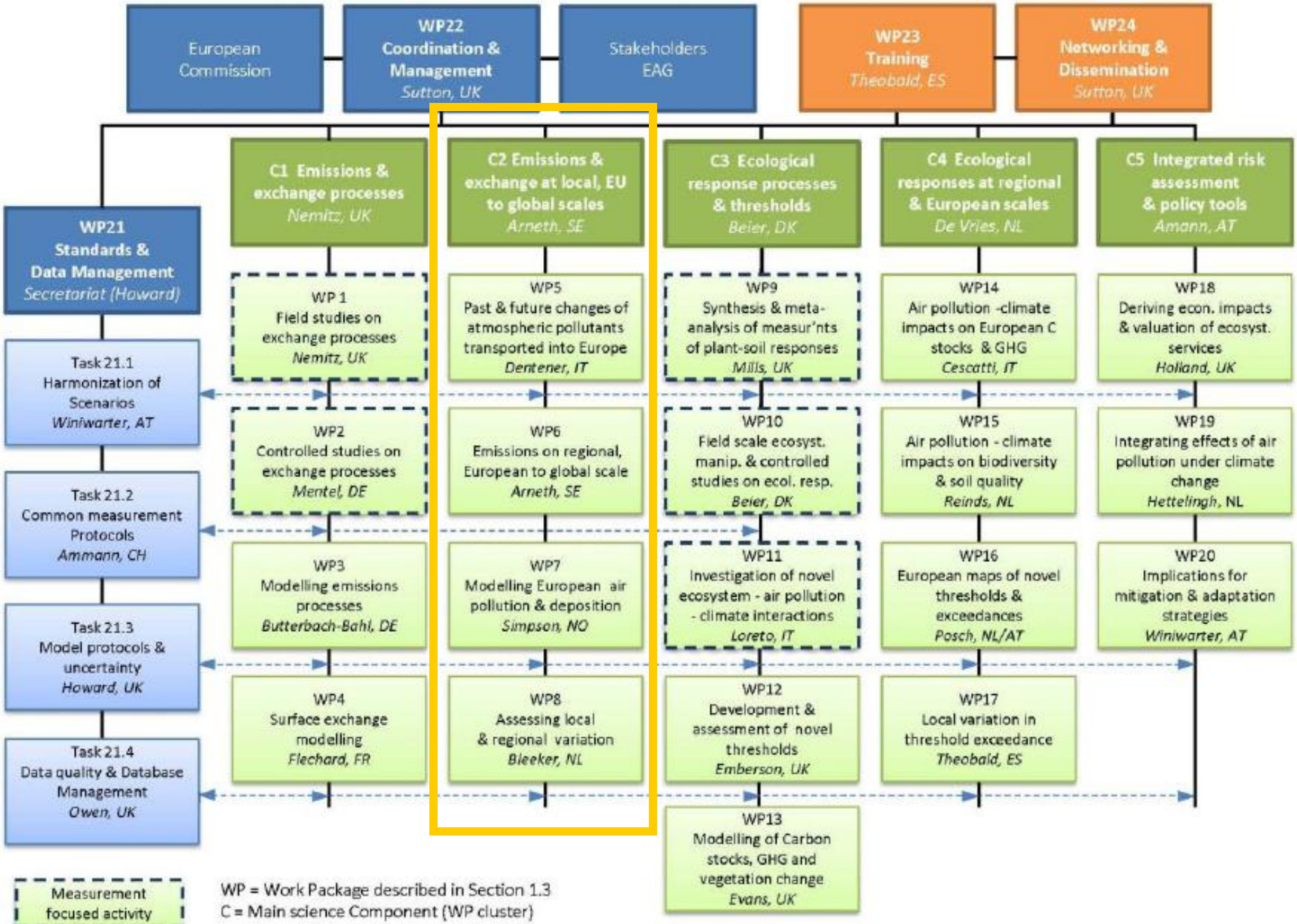
C2: Emissions & exchange at local, EU to global scales


