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U5 Core User Needs Dossier
Version 12

	FUNCTION	NAME	DATE	SIGNATURE
LEAD AUTHOR		Paliouras, E.		
CONTRIBUTING AUTHORS		All Core Users		
REVIEWED BY				
APPROVED BY		Zehner, C ESA	23.05.2006	
ISSUED BY				

EXECUTIVE SUMMARY

This Core User Needs Dossier concisely presents information on the needs of the PROMOTE as they relate to the portfolio of products and services within the Project. It should be noted that the version of this Core User Needs Dossier for Phase II of this Consolidation Stage is quite different than that submitted and accepted in Phase I. This version will focus on the needs of the Core Users as relates to requirements for the PROMOTE products and, as such, will be structured on a service/product basis, rather than on a user-by-user basis. Additionally, the background information collected on the Core Users for the first version will be included, instead, in other PROMOTE documentation, particularly U2: Key User-Segment Profiles.

CHANGE RECORD

Issue	Date	Modified Items / Reason for Change
2.0	30.05.2005	Document structure adapted to fit Phase II needs
2.1	23.05.2006	Accepted version 2 Minor adjustments according to ESA review

TABLE OF CONTENTS

1. INTRODUCTION

1.1 Purpose

The PROMOTE consortium is pleased to count among its members 25 Core User organisations representing international, national, and local interests related to one or more of the atmospheric topics covered by this service: Stratospheric ozone, surface ultraviolet (UV) radiation, air quality, and climate change.

In addition to documenting important information related to the needs of this set of Core Users for interested parties outside of the PROMOTE consortium, the information will also be used as a basis for service product adjustments and improvements, training and promotion planning, and User Federation activities.

1.2 Scope

This document is part of the Task2: Service Portfolio Construction and Delivery task of PROMOTE, and documents for each Core User the policy drivers, operational practices and information required in order to execute their mandates. From this document, the research partners and service developers may be able to alter the planned service portfolio in order to better facilitate product use and utility by the core users.

1.3 References

1.3.1 Applicable Documents

[AD1] Statement of Work, Service Consolidation Actions of EARTHWATCH GMES Services Element, EOEP-GSE-EOAD-SW-02-0002, Issue 6.4, Sep-10, 2002

[AD2] Version 1 of U5: Core User Needs Dossier accepted in Phase I of PROMOTE

[AD3] Version 1 of U6: User Standards Handbook accepted in Phase I of PROMOTE

1.3.2 Reference Documents

There are no reference documents included at this time.

1.4 Document Overview

Because the PROMOTE service element for Atmosphere is divided into four major thematic areas, Chapters 2 through 5 will each address one of these themes. Within each Chapter, each product type will be handled in turn. The SOW, and the first version of this document, calls for coverage of the following topics: Policy Drivers, Specific Information Needs, Current working practices (including current use of geo-spatial information, if applicable), interactions and influences with partner organisations (on international, national, and local levels), potential cost savings and/or performance improvement based on PROMOTE services. This information is now covered in U2: Key

User Segment Profile. Additionally, for U5, the SOW calls for documentation of "applicable existing standards and accepted best practices" within this report, however, these topics are covered in U6: User Standards Handbook, as in Phase I.

2. STRATOSPHERIC OZONE SERVICE LINE

The details compiled in this chapter are the results of Core User consultations. The PROMOTE Core Users involved in this Service Line and who contributed input are:

- ECMWF (V. Bechthold)
- WMO (L. Barrie)
- SPARC/CCMVal (V. Eyring, M. Dameris)

One PROMOTE Core Users with whom consultations are still ongoing is:

- RIVM (H. Slaper)

Since the users are highly qualified scientists, one of their main concerns is to obtain accurate and unambiguous documentation together with traceable data. On the other hand, the user community is willing to accept data in various formats if the documentation allows them to perform transformations into alternative representations. All documentation shall be contained in a Product Specification Document that is under active version control of an international body.

A typical example is the representation of vertical profiles on pressure and/or geometrical grids. There seems to be no clear preference for a specific type of grid if the accompanying documentation of the data provides sufficient detail to perform transformations between alternative representations.

In the following, we use the IGOS/IGACO terms

- trueness: total error (in per cent)
- precision: random error (in per cent)

However, in the case of assimilation, trueness and precision are replaced by time and space dependent forecast/analyses error. For total ozone analyses a trueness of about 3-5 % is achievable to date for low and mid-latitudes, and high-latitude Spring and Summer.

Some misunderstanding of the user requirements might result from the quality differences between single measurements and global maps: the trueness and precision of a single measurement might be diluted somewhat when included into a global map. It seems that this issue still has to be discussed in more detail.

2.1 Assimilated ozone column product (2D)

Spatial coverage	Global (SPARC CCMVal, WMO)
Spatial resolution	Minimum requirements (SPARC CCMVal): **Horizontal resolution:** Spectral triangular 42 (T42), roughly equivalent to 2.8 x 2.8 degrees latitude-longitude. Better than 100 km [50 km for the lower troposphere] (WMO)

Grid / projection	Latitude-Longitude grid (SPARC CCMVal)
Temporal coverage	Entire year, all seasons, time series as long as possible for trend analyses (SPARC CCMVal) Long term record of more than 20 years, sorted by day/month/year (WMO)
Temporal resolution	Daily values (SPARC CCMVal, WMO)
Required parameters and units	Dobson units (SPARC CCMVal)
Acceptable error (target and minimum to be useful)	<5% (SPARC CCMVal) Total columns with precision and trueness of better than 5%, targets are 1 and 2 per cent (WMO)
Definition of error	Total error (SPARC CCMVal) 1 sigma error bar per sample (WMO)
Origin of data, processing history and its representation	Merged observations from various data sources (SPARC CCMVal) Product header parameters to be defined in the Product Specification Document (WMO)
Preferred representation of missing data	Filled with higher order regression (SPARC CCMVal) cloud and event flags per sample (e.g. -1, -2,…) (WMO)
Version control mechanism and representation	Numbering scheme to be defined in the Product Specification Document, under control of an international organization (WMO)
Data format	ASCII (SPARC CCMVal) Use of international standards (e.g. HDF, CDF, etc.) (WMO)
Data exchange	Freely available and downloadable from a website (SPARC CCMVal)
Reference and specification documents	Citable and validated data base (SPARC CCMVal) A Product Specification Document has to contain all details (WMO)
Institution responsible for definitions and modifications	An international proactive organization (e.g. WMO)

Within the next 5 years the significant modifications or additions listed below might not be feasible. However, within the next 10 years the following modifications / improvements shall be made (as soon as possible - the sooner the better)

- Additional provision of true tropospheric columns
- Horizontal resolution of locations up to 10 km (WMO target)

2.2 Near-real time ozone column product (2D)

Spatial coverage	Global (ECMWF)
Spatial resolution / Ground pixel size	Significantly better than 25 km depending on the horizontal gradient of the ozone field (ECMWF)

