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Abbreviations

Abbreviation	Description
LF	Landfall
EREL	Environmental Research Laboratory
ECMWF	European Centre for Medium Range Weather Forecasts
CWT	Characteristic Weather Types
HYSPLIT	Hybrid Single Particle Lagrangian Integrated Trajectory Model

External cooperation

This document was drafted with the cooperation of:

- National Center for Scientific Research ''Demokritos''

ANNEX 9F.1 AIR DISPERSSION MODEL FOR PRE-COMMISSIOINING ACTIVITIES AT LF2

9F.1.1 SUMMARY

The Environmental Research Laboratory (EREL) of the National Centre for Scientific Research “Demokritos” performed the Air dispersion model and specifically the atmospheric dispersion of NOx, CO, PM10 concentrations from the pre-commissioining activities of the EastMed Pipeline Project, at landfall location LF2, at southeast location of Lasithi (eastern Crete).

The study was carried out for ASPROFOS Engineering S.A. by the following EREL personnel:

- Vlachogianni Diamando, M.Sc., Ph.D;
- Sfetsos Athanasios., Ph.D;
- Gounaris Nikolaos., M.Sc;
- Emmanouil George, PhD; and
- Karozis Stelios, M.Sc., Ph.D.

9F.1.2 AIM OF THE REPORT

The scope of this study is to investigate the impact of the dispersion of Nitrogen Oxides (NOx), Carbon Monoxide (CO) and Particulate Matter (PM10), on the atmospheric quality from the pre-commissioining activities of the EastMed Pipeline Project, at landfall location LF2, at southeast location of Lasithi (eastern Crete).

In the current modelling study, the 3-dimensional computer modelling tools were used with appropriate methodology[1] developed by the Environmental Research Laboratory (EREL) of the NCSR “Demokritos”. The position and geometry of data on stacks, emission rates of NOx , CO and PM10 were provided to EREL by Asprofos S.A. based on construction information.

The meteorological data for the area of interest were retrieved by EREL. The data related to the topography of the area were extracted from the Geographic Information System (ARC GIS) available at EREL. The basic computational and analysis steps followed are listed below:

- Processing of the available data, preparation of the input files for the dispersion model regarding the topography (ARC.GIS) and the meteorology of the area.

[1] D. Vlachogiannis, A. Sfetsos, N. Gounaris and A. Papadopoulos,” Investigation of atmospheric dispersion of gas compounds from an industrial installation over a realistic topography”, 17th International Conference on Harmonisation within Atmospheric Dispersion Modelling for Regulatory Purposes, 9-12 May 2016, Budapest.

- Meteorological computational calculations to obtain the characteristic weather types of the area of interest and the respective 3-Dimensional meteorological fields (WRF model).
- Modelling calculations of the atmospheric dispersion of the emissions of NOx , CO and PM10 from the pre-commissioning activities(HYSPLIT model).
- Analysis and evaluation of the model results on the near ground distribution of the NOx , CO and PM10 concentrations.
- Modelled near ground concentrations of the pollutants were compared against European air quality standards (2008/50/EC), adopted by Greek legislation, considering ambient background levels and potential receivers (populated places).

9F.1.3 PREPARATION OF THE INPUT DATA

This part involves the preparation of the input data files for the atmospheric dispersion model. For the specific study, the necessary data include the topography and meteorological fields of the area of interest.

9F.1.3.1 TOPOGRAPHY AND MODELLING DOMAIN

The geographical coordinates of the emission sources of the equipment used near the landfall location LF2 at Lasithi (regional unit of eastern Crete) on Greek Geodetic Reference System GGRS87 (X,Y) and latitude /longitude are shown on Table F1-1

Table F1-1 Geographic coordinates of the Landfall LF2

Position	Start	End
LF2 Atherinolakos - South Crete	694568.563	3874852.674

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The computational domain extent was set to 40 x 40 km^2 to include as many as possible neighbouring urban areas of the eastern part of the Lasithi regional unit (see Figure F1- 1). The topography of the area includes two major mountainous areas (~1500 m) that smooth down to low levels towards the coasts.

