AEROSOL description of work for months 13-30 (March 2006- August 2007)

The Work Packages in the AEROSOL sub-project are

WP_AER_1: Implementation of the direct physical aerosol model in the ECMWF model

WP_AER_2: Refinement of aerosol emission sources

WP_AER_3: Aerosol data assimilation

WP_ AER_4: Evaluation of the model and analysis

The overall planning for the WP in the months 13 to 30 are outlined in the table

Time		**Year 2**				**Year 3**	
		Q1	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**
WP_AER_1							
Task	**1.1**						
	1.2						
	1.3						
	1.4						
	1.5						
WP_AER_2							
Task	**2.1**						
	2.2						
	2.3						
	2.4						
	2.5						
WP_AER_3							
Task	**3.1**						
	3.2						
	3.3						
	3.4						
WP_AER_4							
Task	**4.1**						
	4.2						
	4.3						
	4.4						

The following descriptions provide detailed information on the planning for months 13-30.

WP_AER_1: Implementation of the direct physical aerosol model in the ECMWF model

Lead Partners: MET OFFICE

Partners: ECMWF, CEA-IPSL-LSCE, SA-UPMC, FMI

Task 1.1: implementation of parameterisations for tropospheric aerosols

Task Lead: MET OFFICE

Partners: ECMWF, MPI-M

Met Office contribution
With the help of CNRS-LOA, the Met Office will finalise the procedure for reducing a 24-variable scheme into a 4-variable scheme covering sulphate, BC, OC, dust and sea-salt. The procedure will be first tested in the LMDZ model. We will document the different steps involved in the procedure (e.g., adjustment of sedimentation velocities, adjustment of dry and wet deposition parameters). The reduced model will be compared to the full model in terms of RMSE and against the observations. This will be form the basis to D_AER_1.2.

Task 1.2: implementation of parameterisations for stratospheric aerosols

Task Lead: SA-UPMC

Partners: ECMWF, MET OFFICE

SA-UPMC contribution (months 13-20)
The modal stratospheric aerosol scheme will carry on being tested. The stratospheric aerosol size distribution is assumed to be log-normal. In the first phase, only one moment of the distribution is taken as a prognostic variable. The size and width of the aerosol size distribution along with the latitudinal and seasonal variations will be specified based on the simulation of the fully resolved aerosol scheme. In the second phase, two moments of the model aerosol scheme will be taken as prognostic variables. Both stratospheric aerosol parametrisations are being validated against the fully resolsved aerosol scheme and against a range of in-situ and satellite observations. A fully validated stratospheric aerosol scheme will be delivered to ECMWF at the end of the first phase (month 15). The months 16-30 will be devoted to the implementation of the parametrisation in the IFS model.

Task 1.3: implementation of new emission inventories

Task Lead: ECMWF

Partners: FMI, more partners

multi-partner input to JJM under ECMWF leading

Task 1.4: implementation of aerosol optical properties

Task Lead: MET OFFICE

Partners: ECMWF

Met Office contribution
We will complement the work performed in Task 1.1 to aerosol optical properties. A methodology will be developed to estimate the aerosol optical properties for the reduced model in order to match the aerosol optical depth from the full aerosol scheme. This will cover both SW and LW radiation spectrum. Routines and/or LUT will be provided. This will result into D_AER_1.3.

Task 1.5: production of test simulations

Task Lead: ECMWF

Partners: none

Table of Milestones & Deliverables for the WP_AER_1

Second dust and sea-salt simulation for evaluation in WP_AER_4	ECMWF	D_AER_1.1	T0+13
Methodology for developing a 4-variable simplified scheme	Met Office (with LOA)	D_AER_1.2	T0+13
Aerosol optical properties	Met Office	D_AER_1.3	T0+15
Delivery of a simplified M7 scheme	MPI-M	D_AER_1.4	T0+13?
Finalisation of a prototype direct model	ECMWF	M_AER_1.1	T0+15
Delivery of a stratospheric aerosol model for ECMWF system	SA-UPMC	D_AER_1.5	T0+15
Implementation of a stratospheric aerosol model in ECMWF system	ECMWF	M_AER_1.2	T0+20
Preliminary full aerosol test simulation to be evaluated by WP_AER_4	ECMWF	D_AER_1.6	T0+18
Improved aerosol test simulation to be evaluated by WP_AER_4	ECMWF	D_AER_1.7	T0+27
Delivery of an improved stratospheric aerosol model for ECMWF system	SA-UPMC	D_AER_1.8	T0+30