European Commission
WP22 Coordination & Management Sutton, UK
Stakeholders EAG
WP23 Training Theobald, ES
WP24 Networking & Dissemination Sutton, UK
WP21 Standards & Data Management Secretariat (Howard)
C1 Emissions & exchange processes Nemitz, UK
C2 Emissions & exchange at local, EU to global scales Arneth, SE
C3 Ecological response processes & thresholds Beier, DK
C4 Ecological responses at regional & European scales De Vries, NL
C5 Integrated risk assessment & policy tools Amann, AT
Task 21.1 Harmonization of Scenarios Winiwarter, AT
Task 21.2 Common measurement Protocols Ammann, CH
Task 21.3 Model protocols & uncertainty Howard, UK
Task 21.4 Data quality & Database Management Owen, UK
WP 1 Field studies on exchange processes Nemitz, UK
WP2 Controlled studies on exchange processes Mentel, DE
WP3 Modelling emissions processes Butterbach-Bahl, DE
WP4 Surface exchange modelling Flechard, FR
WP5 Past & future changes of atmospheric pollutants transported into Europe Dentener, IT
WP6 Emissions on regional, European to global scale Arneth, SE
WP7 Modelling European air pollution & deposition Simpson, NO
WP8 Assessing local & regional variation Bleeker, NL
WP9 Synthesis & meta-analysis of measur'nts of plant-soil responses Mills, UK
WP10 Field scale ecosyst. manip. & controlled studies on ecol. resp. Beier, DK
WP11 Investigation of novel ecosystem - air pollution - climate interactions Loreto, IT
WP12 Development & assessment of novel thresholds Emberson, UK
WP13 Modelling of Carbon stocks, GHG and vegetation change Evans, UK
WP14 Air pollution -climate impacts on European C stocks & GHG Cescatti, IT
WP15 Air pollution - climate impacts on biodiversity & soil quality Reinds, NL
WP16 European maps of novel thresholds & exceedances Posch, NL/AT
WP17 Local variation in threshold exceedance Theobald, ES
WP18 Deriving econ. impacts & valuation of ecosyst. services Holland, UK
WP19 Integrating effects of air pollution under climate change Hettelingh, NL
WP20 Implications for mitigation & adaptation strategies Winiwarter, AT
Measurement focused activity
WP = Work Package described in Section 1.3
C = Main science Component (WP cluster)

C2: Objectives

1) understand **past and predict future trends** in Northern Hemispheric O3 concentrations (WP5);

2) provide frameworks to model **spatially and temporally resolved emission fields** in response to meteorology (WP6)

3) and **pollutant deposition fields** at the European (WP7) and global scale;

4) better understand the **air quality and climate change interactions at local and regional** scales (WP8).

→ provide exposure and deposition inputs for the development of metrics for ecosystem threats (C3) and to assess ecological responses under current and future climate (C4)