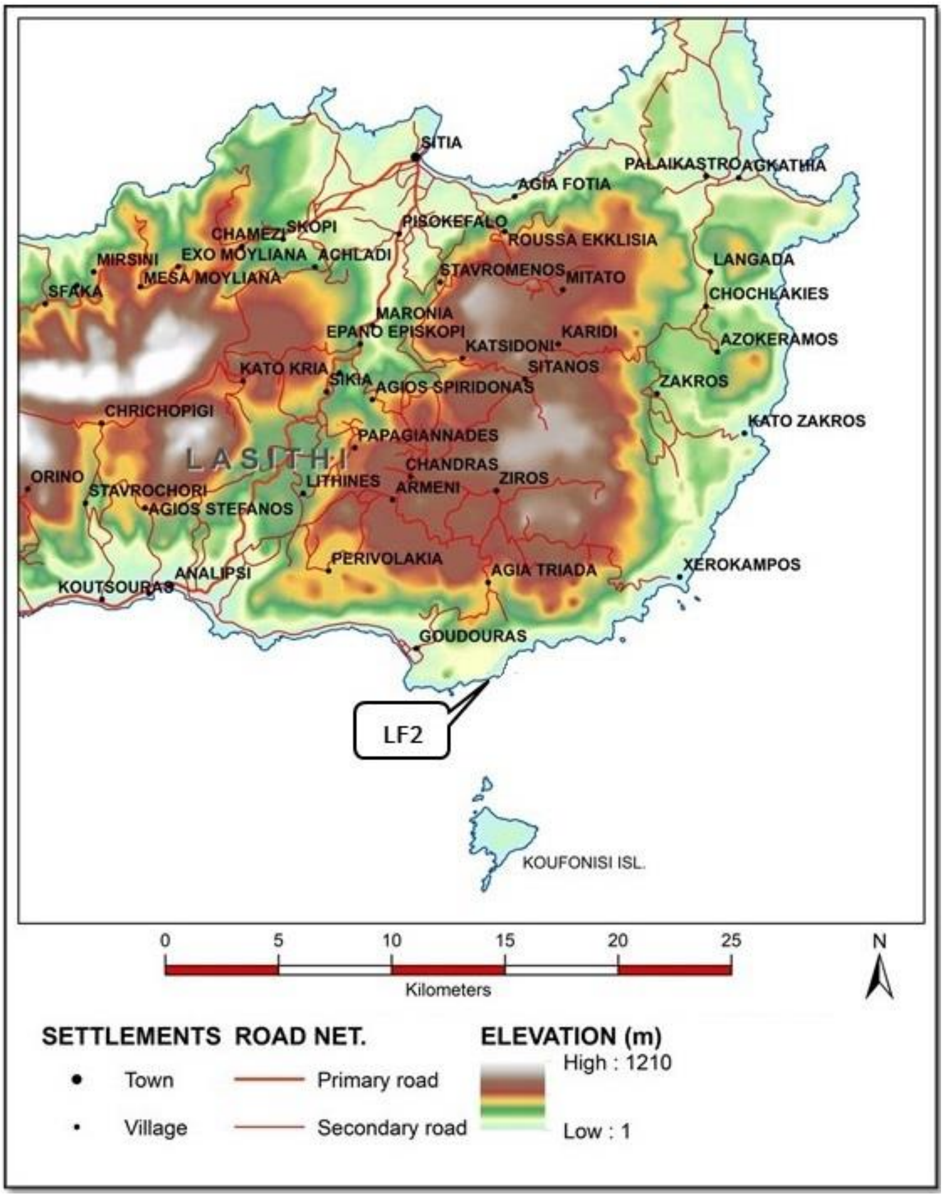

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Figure F1- 1 Topography map of the computational domain of size 40 x 40 km2.

9F.1.3.2 METEOROLOGY AND CHARACTERISTIC WEATHER TYPES

The atmospheric dispersion models use as input data meteorological variables such as wind speed and wind direction, temperature, category of atmospheric stability, mixing layer height etc. The more complex models (like the one used in this study named HYSPLIT) use 3-dimensional meteorological fields as input. The discretised meteorological fields are calculated by prognostic and/or diagnostic models.

For the current study, meteorological data (vertical distribution of wind speed and direction, temperature, mixing layer height, humidity, precipitation, cloud cover etc) were extracted from the European Centre for Medium-Range Weather Forecasts (ECMWF) ERA-5 climate re-analysis dataset, (https://confluence.ecmwf.int/display/CKB/ERA5%3A+data+documentation), available at 3-hourly intervals.

9F.1.3.2.1 Characteristic Weather Types over the study area

To calculate the average levels and the maximum values of the pollutant concentrations from a future installation in the atmosphere on an annual, daily and hourly basis, the procedure of identifying the typical meteorological conditions or else characteristic weather types (CWT) of the area of interest was followed. The prevailing meteorological conditions or in other words characteristic weather types were obtained using the methodology of Sfetsos et al. (2005)[2]. The specific methodology was applied on ERA5 reanalysis data of large scale, as referenced above, covering a period of eleven years (2010-2020). The analysis revealed the prevailing weather conditions in the defined computational domain and the corresponding frequency of occurrence (in percentage) per year. Each weather condition was assigned a characteristic or else typical day (24-hour). The results showed that the area of study is characterised by twelve (12) weather types (see Table F1-2,Table F1-3) The meteorological conditions from the global reanalysis model characterise each typical weather day of the region.

Table F1-2 Characteristic weather types (CWT) and percentage of their frequency of occurrence within a typical year in the area of Lasisthi.

LASITHI	
Typical weather type	Frequency Percentage of occurrence in a year (%)
1	12.2
2	12.8
3	10.8
4	5.9
5	8.5

[2] A. Sfetsos, D. Vlachogiannis, N. Gounaris, and A. K. Stubos, (2005). On the identification of representative samples from large data sets with application to synoptic climatology, Theor. Appl. Climatol. 82, 177–182.

LASITHI	
Typical weather type	Frequency Percentage of occurrence in a year (%)
6	5.9
7	3.6
8	5.7
9	3.7
10	6.3
11	11.6
12	13.1

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Table F1-3 Prevailing meteorological conditions during the 12 characteristic weather types (CWT) in the domain of Lasithi: horizontal component of wind speed, u (m/s), vertical component of wind speed v (m/s), (at 850 mb and 10 meters above mean sea level, a.m.s.l

CWT	u10 (0 h)	u10 (12 h)	v10 (0 h)	T (0 h)	BLH (12 h)	
1	1.658	3.200	-0.406	293.93	582.75	-
2	3.581	3.563	-6.715	294.04	866.97	-
	u10 (0 h)	u10 (12 h)	v10 (0 h)	T (0 h)	BLH (12 h)	-
3	0.657	0.541	-3.381	289.15	291.50	-
4	6.391	3.649	-7.039	287.41	1070.45	-
5	2.717	3.029	-0.528	291.81	485.27	-
	u10 (0 h)	u10 (12 h)	v10 (0 h)	T (0 h)	BLH (12 h)	-
6	6.037	4.044	-6.844	298.53	669.16	-
7	1.034	0.355	-0.824	297.15	177.12	-
8	2.938	1.266	-5.102	296.94	419.34	-
9	5.993	4.202	-8.137	297.97	765.86	-
10	5.187	2.491	-4.894	297.22	331.41	-
	u10 (0 h)	u10 (12 h)	v10 (0 h)	T (0 h)	BLH (12 h)	-
11	2.925	0.460	3.450	287.28	676.93	-
12	4.352	2.951	-5.749	286.22	1203.16	-
CWT	RH (0 h)	RH (12 h)	u850 (0 h)	u850 (12 h)	-	-