Minumum/target number of columns per day	Depends on the availability of other good quality ozone data (ECMWF)
Spacing and density requirements	See above (ECMWF)
Near-real time requirement	As currently delivered (ECMWF)
Near-real time availability	As currently delivered (ECMWF)
Required parameters and units	Total columns of ozone, details to be confirmed (ECMWF)
Acceptable error (target and minimum to be useful)	Better than 10% total error (depending on locations and times, ECMWF)
Definition of error terms	1 sigma error bar, cloud and event flags
Origin of data, processing history and its representation	Product header parameters to be defined in the Product Specification Document
Representation of missing data	event flags (e.g. -1, -2, …)
Version control mechanism and representation	Numbering scheme to be defined in the Product Specification Document, under control of an international organization
Data format	As currently delivered (ECMWF)
Data exchange	As currently delivered (ECMWF)
Reference and specification documents	A Product Specification Document has to contain all details
Institution responsible for definitions and modifications	

Within the next 5 years the modifications or additions listed below shall be made

- At the moment, no explicit requirements are known -

Within the next 10 years the following modifications / improvements shall be made

- At the moment, no explicit requirements are known -

2.3 Assimilated ozone column product (3D)

Spatial coverage	Global (SPARC CCMVal, WMO)
Spatial resolution	Minimum requirements (SPARC CCMVal): **Horizontal resolution:** Spectral triangular 42 (T42), roughly equivalent to 2.8 x 2.8 degrees latitude-longitude Better than 100 km [50 km for the lower troposphere] (WMO)
Vertical coverage	Troposphere and entire stratosphere (SPARC CCMVal) Troposphere, entire stratosphere to mesosphere (WMO)
Vertical resolution (break out by layer if needed)	1km (SPARC CCMVal)

	Minimum vertical resolution ranging from 2 km in the troposphere to 3 km in the stratosphere and mesosphere (WMO)
Grid / projection	Latitude-Longitude grid (SPARC CCMVal)
Temporal coverage	Entire year, all seasons, time series as long as possible for trend analyses (SPARC CCMVal) Long term record of more than 20 years, sorted by day/month/year (WMO)
Temporal resolution	Daily values (SPARC CCMVal, WMO)
Required parameters and units	VMR (SPARC CCMVal)
Acceptable error (target and minimum to be useful)	Lower tropospheric layers: 3% / 20% (WMO) <5% (SPARC CCMVal) Upper tropospheric layers: 3% / 20% (WMO) <5% (SPARC CCMVal) Lower stratospheric layers: 3% / 15% (WMO) <5% (SPARC CCMVal) Upper stratospheric layers: 3% / 15% (WMO) <5% (SPARC CCMVal) Mesosphere: 3% / 15% (WMO) Tropospheric column : 5% / 15% (WMO) <5% (SPARC CCMVal) Total column: 1% / 5% (WMO) <5% (SPARC CCMVal)
Definition of error term	Total error (SPARC CCMVal) 1 sigma error bar (WMO)
Origin of data, processing history and its representation	Merged observations from various data sources (SPARC CCMVal)
Representation of missing data	Filled with higher order regression (SPARC CCMVal) Cloud and event flags per sample (e.g. -1, -2, …) (WMO)
Version control mechanism and representation	Numbering scheme to be defined in the Product Specification Document, under control of an international organization (WMO)
Data format	ASCII (SPARC CCMVal) Use of international standards (e.g. HDF, CDF, etc.) (WMO)
Data exchange	Freely available and downloadable from a website (SPARC CCMVal)
Reference and specification documents	Citable and validated data base (SPARC CCMVal)
Institution responsible for definitions and modifications	An international proactive organization (e.g. WMO)

Within the next 5 years the significant modifications or additions listed below might not be feasible. However, within the next 10 years the following modifications / improvements shall be made (as soon as possible - the sooner the better)

- Additional provision of true tropospheric columns
- Horizontal resolution of locations up to 10 km (WMO target)

- Provision of vertical profiles with 0.5 km height resolution (WMO target)

3. SURFACE ULTRAVIOLET (UV) RADIATION SERVICE LINE

The details compiled in this chapter are the results of Core User consultations. The PROMOTE Core Users involved in this Service Line and which contributed input are:

- BVDD (R. Blumenthal)
- SYKE (T. Pyhälahti)
- ARPAT (G. Licitra, D. Palazzuoli)
- ARPAS (G. Lisciandrello)

3.1 Multisensor UV Dose

The UV dose record consists of a regular time series of UV dose data, i.e. daily doses or monthly or seasonal means covering a long time period. These UV doses account for the important effect of clouds; which necessitates a specific choice for the course of cloud cover during the day. Various (satellite based) algorithms have been developed that obtain the necessary input parameters from a variety of sources. UV doses for erythema effects on the human skin and/or for DNA damage shall be provided.

According to the core user SYKE the "Multi-Sensor UV dose" shall meet the following requirements for the next 2 years:

Latitude/longitude definition and grid (plus mapping projection)	highest available resolution
Definition of integration and averaging times, period of entire time series, time grid	daily, monthly and yearly averages
Definition of the area (entire globe, specific areas, other)	53deg-71deg N, 9deg-33deg E
Definition of the temporal sampling of the main parameters affecting the UV-dose (e.g. clouds, ozone)	Corresponding to the integration time of the actual product(daily, weekly, monthly)
External data bases (e.g. elevation, snow cover etc.), origin	Main interest in aquatic UV, thus ice cover of water will be required
Validation procedures, references	Validation and quality control measurements must be conducted, analysed and the results distributed as a part of the service. Access to simultaneous ground based measurement results should be provided in an integrated manner with the satellite products.
Error bar definition and representation, Representation of missing data	-Estimate of error limits (min-max range of expected true value on the ground) for each individual day/week/month in addition to estimated value -Missing data must be indicated clearly so that it may not be confused to actual values. Existence of missing data within expected coverage area must be indicated too

Used standards (e.g. reference spectra according to CIE etc.)	No specific standards demanded, clear information on used standards on provided data/service required
Definition of interfaces for end users	Both map data for visual inspection and actual data for models/GIS. Web services providing the data and/or transfer of data to SYKE information systems is preferred. PROMOTE websites should be configured so that individual pieces of information can be referred with hyperlinks (URLs) without user involvement. For example, it should be possible to generate the URL from date+time+location information for downloading the daily value of a given day with a simple program.

For the next 5 years:

- Automatic transfer service of data to us with ftp on near real time basis for operational use (push delivery). Possibility of pull-delivery feasible too: Data would be available for on-line access as a web service.
- Estimate on possible variation within one UV data resolution cell due to observed cloud cover
- Two versions of delivered data: 1) Near-real-time delivery data: For daily measurement planning, NRT forecasts etc. Most accurate estimates using currently available instruments, algorithms, external data etc. Consistency of time series is not emphasized, only one estimate with expected error range is required, and 2) Maximum accuracy delivery data: For scientific analysis of UV related phenomena using ground UV estimates, corrected with best available data collected at acquisition time. The data used for corrections may not be available in accurate form in the time of delivery for NRT data. This maximum delivery data is expected to create consistent time series regardless of satellite instrument changes etc. Reprocessing and redelivery of historical data with improved and more accurate algorithms and/or in order to increase consistency in between different satellite instruments is allowed
- Data grid towards 50km or 10 km resolution

For the next 10 years:

- Estimated spectral distribution of surface UV radiation.