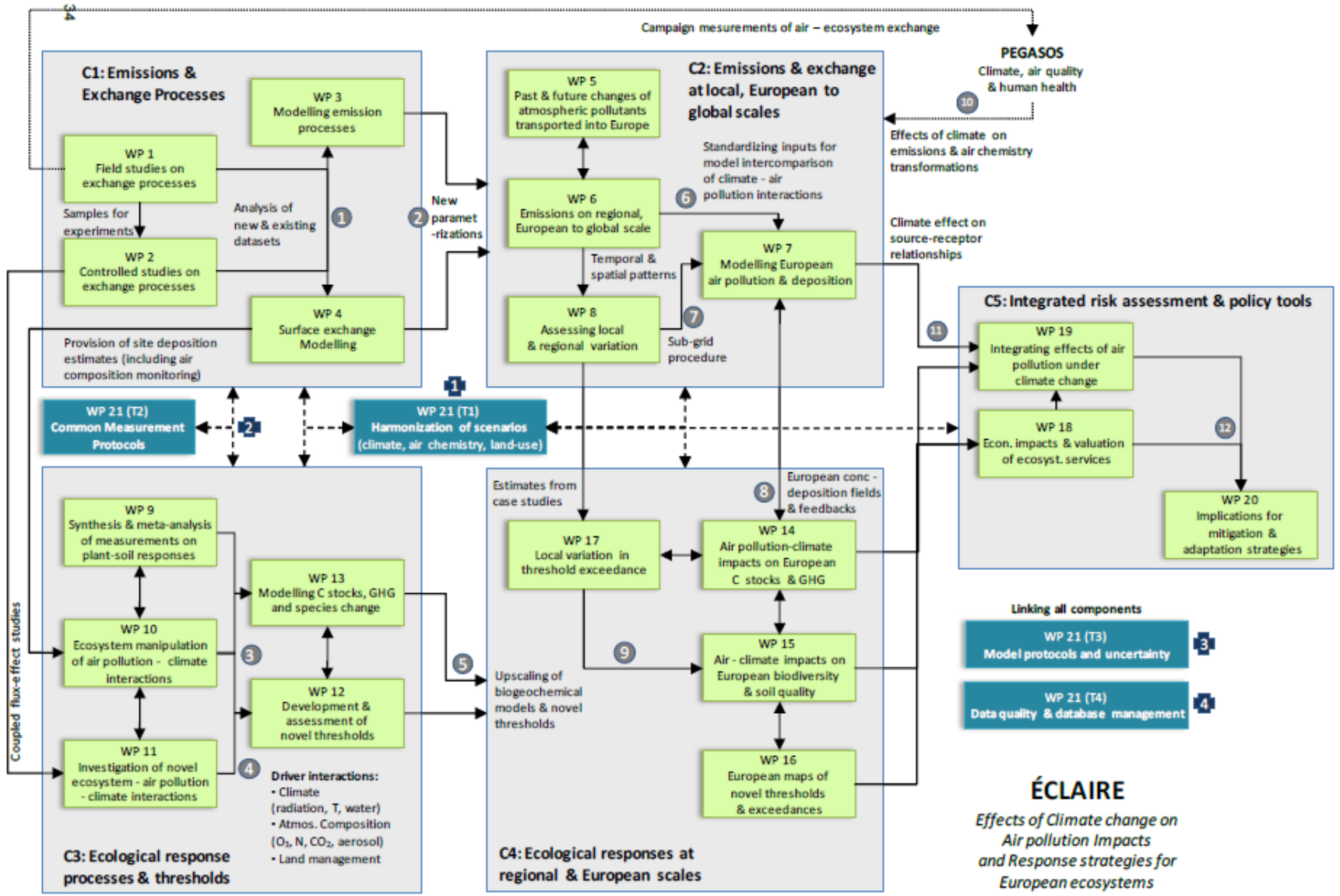
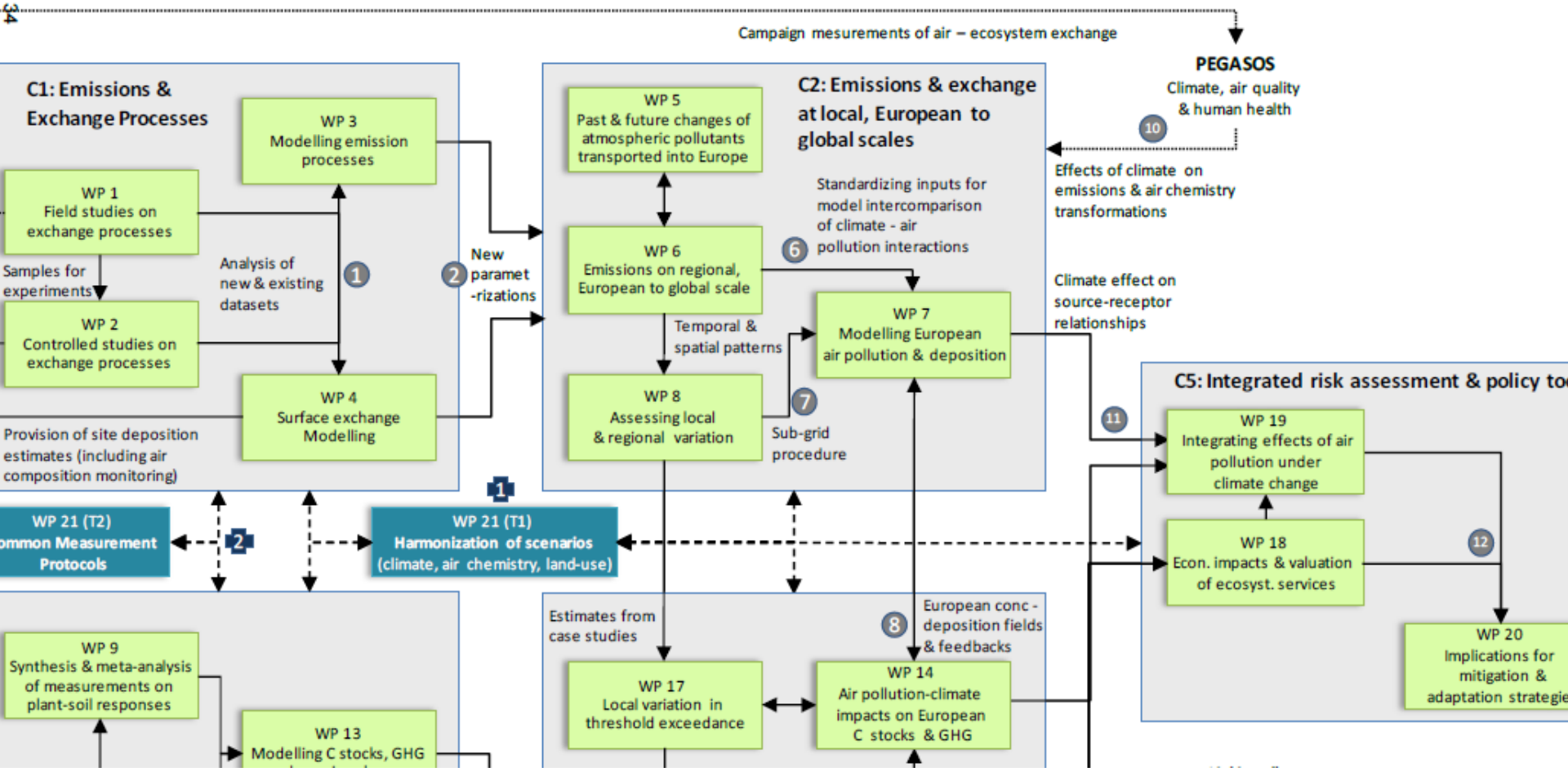