Work Package Planning and Time table for the WP_AER_1

Task Number	Task Name	Start Month	End Month	Total Person Months
1.1	Implementation of the direct physical aerosol model in the ECMWF model	13	30	
1.2	Implementation of parameterisations for stratospheric aerosols	13	30	
1.3	Implementation of new emission inventories	13	30	
1.4	Implementation of aerosol optical properties	13	24	
1.5	Production of test simulations	13	30	

WP_AER_2: Refinement of aerosol emission sources

Lead Partner: FMI

Partners: MPI-M, CEA-IPSL-LSCE, SA-UPMC

Task 2.1 Update and assimilation of the anthropogenic emission inventories of aerosol and its precursors.

Task Lead: FMI

Partners: MPI-M

Contribution from FMI

The work will be concentrated on: (i) delivering the collected emission information for the aerosol model (on-going); (ii) completion of temporal variation coefficients – based on EMEP, EURORAC-GENEMIS and RETRO results. According to information from RETRO consortium, the anthropogenic part of the database is ready for delivering. The information has been accumulated at FMI server, complemented with other global datasets and is being delivered to ECMWF. Collection of the temporal variation coefficients will be continued and, after cross-verification of the obtained results, delivered to GEMS aerosol model.

MPI-M contribution

The AeroCom emission data-base for the year 2000 is considered a starting point to prescribe the aerosol emission inventory. Additional improvements are anticipated including recommendation for nitrate, updating the wildfire inventory (van der Werf 2005), and defining scaling factors and trends to make the year 2000 inventory more applicable for the year 2003. Here a collaboration with CEA-IPSL-LSCE and EC-JRC is anticipated. (In particular emission simulations for the year 2003 near surface winds are needed)

Task 2.2. Assimilation of information on the wild fires

Task Lead: FMI

Partners: MPI-M

Contribution from FMI

To speed-up the re-analysis preparation for 2003, the fire-related emission will be taken from the existing databases. According to information from the RETRO consortium, the fires-related emissions are going to be updated in the database, which so far does not cover 2003. A new database GFEDv2 has emerged with the temporal coverage 1997-2004. This database will be evaluated, cross-compared with RETRO and then delivered for the 2003 re-analysis.

The main effort will be concentrated on building the fire assimilation system, which architecture is getting clear from intensive cross-project discussions. Specific question, which will be addressed by FMI, is the methodology of extracting sufficient

amount of information from satellite retrievals to assess the vertical profile of the fire emission fluxes. downplay this a bit

sub-monthly diurnal variability

assessment of injection height from AEROCOM emission database

Task 2.3. Quantification of the wind-blown dust emission from desert areas

Task Lead: MPI-M

Partners: CEA-IPSL-LSCE

Contribution from CEA-IPSL-LSCE
We will expand the module for wind-blown dust emission by adding emissions from road and arable dust.
Road dust
We will compile a country by country database of the extent of unpaved roads (in kilometres) and gather estimates of traffic occurrences (vehicles/day/km of unpaved road). Based upon recent studies in the San Joachim Valley in California and on measurements conducted over unpaved roads over Kenya, we will estimate the emissions from the different countries prone to unpaved roads dust emissions. Finally, we will map these emissions on the model grid.
Arable lands
Different agricultural practices (tillage, ploughing, rolling, disking, …) favour or lead to soil erosion. These phenomena concern only the first few mm of soil and occur on bare and un-crusted ones. We will account for soil type and soil moisture as they limit soil erosion. A first evaluation will be made by applying to the total area cultivated in summer the emission estimates of dust emission per hectare of soil that undergoes tillage.
Soil moisture influences the potential of surfaces to emit in the following way: they can only occur when precipitation is less than 3mm or is smaller than evaporation. We will use the soil moisture of the upper most layer in the ECMWF model to modulate the emission as they decrease drastically as the water content of the soil utmost layer goes from 0 to 5%.

offline benchmark simulations of dust source (x2).