3.2 Multisensor UV Index

The UV Index is computed using total ozone column density (satellite derived) overhead, the distance from Earth to sun and a database of the Earth surface altitude and albedo. Computations usually use parameterizations or look-up tables based on empirical relations or radiative transfer computations. These off-line RTM computations use climatological values for surface albedo and aerosol loading.

UV Index fields represent two-dimensional distributions on a latitude / longitude grid referring to a given date and time. UV-Index fields are the basis for the generation of regular time series data, i.e. the UV record, and the time integrating erythemal effective UV doses. The UV Index field user requirements are congruent with that for the erythemal effective UV doses provided in the table in the preceding Section 3.1.1.

3.3 UV Index Forecast

A forecast of UV-Index and UV-dose will provide information on present and near future UV on a two-dimensional latitude / longitude grid for a distinct area and for a distinct time interval. Usually the forecasted UV-parameters rely on the information of satellite measurements or model forecasts of its main affecting parameters.

The UV Index has been developed through a common effort by international organizations representing the end users: The World Health Organization (WHO), the United Nations Environment Programme (UNEP), the World Meteorological Organization (WMO), the International Commission on Non-Ionizing Radiation Protection (ICNIRP) and the GERMAN Federal Office for Radiation Protection (Bundesamt für Strahlenschutz) [AD02], [RD02]. The content of the following table follows the recommendations of these organizations.

According to the core user BVDD the "UV Index forecast" shall meet the following requirements for the next 2 years: .

Latitud/longitude definition and grid (plus mapping projection)	Highest available resolution
Definition of forecast time interval	Daily: at least today and two following days. Hourly resolution of UV Index cloudy.
Definition of forecast issues	Impact of stratospheric ozone variations on the biosphere. Warning for unusually enhanced UV levels at the earth surface. Raise public awareness of the risks of excessive exposure to UV. Support national, local, and non-governmental organisations active in the area of UV radiation and sun protection. Support developing countries not yet able to implement UV forecasting on national level.
Definition of the atmospheric state (clear sky, cloudy)	Dynamic ozone forecasts based on data assimilation techniques, preferably hourly resolution. Clear sky and cloudy: Cloud modification derived from predictions for at least from three levels, hourly resolution.
Definition of area (entire globe, specific areas, other)	Entire globe. Site specific forecasts selectable from maps on a global scale with higher resolution.
External data bases, origin	Integrated into the forecasts [RD02]: Dynamic ozone forecasts based on data assimilation techniques, preferably hourly resolution. Topography compatible to the applied grid, albedo effect at least of snow cover. If available

	seasonal and regional changes in aerosol amount and aerosol type.
Validation procedures, references	Validation against ground-based measurements (see section UV monitoring)
Used standards (e.g. UV-Index according to WMO/WHO, reference spectra according to CIE etc.)	CIE (1987) action spectra[AD01]. WMO (1997) [AD02] and COST-713 (2001) [RD02] recommendations on UV-B forecasting.
Error bar definition and representation	N/a
Definition of interfaces to the end users	UV-Index clear sky and cloudy: Global maps of daily maximum. Gridded ASCII data, format clearly defined and user friendly integrated in the data header, e.g. NASA TOMS. WHO (2002) [AD03] recommendations for graphic presentation.
Additional required features	WHO is responsible for the INTERSUN programme [RD03] that is an outcome of Agenda 21 of the 1992 UN Conference on Environment and Development. WHO has been contacted directly concerning requirements on UV Index forecasts. WHO states that the UV Index is used primarily for public information purposes, that UV Index fields and in particular site specific forecasts of UV Index cloudy in a higher resolution are required in response to the INTERSUN programme. Providing such forecasts appears potentially very useful for WHO, particularly on a global scale. The presentation of the forecasts shall apply the recommendations of WHO (2002) “Global Solar UV Index, A Practical Guide” [AD03]. WHO’s base requirements on UV Index forecasting are in agreement with the above table.

For the next 5 years:

- Improvement of resolution and of cloud modification algorithms

For the next 10 years:

- Replace where required seasonal / regional climatology of aerosol amount and type by forecasted values

3.4 UV Dose Forecast

According to the core user SYKE the “UV-dose forecast” shall meet the following requirements for the next 2 years:

Latitude/longitude definition and grid (plus mapping projection)	highest available resolution
Definition of forecast time interval	-one week minimum, half-year7seasonal preferred (for next spring March-May, summer

	June-August, autumn Sep-Nov, winter Dec-Feb) -for climate change etc scenarios as many years as possible
Definition of forecast issues	The forecasts would be used in planning of measurement campaigns and field tests for environmental impacts
Definition of the atmospheric state (clear sky, cloudy)	clear sky and completely overcast scenarios both needed, additionally several estimated scenarios using cloud data from models for atmospheric forecasts (preferentially HIRLAM of FMI in order to keep this data consistent with our other models using this data)
Definition of area (e.g. entire globe, specific sites)	53deg-71deg N, 9deg-33deg E
External data bases, origin	Use of external databases would be research project specific
Validation procedures, references	No requests beyond the service providers own quality control
Used standards (e.g. reference spectra according to CIE etc.)	No specific standards demanded, clear information on used standards on provided data/service required
Error bar definition and representation	-Estimate of error limits (min-max range of expected true value on the ground) for each individual day/week/month in addition to estimated value -Missing data must be indicated clearly so that it may not be confused to actual values. Existence of missing data within expected coverage area must be indicated too.
Definition of interfaces to the end users	Web services providing the data and/or transfer of data to SYKE information systems is preferred. PROMOTE websites should be configured so that individual pieces of information can be referred with hyperlinks (URLs) without user involvement. For example, it should be possible to generate the URL from date+time+location information for downloading the daily value of a given day with a simple program.
Additional required features	Required both: -Short term forecasts for a certain time ahead, delivered in near real time -Estimates on UV level changes in next decades combined with / derived from estimated changes in cloud cover and ozone levels: Estimated change of mean levels & variability of UV at ground

For the next 5 years:

- automatic transfer service of data to us with ftp on near real time basis for operational use (push delivery). Possibility of pull-delivery feasible too: Data would be available for on-line access as a web service.
- Requirement of medium-long-term forecasts (weeks, years, decades ahead) most emphasized
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For the next 10 years:

- Requirement of medium-long-term forecasts (weeks, years, decades ahead) most emphasized

3.5 Sunburn Time Forecast

A forecast of the Sunburn Time in minutes has already been realized in the operational UV-Check Service (Internet and SMS service). The service has been developed at DLR in cooperation with the core user BVDD. In a former version it was already operating before the start of the PROMOTE project, thereby gaining much experience, especially in the cooperation with the sun-protection industry. UV-Check is based on satellite measurements of total ozone (ERS-2/GOME, Earthprobe/TOMS, recently ENVISAT/SCIAMACHY) in combination with user specific information and user estimates of local conditions that affect the intensity of the surface UV radiation. The output parameter Sunburn Time has scientifically been validated in several projects.