Figure 1.6: PERT chart showing the overview of relationships across ÉCLAIRE. For explanation of risk points (1) (1)) see Figure 6b.


Campaign mesurements of air – ecosystem exchange
PEGASOS
Climate, air quality & human health
10
Effects of climate on emissions & air chemistry transformations
C1: Emissions & Exchange Processes
WP 3 Modelling emission processes
WP 1 Field studies on exchange processes
Samples for experiments
WP 2 Controlled studies on exchange processes
Analysis of new & existing datasets
1
2 New paramet -rizations
WP 4 Surface exchange Modelling
Provision of site deposition estimates (including air composition monitoring)
C2: Emissions & exchange at local, European to global scales
WP 5 Past & future changes of atmospheric pollutants transported into Europe
Standardizing inputs for model intercomparison of climate - air pollution interactions
6
WP 6 Emissions on regional, European to global scale
Temporal & spatial patterns
WP 8 Assessing local & regional variation
7
Sub-grid procedure
WP 7 Modelling European air pollution & deposition
Climate effect on source-receptor relationships
11
C5: Integrated risk assessment & policy to
WP 19 Integrating effects of air pollution under climate change
WP 18 Econ. impacts & valuation of ecosyst. services
12
WP 20 Implications for mitigation & adaptation strategie
1
WP 21 (T2) ommon Measurement Protocols
2
WP 21 (T1) Harmonization of scenarios (climate, air chemistry, land-use)
WP 9 Synthesis & meta-analysis of measurements on plant-soil responses
WP 13 Modelling C stocks, GHG
Estimates from case studies
8
European conc - deposition fields & feedbacks
WP 17 Local variation in threshold exceedance
WP 14 Air pollution-climate impacts on European C stocks & GHG

WP 5: Past & future changes of atmospheric pollutants transported into Europe

JRC CNRS Met.no ULUND

Objectives:

1. Current understanding of **ozone and other air pollution trends**, link to based on UNECE TF HTAP, work for IPCC-AR5 and other projects, inflow regions of Europe.