Task 2.4. Quantification of the wind-blown sea salt emission

Task Lead: CEA-IPSL-LSCE

Partners: FMI

Contribution from CEA-IPSL-LSCE
The emission formulation of sea salt will be tested with 2 modes of the size distribution and compared with previous simulation using 3 modes. We will achieve to have fewer tracers in the ECMWF model simulation.
The emission routine will have a module that scales the emissions to the 10m winds produced by the T106 model resolution. In this way the sea-salt emission that is wind driven will be resolution independent.

A full year test with in the LMDz-INCA model will be conducted to serve as comparison and evaluation as the emission scheme is applied to the ECMWF model. Comparison of sea-salt budgets from other models that have been involved in the AEROCOM intercomparison project will also be used.

Contribution from FMI

The team will continue the development of a new hybrid scheme for sea salt emission. The scheme combines two approaches: one of them is used in the first version of the ECMWF model, the other is complementary for small-size particles and larger number of varying parameters. Its full implementation will result in explicitly represented dependencies of emission fluxes and size distributions on water salinity and temperature. The following specific tasks are expected for the period concerned: (i) completion of the model prototype (deliverable 2.1, month T0+14); (ii) evaluation of the prototype against measurements for the selected year; (iii) comparison with the module implemented in ECMWF model. For these tasks, the emission scheme will be implemented into the regional CTM model SILAM, which already contains several parts of its prototype.

offline benchmark for sea-salt source term

Task 2.5. Sources of stratospheric aerosols

Task Lead: SA-UPMC

Partners: MPI-M

SA-UPMC contribution (months 13-20)

In the second phase of the project, the specification of the stratospheric sulphur sources will be refined. We will carry out a literature review on the natural and anthropogenic sources of OCS. Based on this literature review, a latitudinal and seasonal variation of OCS sources will be specified. The production of OCS from the oxidation of the lumped gas-phase short-lived sulphur tracer (SO2+H2S+DMS) will also be considered.

Concerning the emissions of the lumped gas-phase short-lived sulphur tracer, particular attention will be paid to ensure that its mixing ratio at the tropical tropopause is consistent with available observations. The value of the mixing ratio is a critical parameter for the flux of short-lived sulphur into the stratosphere. Based on the simulations of the SA-UPMC global chemistry-transport-aerosol model, a latitudinal and seasonal variation of the stratospheric lifetime of the lumped SO2 tracer will be specified.

Table of Milestones & Deliverables for the WP_AER_2

A prototype version of the sea-salt emission module	FMI / CEA-IPSL-LSCE	D_AER_2.1	T0+14
Report on diurnal and weekly corrections to industrial emission inventories	FMI / MetOffice	D_AER_2.2	T0+14
Implementation of current emission sources	ECMWF	M_AER_1.1	T0+15
An updated version of BUOYANT local-scale fire model for the conditions of large-scale wild fires	FMI	D_AER_2.3.1	T0+18
An updated prototype of BUOYANT local-scale fire model for the conditions of large-scale wild fires	FMI	D_AER_2.3.2	T0+24
Final version of BUOYANT local-scale fire model for GEMS needs	FMI	D_AER_2.3.3	T0+30
An improved module for wind-blown dust emission including industrial, road and arable dust	MPI-M / CEA-IPSL-LSCE	D_AER_2.4	T0+18
An improved module for the sea-salt wind-derived emission using modal and bin schemes	FMI / CEA-IPSL-LSCE	D_AER_2.5	T0+18
Documented package of stratospheric sources	SA-UPMC	D_AER_2.6	T0+20
Implementation of improved emission sources	ECMWF	M_AER_2.2	T0+21
A module for assimilation of the wild fires information from satellites	FMI / ??	D_AER_2.7	T0+24
Implementation of wild fire assimilation module	ECMWF	M_AER_2.3	T0+30

Work Package Planning and Time table

Task Number	Task Name	Start Month	End Month	Total Person Months
2.1	Update and assimilation of the anthropogenic emission inventories of aerosol and its precursors	13	30	
2.2	Assimilation of information on the wild fires	13	30	
2.3	Quantification of the wind-blown dust emission from desert areas	13	30	
2.4	Quantification of the wind-blown sea salt emission	13	30	
2.5	Sources of stratospheric aerosols	13	30	

WP_AER_3: Aerosol data assimilation

Lead Partner: ECMWF

Partners: CNRS-LOA, CEA-IPSL-LSCE, SA-UPMC

Task 3.1: Adaptation of radiative transfer (RT) codes

Lead Partner: ECMWF

Task 3.1a: shortwave radiances in nadir geometry

Task 3.1b: infrared radiances in nadir geometry

No activity foreseen during months 13-30.