According to the core user BVDD the "Sunburn time forecast" shall meet the following requirements for the next 2 years

Latitude/longitude definition and grid (plus mapping projection)	For the satellite derived ozone data: regular grid of 0.083 deg in lat and lon (~10 x 10 km^2) over Europe.
Definition of forecast time interval	Short range (daily) forecast with the option to request sunburn times at every time of the day.
Definition of area	Entire Europe, including the Azores and Canary Islands, i.e. 32ºW-48ºE, 20ºN-72ºN.
External data (bases)	Local data base including all cities, towns, and villages within the defined area that allows to relate every user position to a position in the maps containing spatial distributions of pre-calculated sunburn times.
Definition of user input	Environmental parameters affecting the local UV conditions (e.g. cloud cover, snow cover, water surfaces, and terrain elevation) as well as individual user profiles (e.g. skin-type, age). User input about local environmental conditions is needed for UV relevant quantities highly varying in space and time. User position defined by the country and the nearest city, town, or village.
Used standards	CIE action spectrum for the calculation of the basic quantity, the erythemally weighted UV irradiance.

Definition of user output	The local and individual sunburn time in minutes together with a sun protection factor. Additional recommendations for reasonable behaviour during UV exposure as well as medical background information about the danger of UV exposure.
Definition of interfaces to the end users	User friendly internet service as well as handy SMS-service for local user requests at any place in the defined European area and at any time.
Other requirements	Desirable is : - the UV-Index in addition to the Sunburn Time - the analysis/evaluation of user demands by information about the individual profiles of end users using the service profiles (e.g. skin-type, age etc.). - end user questionnaires as well as the definition of different target groups.

For the next 5 years:

- Climatological UV-maps for selected regions for long term (vacation) planning
- Extension of the service to global coverage and adaptation to up-to-date (mobile) user interfaces

For the next 10 years:

- Further refinement of the service in accordance to further user requirements

3.6 Real Time Solar Photoprotection

Overexposure to solar UV radiation is of considerable public health concern, and it is of paramount importance to induce good habits in people and especially in young people. Together with correct and reliable scientific information on UV exposure effects it is of great value that general public can easily quantify the real exposure to encourage changes in lifestyle.

The “Real Time Solar Photoprotection” consists in providing people, particularly seaside tourists, with a web based UV Index service (taking account of surrounding albedo), photoproctecion information based on personal phototype, recommended exposure time in minutes and, when a SMS mode will be activated, also the alert upon reaching of personal safe dose.

According to the core users ARPA Toscana (ARPAT) and ARPA Sicily (ARPAS), the “Real Time Solar Photoprotection” shall meet the following requirements for the next 2 years

Latitude/longitude definition and grid (plus mapping projection)	Roughly a straight line from (44° 2′ 4″ N, 10° 2′ 46″ E) to (43° 51′ 49″ N , 10° 14′ 24″ E); about 1 km x 1 km grid (ARPAT)

	Roughly an arc passing from (38° 11′ 29 N, 13° 21′ 31″ E), (38° 6′ 11″ N , 13° 23′ 43″ E) and (38° 7′ 10″ N , 13° 30′ 28″ E); about 1 km x 1 km grid (ARPAS)
Definition of forecast time interval	15 minutes (ARPAT, ARPAS)
Definition of area	Versilia coast (ARPAT) Palermo gulf coast (ARPAS)
External data (bases)	Data on columnar ozone, aerosol, cloud coverage (ARPAT, ARPAS). Localities data base within the defined area that allows to relate every selected zone on the map to a position for which the information will be produced (ARPAT, ARPAS). End user personal data: personal characteristics (skin, eyes, hair, etc.), SPF of sunscreen (ARPAT, ARPAS).
Definition of user input	Albedo parameters of different local environment along the area of interest: sand, rock, grass…; GIS data of local environment (ARPAT, ARPAS).
Used standards	UV Index updated every 15 minutes (ARPAT)
Definition of user output	UV Index, individual safe sunburn time and personal sunscreen to reduce cumulative solar exposure (ARPAT, ARPAS).
Definition of interfaces to the end users	User friendly web based information system, graphically georeferenced UV Index (ARPAT, ARPAS).
Other requirements	UV Index data base, or UV Index mapping, for selected beaches in Tuscany during service will be operational (ARPAT). UV Index data base, or UV Index mapping, for selected beaches in Sicily during service will be operational (ARPAS).

For the next 5 years (ARPAST, ARPAS):

- Extend the service to all Tuscany/Sicily coastlines
- Provide the service also on mobile phone via SMS
- Provide via SMS the alert to user upon reaching of personal safe dose

For the next 10 years:

- Extend the service to the whole Tuscany/Sicily (and possibly to other Italian regions)
- Send via web the measured user skin characteristics to a medical expert who in turn provides the diagnosis on user skin health status

4. AIR QUALITY SERVICE LINE

The details compiled in this chapter are the results of Core User consultations. The PROMOTE Core Users involved in this Service Line and which contributed input are:

- ADEME (N. Poisson)
- AirParif (P. Lameloise)
- ARPAL (V. Spirolazzi)
- EMPA (J. Klausen)
- EPA (B. Kelly)
- INERIS (L. Rouil)
- JRC (E. de Saeger)
- LUA (S. Wurzler)
- MNP (R. Koelemeijer)
- NILU (J. Schaug)
- UBA (C. Nagl)

The PROMOTE Core Users with whom consultations are still ongoing are:

- ARPAP (R. Cremonini)
- LBC (S. Potter)
- RCM (S. Karathanasis, T. Vavatzanidis)
- VITO (F. Lefebre)

4.1 Tropospheric NO_2 column

Although SPARC-CCMVal is considered a Core User for the Stratospheric Ozone Service Line, they are interested in using the tropospheric NO2 column product and have included some requirements in the table below.

For the next two years, the following is required:

Temporal coverage requirements (i.e., related to trend analyses – how long a period is desired/required)	Entire year, all seasons, time series as long as possible for trend analyses (SPARC-CCMVal) 5 years (RIVM) Twice weekly (NILU) 3 years (ADEME/INERIS) permanent (AirParif) annual (LUA) whole year (UBA, EMPA) Since 2000 (ARPAL)
Minimum and target temporal resolution requirements	Minimum: monthly (SPARC-CCMVal) Target: diurnal variation (SPARC-CCMVal) Minimum 1 per day, target 1 per hour (RIVM, EMPA) Minimum 6 h, target 1 h (NILU)

	0.5-3 hours (ADEME/INERIS, AirParif) Hourly-daily (LUA) Hourly (ARPAL) Minimum: 1 per day; Target: 1 per hour (UBA)
Spatial coverage requirements	Global (SPARC-CCMVal) Europe (ADEME/INERIS, RIVM) France (AirParif) Germany, North Rhine Westfalia preferred Europe also important for long range transport studies (LUA) Austria (UBA) Lombardia, Italy & surrounding region (ARPAL) Switzerland and Europe (EMPA)
Minimum and target spatial resolution requirements	Minimum requirements (SPARC-CCMVal): **Horizontal resolution:** Spectral triangular 42 (T42), roughly equivalent to 2.8 x 2.8 degrees latitude-longitude. Minimum: 10x10 km2, target 1x1 km2; surface level (RIVM) Minimum regional: 50 km x 50 km (NILU, EMPA) Target: 10 km x 10 km (NILU), 1km x 1km (EMPA) 1-15 km (ADEME/INERIS) 0.1-2km (AirParif) 1-5 km^2 horizontal, range of meters vertical (LUA) 10 km in rural areas, (1 km in urban background areas), concentration should be representative for a layer 10 m above ground (comparable to in-situ measurements); at least for a layer <200 m above ground (minimum mixing height) (UBA) Preferred horizontal: 250m Useful horizontal: 5km Preferred vertical: 4 layers (1-20m, 20-100m, 100-1000m, 1000m-2000m) Useful vertical: 2 layers (1-1000m, 1000-2000m)
Trueness of latitude / longitude / time	As accurate as technically possible (RIVM, SPARC-CCMVal) 5km/5km/30min (NILU) 1 km/1 km/15min (ADEME/INERIS, EMPA) 0.5/0.5/15 mn (AirParif) as accurate as possible (LUA) see above (UBA)
Precision (target and minimum to be useful) Trueness (target and minimum to be useful)	Total error smaller 5% (SPARC-CCMVal) Precision: 5%, min. 20 % (NILU) 10%, min. 15 % (ADEME/INERIS, AirParif) 0.05 Dobson Units (RIVM) 10%, min. 30 % (EMPA) in the long run corresponding to EC Dir.

