.gr
Telephone: +00302107275583
Core Expertise: Sociology: Sociology of science
Gender: M
Years from PhD: 10.00

Prof Aristotelis Tympas (National and Kapodistrian University of Athens)

Participating as Secondary Proposer
E-mail: tympas@phs.uoa.gr
Telephone: +6977614149
Core Expertise: Other humanities: Science and Technology Studies

Gender: M
Years from PhD: 15.00

 **Italy**

[Dr LUCIA MONA](#) (CNR - IMAA)

Participating as Secondary Proposer
E-mail: lucia.mona@imaa.cnr.it
Telephone: +390971427257
Core Expertise: Earth and related Environmental sciences: Meteorology, atmospheric physics and dynamics
Gender: F
Years from PhD: 13.00

[Dr Gian Paolo Gobbi](#) (National Research Council - Institute of Atmospheric Science and Climate CNR)

Participating as Secondary Proposer
E-mail: g.gobbi@isac.cnr.it
Telephone: +390649934343
Core Expertise: Earth and related Environmental sciences: Meteorology, atmospheric physics and dynamics
Gender: M
Years from PhD: 0.00

[Dr Alberto Maurizi](#) (Consiglio Nazionale delle Ricerche - Istituto di Scienze dell'At)

Participating as Secondary Proposer
E-mail: a.maurizi@isac.cnr.it
Telephone: +390516399615
Core Expertise: Earth and related Environmental sciences: Meteorology, atmospheric physics and dynamics
Gender: M
Years from PhD: 0.00

[Dr Angelo Raffaele Donvito](#) (Digimat S.r.l.)

Participating as Secondary Proposer
E-mail: angelo.donvito@digimat.it
Telephone: +390835345000
Core Expertise: Electrical engineering, electronic engineering, Information engineering: Software engineering, operating systems, computer languages
Gender: M
Years from PhD: 0.00

[Dr Francesca Barnaba](#) (Consiglio Nazionale delle Ricerche - Istituto di Scienze dell'Atmosfera e del Clima)

Participating as Secondary Proposer
E-mail: f.barnaba@isac.cnr.it
Telephone: +390649934282
Core Expertise: Earth and related Environmental sciences: Meteorology, atmospheric physics and dynamics
Gender: F
Years from PhD: 13.00

 **Japan**

[Dr Taichu Tanaka](#) (Japan Meteorological Agency)



Participating as Secondary Proposer

E-mail: yatanaka@mri-jma.go.jp

Telephone: +81332128341

Core Expertise: Earth and related Environmental sciences: Meteorology, atmospheric physics and dynamics

Gender: M

Years from PhD: 11.00

[Dr Thomas Sekiyama](#) (Japan Meteorological Agency - Meteorological Research Institute)

Participating as Secondary Proposer

E-mail: tsekiyam@mri-jma.go.jp

Telephone: +81298538708

Core Expertise: Earth and related Environmental sciences: Atmospheric chemistry and composition

Gender: M

Years from PhD: 4.00

[Dr Nobuo Sugimoto](#) (National Institute for Environmental Studies)

Participating as Secondary Proposer

E-mail: nsugimot@nies.go.jp

Telephone: +81298502459

Core Expertise: Earth and related Environmental sciences: Meteorology, atmospheric physics and dynamics

Gender: M

Years from PhD: 31.00

 **Norway**

[Dr Svetlana Tsyro](#) (Norwegian Meteorological Institute)

Participating as Secondary Proposer

E-mail: svetlana.tsyro@met.no

Telephone: +4722963301

Core Expertise: Earth and related Environmental sciences: Atmospheric chemistry and composition

Gender: F

Years from PhD: 8.00

 **Portugal**

[Prof Carlos Borrego](#) (University of Aveiro [Department of Environment and Planning])

Participating as Secondary Proposer

E-mail: cborrego@ua.pt

Telephone: +351234370349

Core Expertise: Environmental engineering: Air pollution

Gender: M

Years from PhD: 35.00

[Ms Carla Gama](#) (University of Aveiro [Centre for Environmental and Marine Studies])

Participating as Secondary Proposer

E-mail: carlagama@ua.pt

Telephone: +351234370200

Core Expertise: Environmental engineering: Air pollution

Gender: F

Years from PhD: 0.00

Romania

[Dr Doina Nicolae](#) (National Institute of Research and Development for Optoelectronics - National Institute of Research and Development for Optoelectronics INOE [Remote Sensing])

Participating as Secondary Proposer

E-mail: nnicol@inoe.ro

Telephone: +40314053303

Core Expertise: Earth and related Environmental sciences: Meteorology, atmospheric physics and dynamics

Gender: F

Years from PhD: 9.00

Turkey

[Mr Cihan DÜNDAR](#) (Turkish State Meteorological Service)

Participating as Secondary Proposer

E-mail: cdundar@mgm.gov.tr

Telephone: +903123022688

Core Expertise: Environmental engineering: Air pollution

Gender: M

Years from PhD: 0.00

[Mr Kahraman Oguz](#) (Turkish State Meteorological Service)

Participating as Secondary Proposer

E-mail: koguz@mgm.gov.tr

Telephone: +905455631266

Core Expertise: Earth and related Environmental sciences: Meteorology, atmospheric physics and dynamics