CWT	u10 (0 h)	u10 (12 h)	v10 (0 h)	T (0 h)	BLH (12 h)	
1	75.94	77.01	1.678	4.693	-	-
2	72.73	62.37	1.892	5.473	-	-
	RH (0 h)	RH (12 h)	u850 (0 h)	u850 (12 h)	-	-
3	79.50	74.90	4.688	4.676	-	-
4	66.35	61.22	4.591	5.893	-	-
5	67.78	68.21	6.278	4.243	-	-
	RH (0 h)	RH (12 h)	u850 (0 h)	u850 (12 h)	v850 (0 h)	v850 (12 h)
6	72.42	66.08	-0.580	3.848	-10.778	-6.761
7	76.09	79.51	5.100	5.399	-1.397	-1.299
8	77.81	75.00	2.769	3.440	-2.669	-2.695
9	67.14	58.34	1.965	1.536	-10.573	-11.697
10	73.34	68.98	0.554	3.452	-5.410	-3.725
	RH (0 h)	RH (12 h)	-	-	-	-
11	73.95	74.36	-	-	-	-
12	64.07	56.99	-	-	-	-

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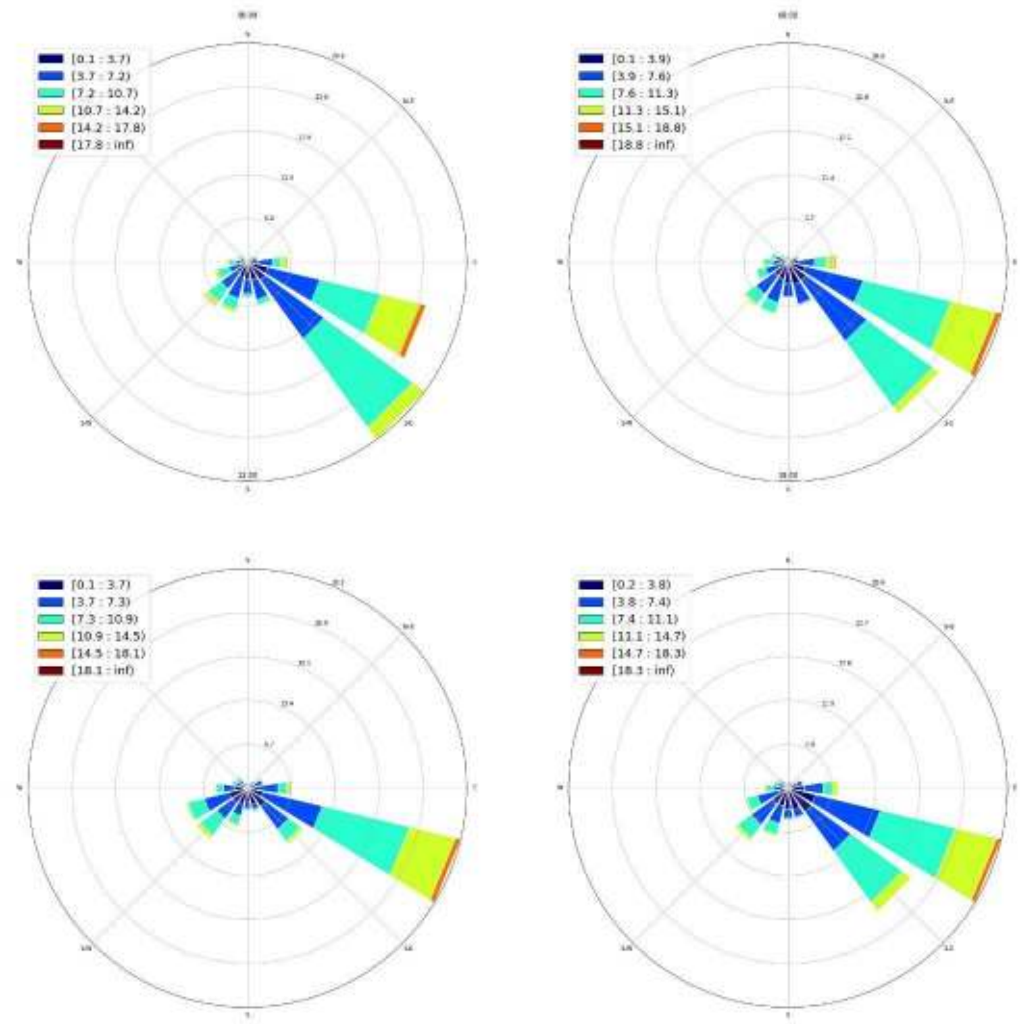

Prepared by: Demokritos on behalf of ASPROFOS, 2022.

Figure F1- 2 Wind rose diagrams in the area of Lasithi, centred at the location of LF2, at 10 m a.s.l. and 06:00, 12:00, 18:00 and 24:00 h, for a typical year.

Figure F1- 2 presents the calculated wind rose diagrams at the location of the LF2, at 10 meters height for a typical year, calculated using ERA5 data. The concentric circles correspond to the relative frequency of each wind direction and the colour gradation is related to the percentage (%) of the wind speed per direction. It can be concluded that the dominant direction at this location is the South-East (SE). The winds from the other directions have much lower frequency of occurrence.