	1999/30/EC, Annex VIII for indicative measurements (25%) (UBA) Trueness: 10%, min. 25 % (NILU) 20%, min. 50 % (EMPA) 20%, min. 25 % (ADEME/INERIS, AirParif) 15% (LUA) Accuracy: 25-50% (ARPAL)
Error bar definition and representation	2 st.dev. (NILU, RIVM) 2 σ (ADEME/INERIS, AirParif) 1 st.dev (EMPA) Total error (SPARC-CCMVal)
Representation of missing data	Filled with higher order regression (SPARC-CCMVal) Blank (ADEME/INERIS, AirParif) -99.99 or similar value < 0 (NILU, RIVM) Definition Given (EMPA)
Product confidence data	Very high (SPARC-CCMVal) 95 % confidence limits to be given (NILU, EMPA) none (ADEME/INERIS, AirParif)
Version control mechanism and representation	References to QC procedures and product version number and last date of modification to be available in background (NILU, RIVM, EMPA)
Representation for data exchange	Freely available and downloadable from a website (SPARC-CCMVal) International standard (e.g, HDF, ASCII) (RIVM, EMPA) ASCII (NILU, UBA) as EURAD (LUA) Raster map of ESRI-GRID or ERDAS-IMG format
Reference and specification documents	Citable and validated data base (SPARC-CCMVal) To be available in background (NILU, RIVM)
Additional Requirements or comments	Information on data originators and models used to be available in background needed, and lower detection limit for the product to be specified (NILU) As satellite remote sensing may provide information on air concentrations or load in regions lacking, or poorly equipped with surface measurements (e.g. Eastern Europe) even trueness and precision values exceeding the “minimum” levels above, and in the two following tables, could be of great interest (NILU) Note that everywhere the values given for precision and trueness are only estimations (ADEME/INERIS, AirParif, EMPA)

	For highly polluted episodes, even smaller than required minimum precision is useful, also (EMPA). The defined precision depends on the target area. Here it is specified with respect to 50 km x 50 km and for the tropospheric column (EMPA). For a trade-off in higher vertical and horizontal resolution, respective reduction in precision would be accepted (EMPA). The absolute value of trueness is less critical than its stability. For long-term studies, a possible trend in trueness should be known or assured to be small (< 1%) (EMPA)

Within the next 5 years the modifications or additions listed below shall be made:

- Measured tropospheric NO2 column, rather than stratospheric NO2 column subtracted from total column with the help of model results (SPARC-CCMVal)
- diurnal variation (SPARC-CCMVal)
- More frequent observations (NILU, EMPA)
- Better specification of uncertainties (RIVM, EMPA)

Within the next 10 years the following modifications / improvements shall be made:

- 1° x 1° latitude-longitude grid (SPARC-CCMVal)
- diurnal variation (SPARC-CCMVal)
- Separation between the planetary boundary layer and the free troposphere (NILU)
- Vertical resolution: 1 point in the PBL (ADEME/INERIS, AirParif)
- Vertical resolution: 1 point in the lower troposphere (below 700 hPa), NO_2, (EMPA)

4.2 Total SO_2 column

For the next two years, the following is required.

Temporal coverage requirements (i.e., related to trend analyses – how long a period is desired/required)	5 years (RIVM) Twice weekly (NILU) 3 years (ADEME/INERIS) permanent (AirParif) annual (LUA) whole year (UBA, EMPA) Since 2000 (ARPAL)
Minimum and target temporal resolution requirements	Minimum 1 per day, target 1 per hour (RIVM, EMPA) Minimum 6 h, target 1 h (NILU)

	0.5-3 hours (ADEME/INERIS, AirParif) Hourly-daily (LUA) Hourly (ARPAL) Minimum: 1 per day; Target: 1 per hour (UBA)
Spatial coverage requirements	Europe (ADEME/INERIS, RIVM) France (AirParif) Germany, North Rhine Westfalia preferred Europe also important for long range transport studies (LUA) Austria (UBA) Lombardia, Italy & surrounding region (ARPAL) Switzerland and Europe (EMPA)
Minimum and target spatial resolution requirements	Minimum: 10x10 km2, target 1x1 km2; surface level (RIVM) Minimum regional: 50 km x 50 km (NILU, EMPA) Target: 10 km x 10 km (NILU), 1km x 1km (EMPA) 1-15 km (ADEME/INERIS) 0.1-2km (AirParif) 1-5 km^2 horizontal, range of meters vertical (LUA) 10 km in rural areas, (1 km in urban background areas), concentration should be representative for a layer 10 m above ground (comparable to in-situ measurements); at least for a layer <200 m above ground (minimum mixing height) (UBA) Preferred horizontal: 250m Useful horizontal: 5km Preferred vertical: 4 layers (1-20m, 20-100m, 100-1000m, 1000m-2000m) Useful vertical: 2 layers (1-1000m, 1000-2000m)
Trueness of latitude / longitude / time	As accurate as technically possible (RIVM) 5km/5km/30min (NILU) 1 km/1 km/15min (ADEME/INERIS, EMPA) 0.5/0.5/15 mn (AirParif) as accurate as possible (LUA) see above (UBA)
Precision (target and minimum to be useful) Trueness (target and minimum to be useful)	Precision: 5%, min. 20 % (NILU) 10%, min. 15 % (ADEME/INERIS) 25% (UBA) 10-55% (AirParif) 0.02 Dobson Units min. (RIVM) 15%, min. 30 % in winter – less interest in summer (EMPA) Trueness: 10%, min. 25 % (NILU) 20%, min. 25 % (ADEME/INERIS, AirParif) 15% (LUA)

	50% (EMPA) Accuracy: 25-50% (ARPAL)
Error bar definition and representation	2 st.dev. (NILU, RIVM) 2 σ (ADEME/INERIS, AirParif) 1 st.dev (EMPA)
Representation of missing data	Blank (ADEME/INERIS, AirParif) -99.99 or similar value < 0 (NILU, RIVM) Definition Given (EMPA)
Product confidence data	95 % confidence limits to be given (NILU, EMPA) none (ADEME/INERIS, AirParif)
Version control mechanism and representation	References to QC procedures and product version number and last date of modification to be available in background (NILU, RIVM, EMPA) As EURAD (LUA)
Representation for data exchange	International standard (e.g, HDF, ASCII) (RIVM, EMPA) ASCII (NILU, UBA) as EURAD (LUA) Raster map of ESRI-GRID or ERDAS-IMG format
Reference and specification documents	To be available in background (NILU, RIVM)
Additional Requirements or comments	Information on data originators and models used to be available in background needed, and lower detection limit for the product to be specified (NILU) As satellite remote sensing may provide information on air concentrations or load in regions lacking, or poorly equipped with surface measurements (e.g. Eastern Europe) even trueness and precision values exceeding the "minimum" levels above, and in the two following tables, could be of great interest (NILU) Note that everywhere the values given for precision and trueness are only estimations (ADEME/INERIS, AirParif, EMPA) For highly polluted episodes, even smaller than required minimum precision is useful, also (EMPA). The defined precision depends on the target area. Here it is specified with respect to 50 km x 50 km and for the tropospheric column (EMPA). For a trade-off in higher vertical and horizontal resolution, respective reduction in precision would be accepted (EMPA).