2. **Transport** of atmospheric pollutants (ozone and precursors, aerosols) into Europe, relative contributions of long-range-transported and European pollution on atmospheric composition and deposition; provide a range of **chemical boundary conditions** accounting for changes in global anthropogenic and natural emissions under current and future climate change conditions

3. Relative **contributions of and impacts on** air pollution of future biogenic and soil and fire emissions.

4 tasks, deliverables between month 18 and 24

Delive-rable Number [61]	Deliverable Title	WP number [53]	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D5.1	Assessment of current GCMs and CTMS	5	11	7.00	R	PU	18
D5.2	Report describing the range of future evolutions of global, hemispheric and European ozone	5	11	7.00	R	PU	36
D5.3	Report describing the contributions of regions and processes on key environmental variables	5	11	7.00	R	PU	36
D5.4	Boundary conditions for regional conditions	5	11	7.00	R	PU	24

Issues

Boundary conditions (O3; other) from ACC, Pegasos, HTAP hindcast: maybe available rather late to ECLAIRE

Fall back option: O. Wilds linearized product for O3 anthropogenic emissions

Natural emissions: completely new; include emissions or the parameterisation itself (preferably).

Attribution: HTAP approach; but with regional disaggregration

Issue: Are regional modellers willing and able to take (range of BC) from global models and how provided.

C2, WP6, Emissions on regional, European, to global scale

Objective: provide

(1) emission patterns for model experiments on European and global, with a focus on terrestrial biogenic and pyrogenic emissions,

(2) improved temporal resolution of non-agricultural anthropogenic emissions

C2, WP6, Emissions on regional, European, to global scale

--**Synthesis of existing** terrestrial biogenic and pyrogenic **emission estimates** from the consortium partners (scale: regional, European, global)→ establish and test for suitable input format and resolution, and file exchange strategies

-- **Improved emissions** from (semi-) natural ecosystems. →emission models to be driven by past, present-day and future climate, CO2 and N deposition scenarios

C2, WP6, Emissions on regional, European, to global scale

-- Emissions from **agricultural sources** → modelled in response to their key drivers, integrate the improvements in process understanding from WP3

--- Emission profiles from **anthropogenic sources**→ key source sectors (road transport, other mobile sources, power generation, industrial production and agriculture), based on experience on highly detailed national scale work. T

Delive-rable Number [61]	Deliverable Title	WP number [53]	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D6.1	Initial dynamic biogenic emissions, based on synthesis of existing work and mainly for testing	6	2	9.00	O	PP	8
D6.2	Improved terrestrial (semi)natural and agricultural emissions	6	2	9.00	O	PP	30
D6.3	Sectoral emission profiles for selected source sectors and countries	6	2	7.50	O	PU	30

C2, WP7, Modelling European air pollution & deposition

Theme (i): **Implement "climate-ready" capabilities into EMEP** (+other?) model, building upon C1:

- multi-layer canopy/chemistry model – impacts of NO and BVOC emissions, aerosol processes, etc.

- Photosynthesis-based stomatal conductance – relations to CO2, N-deposition

- Links to LPJ-GUESS model (biomass, BVOC, phenology, etc.)

C2, WP7 cont.

Theme (ii): **Ensemble modelling** for predictions and uncertainties

- Six different CTMs for current pollution loads – assess accuracy and variability for especially N-deposition and ozone flux estimates

- Future climate+air pollution simulations based upon RCA meteorology + EMEP+MATCH CTMs, up to 2050.

=> Novel maps of pollutant metrics, current and future conditions

Delive-rable Number [61]	Deliverable Title	WP number [53]	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D7.1	Maps of current air pollution	7	6	10.00	R	PU	18
	metrics (APMs) across Europe, from the EMEP model and five other CTMs						
D7.2	Improved EMEP model with climate-change and canopy-chemistry capabilities, able to predict the impac	7	6	10.00	O	PP	40
D7.3	Report on effects of in-canopy BVOC and NO emissions on in-canopy O3 and POD estimates	7	6	10.00	R	PU	44
D7.4	Report on effects of changes in global climate, chemistry, emissions and landcover changes on APMs	7	6	10.00	R	PU	48
D7.5	Source-receptor matrices of APMs for current and future conditions	7	6	12.00	O	PP	36

WP8 : Assessing local and regional variation

Aim of WP8

Develop a better scientific understanding of the air pollution and climate change relationships at **regional/local/landscape-scale and sub-grid approaches** for inclusion in large-scale models that enable a good representation of the multitude of processes that play a role on smaller scales.