Task 3.1c: shortwave radiances in limb geometry

No activity foreseen during months 13-30.

Task 3.2: Preparation and harmonisation of aerosol satellite dataset

Lead Partner: ECMWF

Partners: MPI-M, CNRS-LOA, SA-UPMC

Task 3.2a: Tropospheric (column) aerosol products

Lead Partner: ECMWF

Partners: MPI-M, CNRS-LOA

MPI-M contribution

In order to maximize benefits of aerosol remote sensing from space a rigorous evaluation to quality ground data (e.g., AERONET) is required. First efforts with long-term statistics to construct a composite of different satellite retrievals for a globally 'best' satellite product were already somewhat successful for AOD and will be expanded to Angstrom data. These efforts need to be fine tuned based on temporally simultaneous comparisons. In a test case, AERONET data have been already filtered at Terra overpass (to be further reduced to the samples of successful retrievals). Collaboration with CNRS-LOA is anticipated to harmonize data. In that context also initial ideas were tested to merge quality point data (AERONET) into less accurate spatial data patterns (satellite data).

CNRS-LOA contribution.

In the second stage of the project we will develop in collaboration with ECMWF a methodology for sampling quality-assured MODIS satellite radiances prior assimilation. We will first focus on the downscaling of the radiance to the model grids.

CNRS-LOA contribution
In the first phase of the project, we have started to develop a methodology for sampling quality-assured MODIS satellite products prior assimilation. This methodology is based on assessment of the inversion errors associated with each observation. In the second step of the project, we will test and implement this methodology in order to provide a comprehensive error balance of the MODIS aerosol product.

CNRS-LOA contribution

The evaluation of the GLOBAER will be done during this second stage of the project. Aerosol products will be compared versus AERONET data acquired within 15 min prior and after the satellite acquisition. GLOBAER partners are asked to provide extraction tools for the satellite products that facilitate the validation exercise.

blacklist, satellite composite

Task 3.2b: Stratospheric (height-resolved) aerosol products

Lead Partner: SA-UPMC

Partners: ECMWF

SA-UPMC contribution (months 13-20)
The SAGE satellite-derived aerosol products will be prepared for delivery to ECMWF.

Task 3.3: Error covariance matrices

Lead Partner: CEA-IPSL-LSCE

Partners: ECMWF, CNRS-LOA

Task 3.3a: observational error covariance matrices

ocean first, then land; bias error

Task 3.3b: model error covariance matrices

Task 3.4: Test of a 1D-VAR system using aerosol products

Lead Partner: ECMWF

Partners: CNRS-LOA, SA-UPMC

Task 3.4a: 1D-VAR system for the column aerosol optical depth

Task 3.4b: 1D-VAR system for the stratospheric aerosol extinction coefficient

Task 3.5: Test of a 1D-VAR and 4D-VAR system using aerosol radiances

No activity foreseen during the months 13-30.

Table of Milestones & Deliverables for the WP_AER_3

Methodology for sampling quality-assured MODIS satellite products prior assimilation.	CNRS-LOA	D_AER_3.1	T0+15
First estimate of the observational operator contribution to the observational error covariance matrix.	CEA-IPSL-LSCE	D_AER_3.2	T0+15
Preparation of SAGE satellite-derived aerosol products	SA-UPMC	D_AER_3.3	T0+20
Evaluation of the various aerosol satellite datasets (including GLOBAER) against AERONET (within 30 min).	CNRS-LOA	D_AER_3.4	T0+22
Improved estimate of the observational operator contribution to the observational error covariance matrix.	CEA-IPSL-LSCE	D_AER_3.5	T0+25
Development of tangent-linear (TL) and adjoint (AD) versions of the 6S RT code	ECMWF	D_AER_3.6	T0+26
Methodology for sampling quality-assured MODIS satellite radiances prior assimilation	CNRS-LOA	D_AER_3.8	T0+30
Preliminary 1D-Var tests with 6S adjoint on point measurements	*ECMWF*	*See PRO workplan*	*T0+30*