	The absolute value of trueness is less critical than its stability. For long-term studies, a possible trend in trueness should be known or assured to be small (< 1%) (EMPA)

Within the next 5 years the modifications or additions listed below shall be made:

- More frequent observations (NILU, EMPA)
- Better specification of uncertainties (RIVM, EMPA)

Within the next 10 years the following modifications / improvements shall be made:

- Separation between the planetary boundary layer and the free troposphere (NILU)

4.3 Total HCHO column

For the next two years, the following is required.

Temporal coverage requirements (i.e., related to trend analyses – how long a period is desired/required)	Typically several years at least. For trend analysis, typically more than 10 years is necessary (MNP) HCHO (toxic photochemical oxidant) data are important in relation with O3 data (indicator of photochemical pollution). My preference: a daily map around solar noon during episodes, at least (JRC) Twice weekly (NILU) 3 years (ADEME/INERIS) permanent (AirParif) annual (LUA) whole year (UBA, EMPA) Since 2000 (ARPAL)
Minimum and target temporal resolution requirements	See above for JRC (JRC) Minimum: One observation per day (MNP) Target: One observation per hour (MNP) Minimum 1 per day, target 1 per hour (RIVM, EMPA) Minimum 6 h, target 1 h (NILU) 0.5-3 hours (ADEME/INERIS, AirParif) Hourly-daily (LUA) Hourly (ARPAL) Minimum: 1 per day; Target: 1 per hour (UBA)
Spatial coverage requirements	Northern hemisphere (JRC) Europe (ADEME/INERIS, MNP) France (AirParif) Germany, North Rhine Westfalia preferred Europe also important for long range transport studies (LUA) Austria (UBA)

	Lombardia, Italy & surrounding region (ARPAL) Switzerland and Europe (EMPA)
Minimum and target spatial resolution requirements	Minimum: 40x40 km2 (MNP) Target: 10x10 km2 (MNP) 1 km (JRC) Minimum: 10x10 km2, target 1x1 km2; surface level (RIVM) Minimum regional: 50 km x 50 km (NILU, EMPA) Target: 10 km x 10 km (NILU), 1km x 1km (EMPA) 1-15 km (ADEME/INERIS) 0.1-2km (AirParif) 1-5 km^2 horizontal, range of meters vertical (LUA) 10 km in rural areas, (1 km in urban background areas), concentration should be representative for a layer 10 m above ground (comparable to in-situ measurements); at least for a layer <200 m above ground (minimum mixing height) (UBA) Preferred horizontal: 250m Useful horizontal: 5km Preferred vertical: 4 layers (1-20m, 20-100m, 100-1000m, 1000m-2000m) Useful vertical: 2 layers (1-1000m, 1000-2000m)
Trueness of latitude / longitude / time parameters	1 km; 1 second (MNP) 5km/5km/30min (NILU) 1 km/1 km/15min (ADEME/INERIS, EMPA) 0.5/0.5/15 mn (AirParif) as accurate as possible (LUA) see above (UBA)
Precision (target and minimum to be useful) Trueness (target and minimum to be useful)	Threshold trueness: 0.05 Dobson Units (MNP) Target trueness: 0.02 Dobson Units (MNP) Precision should allow this trueness (MNP) Overall uncertainty 15%
Error bar definition and representation	Product should contain error estimate for each retrieved HCHO column (MNP) 2 st.dev. (NILU) 2 σ (ADEME/INERIS, AirParif) 1 st.dev (EMPA)
Representation of missing data	Blank (ADEME/INERIS, AirParif) -99.99 or similar value < 0 (NILU, RIVM) Definition Given (EMPA)
Product confidence data	95 % confidence limits to be given (NILU, EMPA) none (ADEME/INERIS, AirParif)
Version control mechanism and representation	Processing version number should be in the product. Good documentation of processor versions should be available (MNP) References to QC procedures and product

	version number and last date of modification to be available in background (NILU, EMPA)
Representation for data exchange	Transfer via ftp or CDROMs, HDF format (MNP) International standard (e.g, HDF, ASCII) (EMPA) ASCII (NILU, UBA) as EURAD (LUA) Raster map of ESRI-GRID or ERDAS-IMG format
Reference and specification documents	Good documentation of method (all assumptions, and their impact on the result) is essential (MNP) To be available in background (NILU)
Additional Requirements or comments	Information on data originators and models used to be available in background needed, and lower detection limit for the product to be specified (NILU) As satellite remote sensing may provide information on air concentrations or load in regions lacking, or poorly equipped with surface measurements (e.g. Eastern Europe) even trueness and precision values exceeding the "minimum" levels above, and in the two following tables, could be of great interest (NILU) Note that everywhere the values given for precision and trueness are only estimations (ADEME/INERIS, AirParif, EMPA) For highly polluted episodes, even smaller than required minimum precision is useful, also (EMPA). The defined precision depends on the target area. Here it is specified with respect to 50 km x 50 km and for the tropospheric column (EMPA). For a trade-off in higher vertical and horizontal resolution, respective reduction in precision would be accepted (EMPA). The absolute value of trueness is less critical than its stability. For long-term studies, a possible trend in trueness should be known or assured to be small (< 1%) (EMPA)

Within the next 5 years the modifications or additions listed below shall be made:

- get closer to the target requirements (MNP)
- More frequent observations (NILU, EMPA)
- Better specification of uncertainties (MNP, EMPA)

Within the next 10 years the following modifications / improvements shall be made:

- Separation between the planetary boundary layer and the free troposphere (NILU)

General Comments: "Our interest in HCHO is quite general: the idea is to assimilate such observations in air quality models, and see whether the modelled air quality fields improve. In practice, this will likely be done by one of our research partners rather than by our institute. We are more interested in the final results, not in level-2 products by its own. Nevertheless, the requirements below hold for the level-2 product". (MNP)

4.4 Aerosol Optical Depth

For the next two years, the following is required.