9F.1.3.2.2 Weather conditions description

The description of the weather conditions prevailing during each characteristic weather type of Table F1-2(CWT) is provided below.

- CWT1
  A deep low barometric atmospheric system is moving eastwards, north of Crete, causing cloudiness and rain by night, at the Lasithi region during this autumn type. The winds are blowing from west directions, moderate to strong and the temperature reaches 21-23 degrees Celsius at noon (in the southern areas).
- CWT2
  Smooth barometric field of relatively high pressures is covering the area, with sunny weather and only local clouds over the Lasithi region during this autumn type. The winds blow north-westerlies, strong to near gale and the temperature reaches 22-24 degrees Celsius at noon.
- CWT3
  Smooth barometric field of relatively high pressures is covering the area of interest, with fine spring weather. The winds blow north-westerlies moderate to strong and the temperature up to 24 degrees Celsius at noon.
- CWT4
  A relatively low-pressure barometric field is affecting the weather of the area with fair conditions and few clouds over the area of Crete during this spring type. The winds are north-westerlies strong and the temperature reaches 18-20 degrees Celsius at noon.
- CWT5
  Smooth barometric field of relatively low pressures is covering the area with scattered clouds during this spring type. The winds blow from southwest directions with moderate speeds and the temperature rises to 20-22 Celsius degrees.
- CWT6
  A smooth barometric field is resulting to fine summer weather over the area of interest. The winds blow from northwest with strong intensity and the temperature is reaching 29-31 degrees Celsius over the southern coasts.
- CWT7
  Relatively low pressures between Crete and Cyprus are combined with high pressures over north-western Greece, resulting to fine weather conditions over Lasithi region, with light to

moderate north-westerly winds and temperature of 30-32 degrees Celsius, during this summer type.

- CWT8

  Relatively low pressures over the central Aegean Sea are resulting to temporary cloudiness over Lasithi region and short rains in the afternoon over mountainous areas. The winds blow from southwest directions strong, veering in the afternoon to northerlies strong, while the temperature reaches 25-27 degrees Celsius, during this summer type.
- CWT9

  Relatively low pressures between Crete and Cyprus are combined with high pressures over central Mediterranean Sea, resulting to fine weather conditions over Crete, with strong to near gale north-westerly winds and temperature of 28-30 degrees Celsius, during this summer type.
- CWT10

  Relatively low pressures over Cyprus are combined with high pressures over north-western Greece, resulting to fine weather conditions over the study area, with strong to near gale north-westerly winds and temperature of 32-34 degrees Celsius, during this summer type.
- CWT11

  An extensive low-pressure system over the Italian peninsula is moving slowly eastwards, resulting to gradual cloudiness over Crete, gradual intense of the south-easterly winds and maximum temperature of 13-15 degrees Celsius over the southern coastal areas, during this winter type.
- CWT12

  Relatively high pressures are covering the Greek area, resulting to good weather over the study area. The winds blow from northwest with strong intensity, veering in the afternoon to westerlies weakening particularly in late hours, while the temperature rises to 16-18 degrees Celsius, during this winter type.

9F.1.3.2.3 Atmospheric model WRF

The prognostic meteorological model Weather Research Forecasting (WRF-ARW) version 3.6.1 (Skamarock et al., 2008)[3] was set-up and used for the calculation of the 3-dimensional meteorological fields. The WRF model calculated the 3-dimensional meteorological fields of the region of interest, in a domain of 40 × 40 km^2 (Figure F1- 1) and horizontal and temporal resolution of 1 × 1 km^2 and 1-

3 Skamarock, W. C., J. B. Klemp, J. Dudhia, D. O. Gill, D. M. Barker, M. G. Duda, X.-Y. Huang, W. Wang, and J. G. Powers, 2008: A description of the Advanced Research WRF version 3. NCAR Technical Note 475, http://www.mmm.ucar.edu/wrf/users/docs/arw_v3.pdf.

hour, respectively. The ERA-5 data for the determined characteristic weather days were used as initial and boundary conditions to the meteorological model (WRF). The model simulations were performed for the 12 characteristic weather days (CWT).

As an example of the WRF results, Figure F1- 3 and Figure F1- 4 display examples of the WRF calculated 3-dimensional temperature and wind fields for CWT1 (autumn), CWT4 (spring), CWT6 (summer) and CWT11 (winter) at 12:00 hr and 24:00 hr. The calculated meteorological fields were consequently used as input to the dispersion model.