Objectives

1. **Synthesize the available knowledge** on local interactions in relation to climate and air quality, as well as the way this knowledge is included in local-scale atmosphere-biosphere modelling systems

2. **Analyze the sensitivity** of landscape scale effects on changing pollutant fluxes, especially as affected by climate change

3. **Include local/landscape-scale effects** of climate change and air pollution interactions into large scale/European scale models by means of sub-grid representation of the most important processes

Task 8.1

- **Collect information** about existing local-scale models dealing with with atmosphere-biosphere exchange

- These models also take the climate change and air quality interactions into account

- Deliverables:
  - Synthesis report on the relevant local scale models

Task 8.2

- Improve our scientific understanding of **air quality/climate change relations at landscape scale**

- Based on an extended version of the NitroScape model. This model is (at present) able to:
  - Simulate different flows/interactions of Nr in a landscape in relation to agricultural management

- Future developments of NitroScape (during ECLAIRE):
  - Extend the model to also capture other processes (e.g. climate change effects)
  - Able to analyze sensitivity to climate change, especially in relation to atmospheric deposition

- Produce **high resolution deposition maps** for different regions, available as input to other WP's (e.g. WP17)

- Deliverables:
  - Report on local scale interactions between air quality and climate change

Task 8.3

- Development of **sub-grid parameterisations** for European scale CTMs.
- Improvement of **transport/deposition models** (e.g. EMEP), so they can better represent sub-grid variability
- Method based on statistical approach, linking to e.g. land cover and emissions variability
- Procedure will combine low-resolution EMEP results with available high resolution landcover/emissions datasets
- Deliverables:
  - Sub-Grid module for inclusion in the EMEP model

Delive-rable Number [61]	Deliverable Title	WP number [53]	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D8.1	Synthesis report on the different local scale models dealing with atmosphere-biosphere exchange	8	8	11.00	R	PU	12
D8.2	Report on local scale interactions between air quality and climate change	8	8	11.00	R	PU	30
D8.3	Concentration and deposition maps	8	8	11.00	R	PU	16
D8.4	Sub-Grid module for inclusion in the EMEP model	8	8	13.00	O	PP	30
	Progress report						

Milestone number [59]	Milestone name	WP number [53]	Lead beneficiary number	Delivery date from Annex I [60]	Comments
MS23	Evaluation of AR5 and other simulations with climate and chemistry global models	WP5	11	18	
MS24	Future simulations with improved biogenic and soil emissions	WP5	11	24	
MS25	WP meeting and decision on emission-model experimental protocol	WP6	2	8	WP meeting and decisi on emission-model experimental protocol, including spatial and temporal profiles (in coordination with the otl C2 WPs)
MS26	First improved emission estimates, based on model development	WP6	2	24	
MS27	Improved emission estimates, evaluated against ÉCLAIRE results	WP6	2	30	Improved emission estimates, documented other groups in ÉCLAIR evaluation against ÉCLAIRE results
MS28	Implementation and initial testing of coupled model system	WP7	6	24	Implementation and initial testing of coupled model system: EMEP with C1 (preliminary) DO3SE and canopy-chemistry models, combined with WP2.1 boundary conditions and WP2.2 emissions and landcover chan
MS29	Initial ensemble runs for current conditions	WP7	6	18	
MS30	Incorporation of sub-grid methodology from WP2.4 into EMEP model	WP7	6	30	
MS31	Future scenario data-sets ready	WP7	6	30	
MS32	"Final" model-system ready. Commencement of source-receptor calculations	WP7	6	36	
MS33	Inventory of relevant local scale models	WP8	8	10	
MS34	Report on local scale models inventory	WP8	8	12	
MS35	Update of NitroScape to reflect ÉCLAIRE needs	WP8	8	16	
MS36	Concentration/ Deposition maps	WP8	8	16	Concentration/Deposition maps (e.g. NH3 on 5 km x 5 km, 1 km x 1 km, up to 50 m x 50 m resolution) available for further use in ÉCLAIRE (e.g. WP4.4)
MS37	Description of local scale interactions between air quality and climate change	WP8	8	30	Description of local scale interactions between air quality and climate change, based on e.g. NitroScape / EMEP4UK
MS38	Sub-grid module available for implementation in EMEP model	WP8	8	40	