Temporal coverage requirements (i.e., related to trend analyses – how long a period is desired/required)	5 years (RIVM) Twice weekly (NILU) 3 years (ADEME/INERIS) permanent (AirParif) annual (LUA) whole year (UBA, EMPA) Since 2000 (ARPAL)
Minimum and target temporal resolution requirements	Minimum 1 per day, target 1 per hour (RIVM, EMPA) Minimum 6 h, target 1 h (NILU) 0.5-3 hours (ADEME/INERIS, AirParif) Hourly-daily (LUA) Hourly (ARPAL) Minimum: 1 per day; Target: 1 per hour (UBA)
Spatial coverage requirements	Europe (ADEME/INERIS, RIVM) France (AirParif) Germany, North Rhine Westfalia preferred Europe also important for long range transport studies (LUA) Austria (UBA) Lombardia, Italy & surrounding region (ARPAL) Switzerland and Europe (EMPA)
Minimum and target spatial resolution requirements	Minimum: 10x10 km2, target 1x1 km2; surface level (RIVM) Minimum regional: 50 km x 50 km (NILU, EMPA) Target: 10 km x 10 km (NILU), 1km x 1km (EMPA) 1-15 km (ADEME/INERIS) 0.1-2km (AirParif)

	1-5 km^2 horizontal, range of meters vertical (LUA) 10 km in rural areas, (1 km in urban background areas), concentration should be representative for a layer 10 m above ground (comparable to in-situ measurements); at least for a layer <200 m above ground (minimum mixing height) (UBA) Preferred horizontal: 250m Useful horizontal: 5km Preferred vertical: 4 layers (1-20m, 20-100m, 100-1000m, 1000m-2000m) Useful vertical: 2 layers (1-1000m, 1000-2000m)
At what wavelength should AOD be estimated?	550 nm (UBA) 500 or 550 nm preferred (MNP) 500 or 865 (EMPA quoting GAW guidelines) 415, 500, 610, 665 or 860 nm (LUA) No preference (JRC)
Trueness of latitude / longitude / time	As accurate as technically possible (RIVM) 5km/5km/30min (NILU) 1 km/1 km/15min (ADEME/INERIS, EMPA) 0.5/0.5/15 mn (AirParif) as accurate as possible (LUA) see above (UBA)
Precision (target and minimum to be useful) Trueness (target and minimum to be useful)	Precision: 0.015, min. 0.02 units (NILU) 0.05, min. 0.05 units (ADEME/INERIS) 0.05 (min), 0.015 (target) (RIVM) 15%, min. 30% (EMPA) Trueness: 0.02, min.0.03 units (NILU) 25% (LUA) 50% (EMPA)
Error bar definition and representation	2 st.dev. (NILU, RIVM) 2 σ (ADEME/INERIS, AirParif) 1 st.dev (EMPA)
Representation of missing data	Blank (ADEME/INERIS, AirParif) -99.99 or similar value < 0 (NILU, RIVM) Definition Given (EMPA)
Product confidence data	95 % confidence limits to be given (NILU, EMPA) none (ADEME/INERIS, AirParif)
Version control mechanism and representation	References to QC procedures and product version number and last date of modification to be available in background (NILU, RIVM, EMPA)
Representation for data exchange	International standard (e.g, HDF, ASCII) (RIVM, EMPA) ASCII (NILU, UBA) as EURAD (LUA) Raster map of ESRI-GRID or ERDAS-IMG format
Reference and specification documents	To be available in background (NILU, RIVM)

Additional Requirements or comments	Information on data originators and models used to be available in background needed, and lower detection limit for the product to be specified (NILU) As satellite remote sensing may provide information on air concentrations or load in regions lacking, or poorly equipped with surface measurements (e.g. Eastern Europe) even trueness and precision values exceeding the "minimum" levels above, and in the two following tables, could be of great interest (NILU) Note that everywhere the values given for precision and trueness are only estimations (ADEME/INERIS, AirParif, EMPA) For highly polluted episodes, even smaller than required minimum precision is useful, also (EMPA). The defined precision depends on the target area. Here it is specified with respect to 50 km x 50 km and for the tropospheric column (EMPA). For a trade-off in higher vertical and horizontal resolution, respective reduction in precision would be accepted (EMPA). The absolute value of trueness is less critical than its stability. For long-term studies, a possible trend in trueness should be known or assured to be small (< 1%) (EMPA)

Within the next 5 years the modifications or additions listed below shall be made:

- More frequent observations (NILU, EMPA)
- Better specification of uncertainties (RIVM, EMPA)

Within the next 10 years the following modifications / improvements shall be made:

4.5 Aerosol Type

For the next two years, the following is required.

Temporal coverage requirements (i.e., related to trend analyses – how long a period is desired/required)	5 years (RIVM) Twice weekly (NILU) 3 years (ADEME/INERIS)

	permanent (AirParif) annual (LUA) whole year (UBA, EMPA) Since 2000 (ARPAL)
Minimum and target temporal resolution requirements	Minimum 1 per day, target 1 per hour (RIVM, EMPA) Minimum 6 h, target 1 h (NILU) 0.5-3 hours (ADEME/INERIS, AirParif) Hourly-daily (LUA) Hourly (ARPAL) Minimum: 1 per day; Target: 1 per hour (UBA)
Spatial coverage requirements	Europe (ADEME/INERIS, RIVM) France (AirParif) Germany, North Rhine Westfalia preferred Europe also important for long range transport studies (LUA) Austria (UBA) Lombardia, Italy & surrounding region (ARPAL) Switzerland and Europe (EMPA)
Minimum and target spatial resolution requirements	Minimum: 10x10 km2, target 1x1 km2; surface level (RIVM) Minimum regional: 50 km x 50 km (NILU, EMPA) Target: 10 km x 10 km (NILU), 1km x 1km (EMPA) 1-15 km (ADEME/INERIS) 0.1-2km (AirParif) 1-5 km^2 horizontal, range of meters vertical (LUA) 10 km in rural areas, (1 km in urban background areas), concentration should be representative for a layer 10 m above ground (comparable to in-situ measurements); at least for a layer <200 m above ground (minimum mixing height) (UBA) Preferred horizontal: 250m Useful horizontal: 5km Preferred vertical: 4 layers (1-20m, 20-100m, 100-1000m, 1000m-2000m) Useful vertical: 2 layers (1-1000m, 1000-2000m)
Trueness of latitude / longitude / time	As accurate as technically possible (RIVM) 5km/5km/30min (NILU) 1 km/1 km/15min (ADEME/INERIS, EMPA) 0.5/0.5/15 mn (AirParif) as accurate as possible (LUA) see above (UBA)
Precision (target and minimum to be useful) Trueness (target and minimum to be useful)	Precision: < 10% misassignments (ADEME/INERIS, AirParif) 20% (UBA) Trueness: 25% (LUA)
Error bar definition and representation	2 st.dev. (NILU, RIVM)