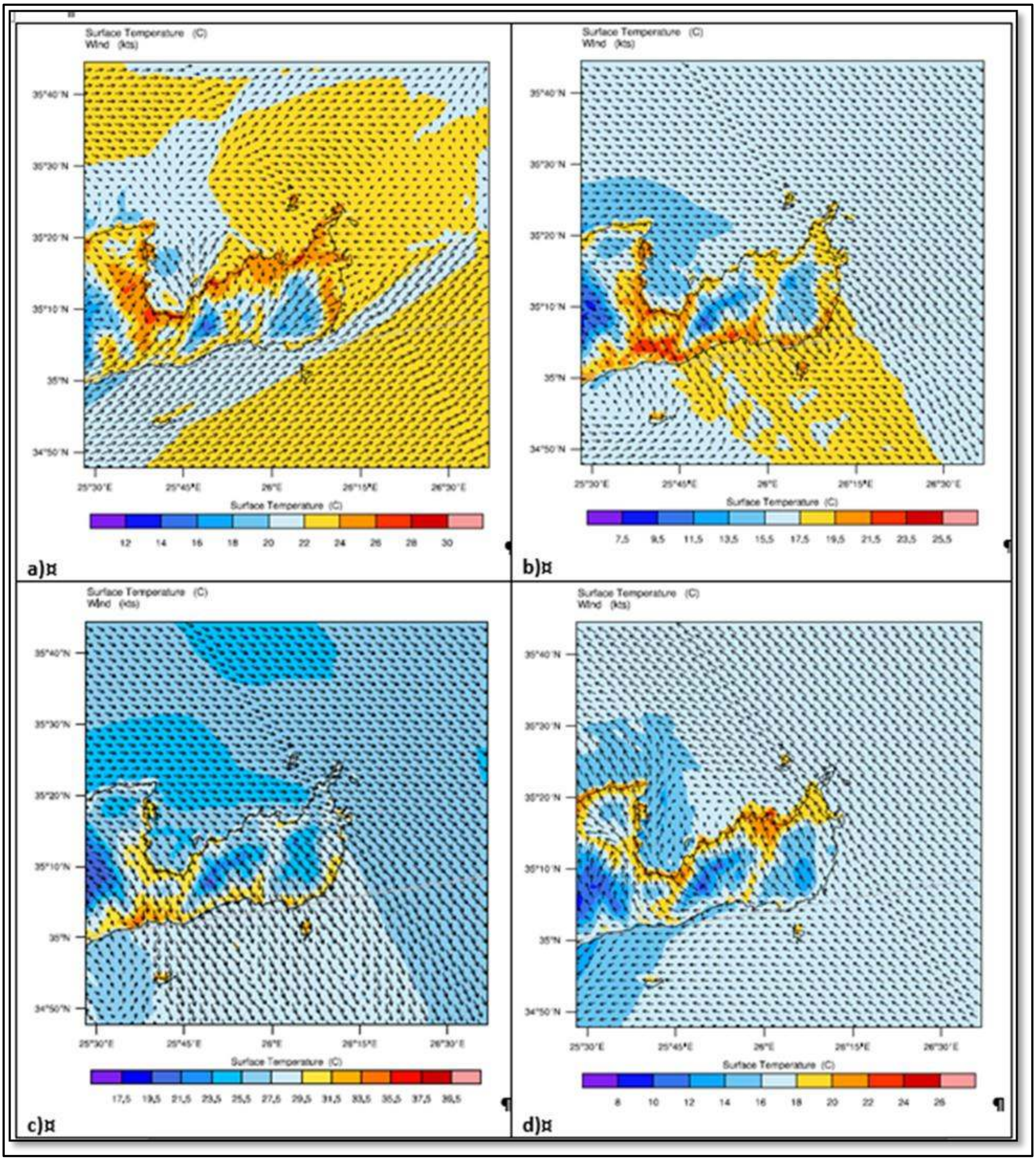

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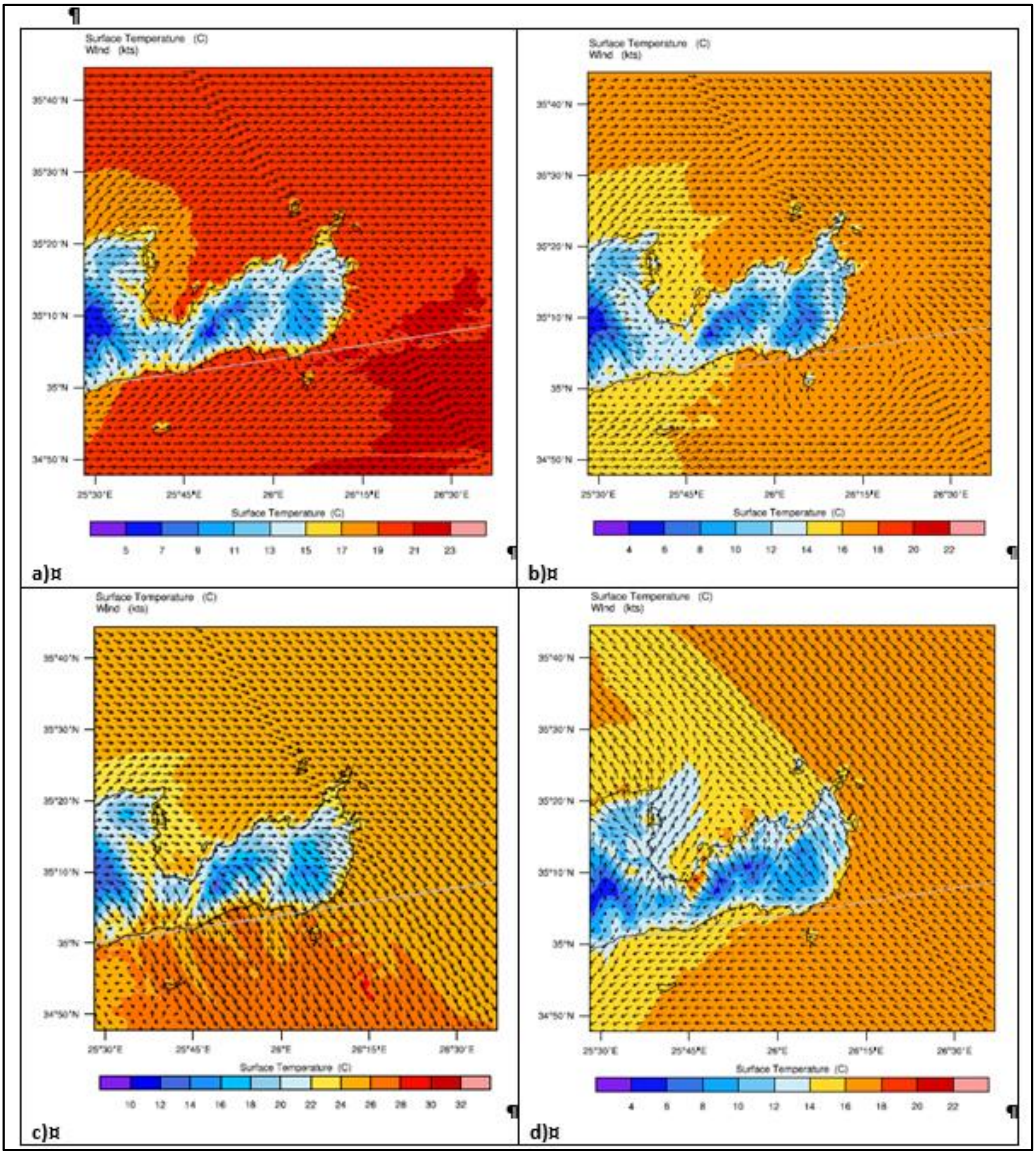
Figure F1- 3 WRF calculated near surface temperature and wind fields in the area of Lasithi (LF2), at 12:00hr for: a) CWT1(autumn), b) CWT4 (spring), c) CWT6 (summer) and d) CWT11 (winter).