Work Package Planning and Time table for the WP_AER_3

Task Number	Task Name	Start Month	End Month	Total Person Months
3.1	Adaptation of radiative transfer (RT) codes	13	30	
3.2	Preparation and harmonisation of aerosol satellite dataset	13	30	
3.3	Error covariance matrices	13	30	
3.4	Test of a 1D-VAR system using aerosol products	13	30	

WP_AER_4: Evaluation of the model and analysis

Lead Partners: NUIG & CNRS-LOA

Partners: DWD, RMIB, MPI-M, CEA-IPSL-LSCE, SA-UPMC, ECMWF, DLR (at no cost)

Task 4.1: Assessment of diagnostics and skill scores

Task Lead: MPI-M

Partners: CNRS-LOA, ECMWF, CEA-IPSL-LSCE

MPI_M contribution

Implement available data into the AeroCom data-base and make them available for interactive viewing with standard AeroCom tools. In that context current AeroCom web-tools need to be expanded, to include additional visualization (e.g. merit plots) and quantification tools (e.g. scores) and also to be able to handle a 3 hour temporal resolution data. Here a collaboration with CEA-IPSL-LSCE is expected. 'Data' to be uploaded focus on available remote sensing data of aerosol from ground networks (mainly AERONET) and from various space sensors in terms of multi-year statistics (general reference) and at high temporal resolution for the year of choice (2003). Although model scores to surface data will be based mainly on a selected few (51) surface sites (with high data frequency), no ECWMF interpolation to those sites is generally needed. ECWMF output (as input to the AeroCom tool) is fine, if it is follows the AeroCom protocol (e.g. netcdf).

List of case studies 'aerosol events' DWD+MPI-M, with link to GRG

Task 4.2: Evaluation of aerosol radiative properties and associated radiative fluxes

Task Lead: DWD

Partners: RMIB, ECMWF, CNRS-LOA, MPI-M

DWD contribution

In months 13-30 DWD plans to:

- continue (spectral) AOD validation based on GAW global and regional database (target year 2003), identify / select specific events suitable for model evaluation,
- extend validation of reanalysis runs from year 2003 to longer period (e.g., 1996-2005) incl. validation of modelled aerosol radiative effects on surface irradiance,
- continue to complete GAW aerosol optical properties database (station contacts) and begin with transition to real-time data flow (DWD as GAW/GEMS interface),
- establish / improve quality level characterization of station AOD data incl. station characteristics,
- collaborate with RMIB and MPI-M on AOD validation,
- merge task 4.2 validation results to support overall validation by NUIG,
- collaborate with modellers to identify model deficits and improve model(s).

RMIB contribution

1) Brewer spectrophotometer and AOD retrieval (months 13-18)

Prepare the data set of AOD in the UV for the available Brewer stations and the available time period. This will include quality checks of the available Brewer data, and preparing the data in the suitable data format for the AEROCOM database. Delivery of this data set (T0+18).

2) Satellite data and AOD retrieval (months 13-24):

i) Model validation with SEVIRI aerosol optical depth product (T0+24)

The SEVIRI aerosol index and AOD will be reprocessed backwards in time to mid 2003. The model AODs will be compared with the SEVIRI ones for the model validation period.

ii) Working on combined GERB / SEVIRI TOA radiative flux (T0+24).

The GERB fluxes need to be combined with the SEVIRI aerosol index to derive the aerosol radiative forcing.

3) Evaluation

(months 13-18)

i) Comparisons of the Brewer-AOD values and SEVIRI aerosol index data with AOD test model runs 1and 2 (WP_AER_1, for sea-salt and desert dust aerosol, D_AER_1.1).

ii) Report on the performance/results to the modelling partners

(months 18-24)

i) Comparisons of the Brewer-AOD values and SEVIRI aerosol index data with AOD from the preliminary full aerosol test simulation (D_AER_1.6).

ii) Feedback and report on the performance/results to the modelling partners.

iii) Adding to the preliminary report from validation partners on the preliminary first full aerosol simulation (D_AER_4.8).

(months 27-30)

i) Comparisons of the Brewer-AOD values and SEVIRI aerosol index data with AOD from the improved full aerosol test simulation (D_AER_1.7).

ii) Feedback and report on the performance/results to the modelling partners.

iii) Adding to the final report from validation partners on the improved first full aerosol simulation (D_AER_4.11).