	2 σ (ADEME/INERIS, AirParif) 1 st.dev (EMPA)
Representation of missing data	Blank (ADEME/INERIS, AirParif) -99.99 or similar value < 0 (NILU, RIVM) Definition Given (EMPA)
Product confidence data	95 % confidence limits to be given (NILU, EMPA) none (ADEME/INERIS, AirParif)
Version control mechanism and representation	References to QC procedures and product version number and last date of modification to be available in background (NILU, RIVM, EMPA)
Representation for data exchange	International standard (e.g, HDF, ASCII) (RIVM, EMPA) ASCII (NILU, UBA) as EURAD (LUA) Raster map of ESRI-GRID or ERDAS-IMG format
Reference and specification documents	To be available in background (NILU, RIVM)
Additional Requirements or comments	Information on data originators and models used to be available in background needed, and lower detection limit for the product to be specified (NILU) As satellite remote sensing may provide information on air concentrations or load in regions lacking, or poorly equipped with surface measurements (e.g. Eastern Europe) even trueness and precision values exceeding the "minimum" levels above, and in the two following tables, could be of great interest (NILU) Note that everywhere the values given for precision and trueness are only estimations (ADEME/INERIS, AirParif, EMPA) For highly polluted episodes, even smaller than required minimum precision is useful, also (EMPA). The defined precision depends on the target area. Here it is specified with respect to 50 km x 50 km and for the tropospheric column (EMPA). For a trade-off in higher vertical and horizontal resolution, respective reduction in precision would be accepted (EMPA). The absolute value of trueness is less critical than its stability. For long-term studies, a possible trend in trueness should be known or assured to be small (< 1%) (EMPA)

Within the next 5 years the modifications or additions listed below shall be made:

- More frequent observations (NILU, EMPA)
- Better specification of uncertainties (RIVM, EMPA)

Within the next 10 years the following modifications / improvements shall be made:

4.6 Near Surface Air Quality: Concentrations

This service delivers assimilated air quality fields consisting of a regular time series surface concentrations of air pollutants (Ozone, Sulphur dioxide, Nitrogen dioxide, Carbon monoxide, Formaldehyde, Benzene, particulate matter (PM10, PM2.5), Air Quality Index) on a given latitude/longitude grid. Each data set refers to a given date and time-of-day.

For the next two years, the following is required.

Latitude/Longitude definition, grid, projection requirements	UTM, or EMEP grid 50 km x 50 km or finer (NILU) Georeferenced (ADEME/INERIS, AirParif) As EURAD (LUA)
Time period, time grid and representation, date definition	Summer period for photochemically active substances, winter period for SO2, NOx, C6H6, annually for PM. Target 1 h time grid, minimum daily (NILU) Period of operation: > 5 years (RIVM) Every 3h, every day, mapping (ADEME/INERIS, AirParif) as EURAD (LUA)
Temporal resolution	Target every hour, minimum daily (NILU, RIVM) 3 hours (ADEME/INERIS, AirParif) as EURAD (LUA) Daily (NILU)
Timeliness	as EURAD (LUA)
Precision (target and minimum to be useful) Trueness (target and minimum to be useful)	Target 5 %, min. 30 % (NILU, RIVM) as EURAD (LUA) Target 7 %, min. 30 % (NILU) Species dependent (~ 20%) (ADEME/INERIS, AirParif) SO_2, NO_2, NO_x, O_3: hourly values: 50% (LUA) daily values: 50% (LUA) annual values: 70% (LUA) Particulate matter: annual values: 50% (LUA)
Error bar definition and representation	2 st.dev. (NILU, RIVM) 2 σ (ADEME/INERIS, AirParif) as EURAD (LUA)

Representation of missing data	-99.99 or similar value < 0 (NILU, RIVM) Interpolated (ADEME/INERIS, AirParif) as EURAD (LUA)
Product confidence data	95 % confidence limits to be given (NILU) none (ADEME/INERIS, AirParif) as EURAD (LUA)
Version control mechanism and representation	References to QC procedures and product version number and last date of modification to be available in background (NILU, RIVM) as EURAD (LUA)
Representation for data exchange	ASCII (NILU) as EURAD (LUA)
Reference and specification documents	To be available in background (NILU, RIVM) as EURAD (LUA)
Additional Requirements or comments	One point in the pbl (AirParif) In Austria, currently no gridded data are used therefore, specifications cannot be provided. Nevertheless, as a complimentary supplement to the current practices of in situ measurements this may provide very useful options (UBA)

Within the next 5 years the modifications or additions listed below shall be made:

- Add estimates of emissions of gases and aerosols, and deposition of acidifying and eutrophying substances (MNP)

Within the next 10 years the following modifications / improvements shall be made:

- Improved spatial/time resolution and meeting target requirements as far as possible (NILU)

4.7 Near Surface Air Quality: Forecast

The air quality forecasting service is generally based on comprehensive deterministic three-dimensional air quality forecast models. The underlying algorithms are solving advection-diffusion-reaction type equations. The use of statistical components is restricted to auxiliary tasks only, like error validation. The forecasts include chemical weather predictions ranging from 3 to 4 days, which are based on driving meteorological forecasts.

The envisaged service encompasses integration domains from the European continental scale down to selected European regions and cities by nesting techniques with the following atmospheric constituents considered:

- **surface gridded forecast**
  - Ozone
  - Sulphur dioxide,

- Nitrogen dioxide,
- Carbon monoxide,
- Formaldehyde
- Benzene
- particulate matter PM10, PM2.5
- Air Quality Index

The PROMOTE forecast products will be in the form of maps. The parameters listed below in the User Requirements section are therefore geared towards collecting information on the required quality and desired appearance of the forecast maps.

For the next two years, the following is required.

Latitude/Longitude definition, grid, projection requirements	UTM, or regional (EMEP grid 50 km x 50 km) to city grid 1 km x 1km (NILU) Georeferenced ; regular latitude/ longitude grid (ADEME/INERIS, AirParif)
Time period, time grid and representation, date definition	Summer for photochemically active substances, winter for SO2, NO2, annual for PM and AQI. Simple yymmddhh date definition, with daily forecast and colour representation in maps. (NILU) 72h forecasts, Availability of J, J+1, J+2 forecasts each morning at 5h UT (ADEME/INERIS) Every 3 hr, every day, mapping (AirParif) Period of operation: > 5 years; forecast horizon 72 h, 3 h resolution (RIVM)
Temporal resolution	Daily (NILU) Hourly computation (ADEME/INERIS) 3 hours (AirParif) 3 hours (RIVM)
Timeliness	Daily (NILU, RIVM) Public information, help for pollution episodes (ADEME/INERIS)
Precision (target and minimum to be useful) Trueness (target and minimum to be useful)	5-25% for 1 to 4 days (NILU, RIVM) on the order of 20% (ADEME/INERIS, AirParif) 7-25% for 1 to 4 days (NILU) on the order of 20% (ADEME/INERIS)
Error bar definition and representation	As above (NILU) 2 σ (ADEME/INERIS, AirParif)
Representation of missing data	As above (NILU) In maps by colour, e.g. white (NILU) Interpolated (ADEME/INERIS, AirParif)
Product confidence data	As above (NILU) None (ADEME/INERIS, AirParif)
Version control mechanism and representation	As above (NILU)
Representation for data exchange	As above (NILU)
Reference and specification documents	As above (NILU)
Additional Requirements or comments	Above information concerns: Ozone, CO, NO2,

	SO2 and PM (10 or 2.5, tbd) (ADEME/INERIS, AirParif)

Within the next 5 years the modifications or additions listed below shall be made:

- Availability of Benzene, H2CO, C2H6, PM 2.5 (ADEME/INERIS, AirParif)

Within the next 10 years the following modifications / improvements shall be made:

- Improving trueness of product (NILU)

5. CLIMATE CHANGE SERVICE LINE

This service is still under definition phase and detailed core user requirements will be collected during Promote STAGE 2.