Prepared by: Demokritos on behalf of ASPROFOS, 2022.

Figure F1- 4 WRF calculated near surface temperature and wind fields in the area of Lasithi (LF2), at 24:00hr for: a) CWT1(autumn), b) CWT4 (spring), c) CWT6 (summer) and d) CWT11 (winter).

9F.1.3.3 SIMULATION OF THE DISPERSION OF THE POLLUTANTS

This chapter presents the preparation of the input data for the atmospheric dispersion model HYSPLIT (Hybrid Single Particle Lagrangian Integrated Trajectory Model) used in the study.

9F.1.3.3.1 The Dispersion Model

The HYSPLIT model is the newest version of a complete system for computing simple air parcel trajectories to complex dispersion and deposition simulations. As a result of a joint effort between NOAA and Australia's Bureau of Meteorology, the model has been used for several applications (https://ready.arl.noaa.gov/HYSPLIT.php). The Air Resources Laboratory's HYbrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) model is a complete system for computing both simple air parcel trajectories and complex dispersion and deposition simulations. The model calculation method is a hybrid between the Lagrangian approach, which uses a moving frame of reference as the air parcels move from their initial location, and the Eulerian approach, which uses a fixed three-dimensional grid as a frame of reference. In the model, advection and diffusion calculations are made in a Lagrangian framework following the transport of the air parcel, while pollutant concentrations are calculated on a fixed grid. The model is designed to support a wide range of simulations related to the atmospheric transport and dispersion of pollutants and hazardous materials, as well as the deposition of these materials onto the Earth's surface.

9F.1.3.3.1.1 Data of the pollutant emissions from pre-commissionig test at location LF2

In order to test the integrity of the pipelines, a pre-commissioning test is performed after the pipelines installation. Specifically in Landfall 2(LF2) a pre-commissioning test will be performed for the OSS2, OSS2N, OSS3 and OSS3N pipelines. The tests will be performed serially for the 4 pipelines and the emission data are the same for the 4 pipelines. Pre-commissioning for OSS2 and OSS2N pipelines is expected to last for 15 days each, while for OSSS3 and OSS3N pipelines 8 days each. The equipment to be used for the pre-commissioning test and the emitted pollutants NOx, CO, PM10 are described in Table F1-4. The developed model uses the emissions of the aforementioned equipment.

Table F1-4 Technical data on emission sources from the equipment to be used in the pre-commissioning test and data for emitted pollutants NOx, CO, PM10.

Type of data	unit	Compressors @ 2,000 scfm	Boosters @ 3,000 scfm	MEG injection pumps	Air dryer	Power generators
Equipment Number	#	12	9	2	5	2
Engine Size	kW	500	500	200	300	500

Type of data	unit	Compressors @ 2,000 scfm	Boosters @ 3,000 scfm	MEG injection pumps	Air dryer	Power generators
Total power	MW	13.4				
Area	m2	0.049	0.049	0.049	0.049	0.049
Diameter [m]	m	0.25	0.25	0.25	0.25	0.25
Height [m]	m	3	3	3	3	3
Flue Gas Temp. [°C]	°C	550	550	550	550	550
Flue Gas Temp. [K]	K	823	823	823	823	823
Flue Gas Velocity [m/s]	m/s	40	40	40	40	40
NOX EF	g/kWh	4	4	4	4	4
CO EF	g/kWh	3.5	3.5	3.5	3.5	3.5
PM EF	g/kWh	0.2	0.2	0.2	0.2	0.2
NO_X Emission rate	g/s	0.56	0.56	0.22	0.33	0.56
CO Emission rate	g/s	0.49	0.49	0.19	0.29	0.49
PM10 Emission rate	g/s	0.03	0.03	0.01	0.02	0.03

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9F.1.4 ATMOSPHERIC DISPERSION CALCULATIONS

This section focuses on the analysis of the HYSPLIT model results of the concentration values of NO_x, COand PM10 from the equipment to be used in the pre-commissioning test.

Considering that pre-commissioning activities will last for a limited number of days, the study has considered short term concentrations. The concentrations of NO_x were calculated on an hourly basis to compare the modelled calculated results with the respective air quality limits as set by the legislation in force (MD 14122/549/E.103/2011 "Measures to improve air quality in compliance with the provisions of Directive 2008/50/EC "on the air quality and cleaner air for Europe" the European Parliament and Council of the European Union of 21 May 2008"). According to the current directive, the air quality limit for NO_2 for averaging period of 1 hour is set at 200 μg/m^3, not to be exceeded more than 18 times a calendar. The CO values were calculated as maximum daily 8 hour running mean concentrations for comparison with the respective air quality limit of 10 mg/m^3 (Directive 2008/50/EC). The air quality limit for PM10 for averaging period of 1 day is set at 50 μg/m^3, not to be exceeded more than 35 times a calendar.