Gender: M

Years from PhD: 0.00

[Prof Gürdal Tuncel](#) (Middle East Technical University)

Participating as Secondary Proposer

E-mail: tuncel@metu.edu.tr

Telephone: +903122105871

Core Expertise: Environmental engineering: Air pollution

Gender: M

Years from PhD: 31.00

[Dr SERKAN KARAS](#) (BILKENT UNIVERSITY)

Participating as Secondary Proposer

E-mail: karas@bilkent.edu.tr

Telephone: +05367752805

Core Expertise: Other humanities: SOCIOLOGY, HISTORY AND POLITICS OF TECHNOLOGY

Gender: M

Years from PhD: 2.00

United States

[Dr Carlos Perez Garcia-Pando](#) (Columbia University)

Participating as Secondary Proposer

E-mail: carlos.perezga@nasa.gov

Telephone: +13474041664

Core Expertise: Earth and related Environmental sciences: Atmospheric chemistry and composition

Gender: M



Years from PhD: 11.00

South Africa

[Prof Stuart Piketh](#) (North-West University)

Participating as Secondary Proposer

E-mail: Stuart.Piketh@nwu.ac.za

Telephone: +27182991582

Core Expertise: Earth and related Environmental sciences: Atmospheric chemistry and composition

Gender: M

Years from PhD: 16.00

Brazil

[Dr Eduardo Landulfo](#) (Instituto de Pesquisas Energeticas e Nucleares)

Participating as Secondary Proposer

E-mail: elandulf@ipen.br

Telephone: +551131339372

Core Expertise: Earth and related Environmental sciences: Meteorology, atmospheric physics and dynamics

Gender: M

Years from PhD: 19.00

Chile

[Dr Nicolas Huneeus](#) (Universidad de Chile)

Participating as Secondary Proposer

E-mail: nhuneeus@dgf.uchile.cl

Telephone: +56229784592____

Core Expertise: Earth and related Environmental sciences: Atmospheric chemistry and composition

Gender: M

Years from PhD: 9.00

Morocco

[Mr Rachid WAHABI](#) (Ministry of Health)

Participating as Secondary Proposer

E-mail: wahabirachid3@gmail.com

Telephone: +212661338452

Core Expertise: Chemical engineering: Environmental Health

Gender: M

Years from PhD: 0.00

Saudi Arabia

[Prof Georgiy Stenchikov](#) (KAUST)

Participating as Secondary Proposer

E-mail: georgiy.stenchikov@kaust.edu.sa

Telephone: +966128080265

Core Expertise: Earth and related Environmental sciences: Meteorology, atmospheric physics and dynamics

Gender: M

Years from PhD: 40.00

Serbia



[Dr slobodan nickovic](#) (republic hydrometeorological service of serbia)

Participating as Secondary Proposer

E-mail: nickovic@gmail.com

Telephone: +381656548154

Core Expertise: Earth and related Environmental sciences: Meteorology, atmospheric physics and dynamics

Gender: M

Years from PhD: 34.00

[Dr Ana Vukovic](#) (Faculty of Agriculture, University of Belgrade)

Participating as Secondary Proposer

E-mail: pazisadana@gmail.com

Telephone: +381638095908

Core Expertise: Earth and related Environmental sciences: Meteorology, atmospheric physics and dynamics

Gender: F

Years from PhD: 2.00

[Mr Goran Pejanovic](#) (republic hidrometeorological service of srbija)

Participating as Secondary Proposer

E-mail: goran.pejanovic@hidmet.gov.rs

Telephone: +381112066900

Core Expertise: Earth and related Environmental sciences: Meteorology, atmospheric physics and dynamics

Gender: M

Years from PhD: 0.00

[Dr Zoran Mijic](#) (Institute of Physics)

Participating as Secondary Proposer

E-mail: zoran.mijic@ipb.ac.rs

Telephone: +381113713004

Core Expertise: Earth and related Environmental sciences: Meteorology, atmospheric physics and dynamics

Gender: M

Years from PhD: 5.00

 **Jordan**

[Prof Tareq Hussein](#) (The University of Jordan - Faculty of Science [Department of Physics])

Participating as Secondary Proposer

E-mail: t.hussein@ju.edu.jo

Telephone: +96265355000

Core Expertise: Earth and related Environmental sciences: Meteorology, atmospheric physics and dynamics

Gender: M

Years from PhD: 11.00

 **Namibia**

[Dr Gillian Maggs-Kolling](#) (Gobabeb Research and Training Center)

Participating as Secondary Proposer

E-mail: gillianm@gobabebtrc.org

Telephone: +26464694199

Core Expertise: Earth and related Environmental sciences: Biogeochemistry, biogeochemical cycles



Gender: F
Years from PhD: 18.00

Dr Sam Mafwila (Sam Nujoma Marine and Coastal Resources Research Centre)

Participating as Secondary Proposer

E-mail: smafwila@unam.na

Telephone: +26464502609

Core Expertise: Earth and related Environmental sciences: Chemical oceanography

Gender: M

Years from PhD: 5.00



COST is supported by
the EU Framework Programme
Horizon 2020

COST Association
Avenue Louise 149 | 1050 Brussels, Belgium
t: +32 (0)2 533 3800 | f: +32 (0)2 533 3890
office@cost.eu | www.cost.eu