<u>MPI-M contribution</u>

AERONET data (statistics) have been processed and are available via ftp (note: the currently available daily data are slightly time-shifted due to a local time vs UTC time error that mainly affects Asian and Australian sites – a correct reprocessed version will be made available soon on the same ftp site). Data on aerosol include, direct measurements (AOD, Angstrom), derived properties (size-distribution, absorption) and associated properties (lidar ratio and radiative forcing). Evaluations will largely rely on current and newly developed tools. Here, a collaboration with partners, particular with the DWD group, regarding data-stream from non-AERONET aerosol data (GAW, Brewer, Skynet?) in the AeroCom web tool and help with the data-analysis and the model-assessment is anticipated.

Initiate contact to AERONET for NRT data flow

Task 4.3: Evaluation of aerosol physico-chemical properties

Task Lead: NUIG

Partners: MPI-M, DLR (at no cost)

In terms of validation of aerosol physical and chemical properties, the best available datasets are found in the EMEP, IMPROVE and GAW monitoring networks including super-sites audited for data quality.

NUIG contribution
During the first 12 months, significant amounts of GAW and EMEP databases were gathered into one location for preparation of model analysis. In addition, during the last quarter of year 1, access to the MARS data system was enabled and software interfaces started to be developed to access the data in a format suitable for comparison with the databases. The first-cut combined EMEP and GAW databases will be delivered on month 15 and interface software will continue to be developed through this period as the model simulations develop. Access to IMPROVE data will be pursued.
Model validation is an ongoing process as is the development scheme of aerosol components in the model and in this context, the model validation will proceed throughout this period. Preliminary reporting from validation partners on the first full aerosol simulation will be delivered on month 24.

MPI-M contribution
Collaboration, with NUIG, to the point, where AERONET aerosol optical properties (e.g. aerosol absorption and/or aerosol size), can help in the aerosol classification (no chemical analysis). Particular interesting are of course comparisons (of remote sensing data) to simultaneous data derived from in-situ data.

Task 4.4: Analysis of model results with respect to air quality

Task Lead: CNRS-LOA

CNRS-LOA contribution
We will provide an analysis of aerosol case studies for past periods, selected stations and selected weather situations for 2003-2004. We will continue the evaluation of POLDER retrievals for monitoring and characterization of pollution events of particles and include evaluation of MODIS aerosol retrievals. We will extend our analysis of PM2.5 and AERONET data over Western Europe and more recent years (2004-2005). We will include the evaluation of the model analysis (T0+18) and provide a final report on the utility of satellite data and global model analysis for air quality monitoring (T0+30).

Table of Milestones & Deliverables for the WP_AER_4

AEROCOM database of aerosol radiative quantities	MPI-M	D_AER_4.1	T0+15
Delivery of GAW preliminary AOD database	DWD	D_AER_4.2	T0+15
Database of aerosol physical and chemical properties	NUIG	D_AER_4.3	T0+15
Case studies of past periods, selected stations, selected weather situations	CNRS-LOA+MPI-M+DWD	D_AER_4.4	T0+15
Delivery of an extended set of Brewer AOD data for upload on the AEROCOM database	RMIB	D_AER_4.5	T0+18
Preliminary report on the utility of satellite data for air quality monitoring	CNRS-LOA	D_AER_4.6	T0+18
Report on identification of the key evaluation procedures between the sub-projects and possible inconsistencies.	UPMC-SA CT?	D_AER_4.7	T0+20
Preliminary report from validation partners on the first full aerosol simulation	Lead NUIG	D_AER_4.8	T0+24
Definition of improvements to validation (report)	MPI-M	D_AER_4.9	T0+24
GERB/SEVIRI aerosol optical depth product	RMIB	D_AER_4.10	T0+24
Final report from validation partners on the first full aerosol simulation	Lead NUIG	D_AER_4.11	T0+30
Final report on the utility of satellite data and global model analysis for air quality monitoring	CNRS-LOA	D_AER_4.12	T0+30

Work Package Planning and Time table for the WP_AER_4

Task Number	Task Name	Start Month	End Month	Total Person Months
4.1	Assessment of diagnostics and skill scores	13	30	
4.2	Evaluation of aerosol radiative properties and associated radiative fluxes	13	30	
4.3	Evaluation of aerosol physico-chemical properties	13	30	
4.4	Analysis of model results with respect to air quality	13	30	