The modelling approach was performed without the inclusion of the photochemical reactions which could reduce the concentrations of NO_x and CO in the atmosphere for the reason of obtaining the maximum possible values in the domain. Moreover, detailed data on the compounds from high resolution inventories would be needed for a photochemical model, which were not available. Special attention was given to the populated areas around the location of the LF2.

9F.1.4.1 Pollutant concentrations from pre-commissioning test

The atmospheric dispersion calculations for the pre-commissioning test were performed for 2 characteristic weather types CWT3 and CWT12 that had resulted in the maximum concentration values of NOx and CO in the domain during the simulations of emissions from the Gas Compressor Stations (CS2 & CS2N).

To simulate worst-case scenarios in the case pre-commissioning test, the meteorology calculations were based on synthetic data. The procedure assumed that the 24-hour CWT prolonged for 15 consecutive days i.e. for the total duration of the hydraulic experiments.

The modelling results and analysis showed that concentration values for the three pollutants remained well below the air quality limits (2008/50/EC).

There are no residential areas affected by the 2 characteristic weather types in the domain.

Table F1-5 shows the maximum hourly concentrations of NO_x as well as the maximum 8-hour running mean value of CO and the maximum daily (mean) PM10 concentrations calculated in the domain for direct comparison with the legislative limits. It can be deduced that these maximum pollutant values are very low compared to the air quality limits (2008/50/EC).

Table F1-5 Maximum calculated average concentration values of NOx, CO, and PM10 of 15 days of CTW3 and CTW12 in the domain and air quality limits (2008/50/EC).

LF2			
Characteristic Weather types (CWT)	Maximum hourly (mean) NOX concentration (μg/m3)	Maximum 8-h mean CO concentration (μg/m3)	Maximum daily (mean) PM10 concentration (μg/m3)
	(Limit 200 μg/m3)	(Limit 10000 μg/m3)	(Limit 50 μg/m3)

LF2			
Characteristic Weather types (CWT)	Maximum hourly (mean) NOX concentration (μg/m3)	Maximum 8-h mean CO concentration (μg/m3)	Maximum daily (mean) PM10 concentration (μg/m3)
3	43.7	36.5	0.44
12	48.4	47.5	0.34

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From Table F1-5 **it can be deduced, that no exceedances of the NO_x, CO and PM10 respective air quality limits occur over the populated areas within an approximate distance of 20 km from LF2.** In fact, the maximum concentrations and hourly NO_x, maximum 8-h mean CO and Maximum daily (mean) PM10 concentrations are found to be very low compared to the legislative limits (2008/50/EC).

Generally, it can be concluded that the modelled NO_x , CO and PM10 concentrations from the pre-commissioning test, in the location of LF2, emitted from 12 Compressors with capacity 500 KW each, 9 Boosters with capacity 500 KW each, 2 Meg pumps with capacity 200 KW each, 5 air dryers with capacity 300 KW each, 2 Power Genarators with capacity 500 KW each, are very low and insignificant compared to the air quality limits of the legislation in force.

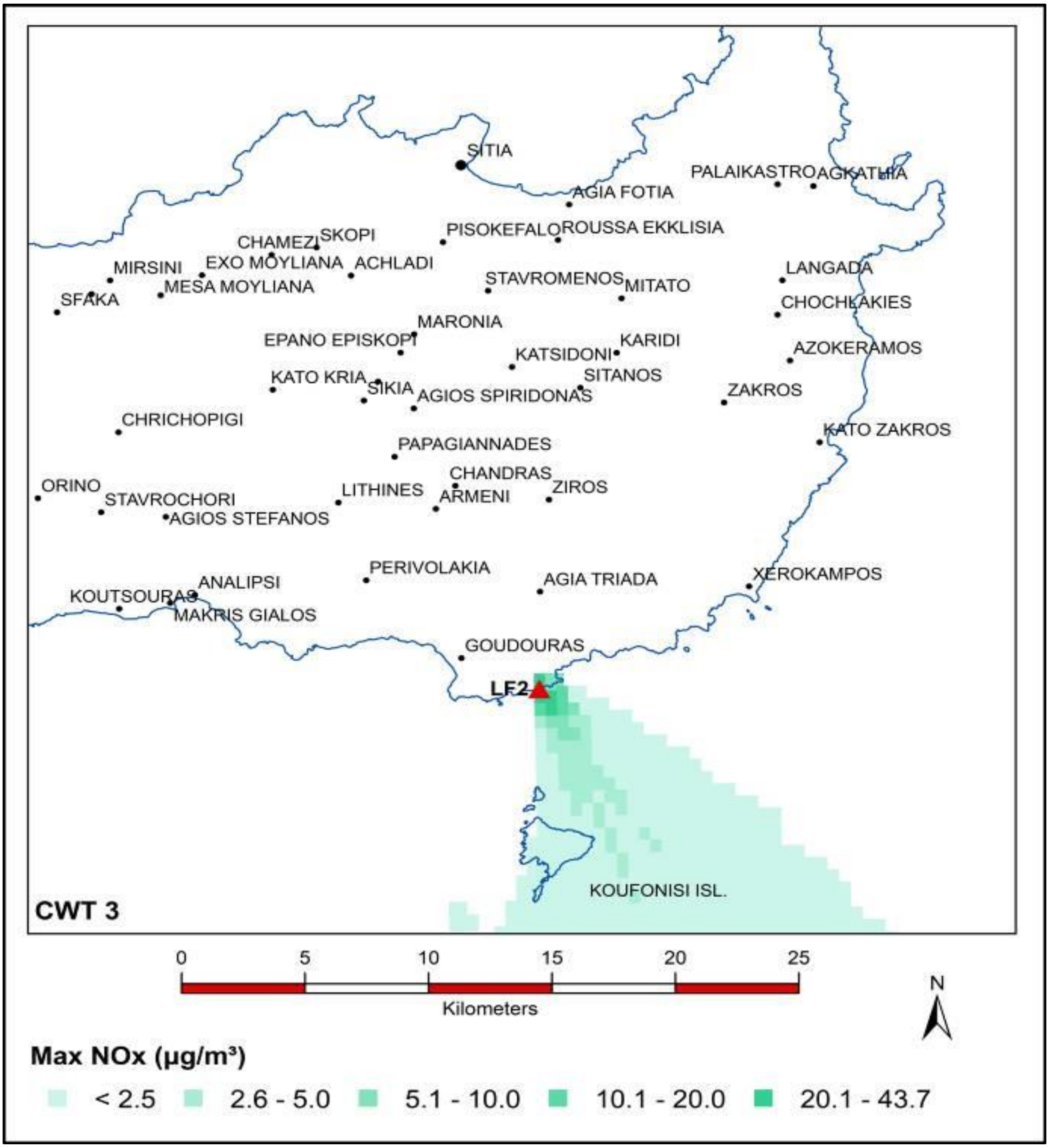

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Figure F1- 5 Modelled near surface maximum hourly average concentrations of NOx, resulted from 15-days simulation of CWT3. Air quality limit for hourly NO2: 200 (µg/m3).

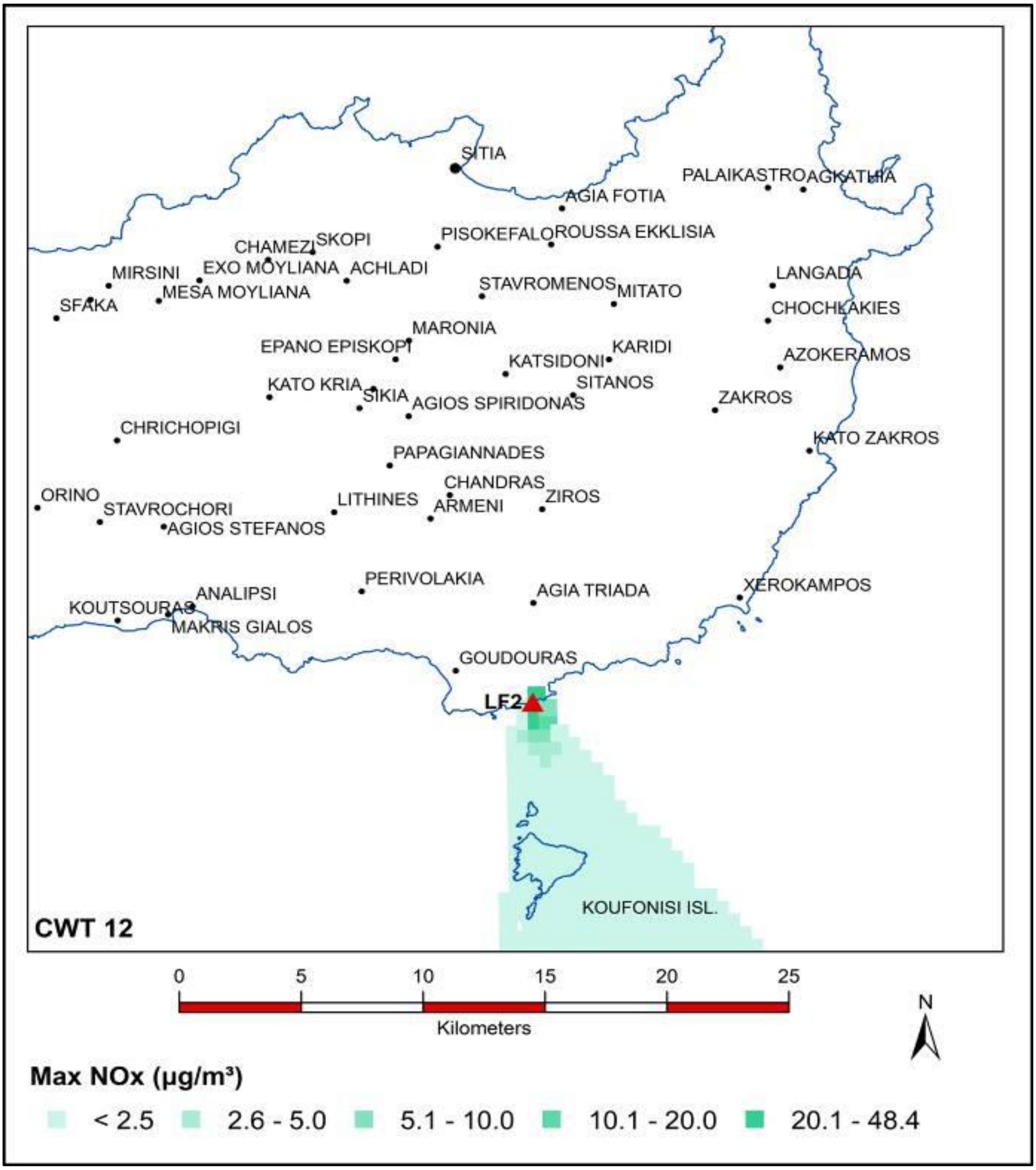

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Figure F1- 6 Modelled near surface maximum hourly average concentrations of NOx, resulted from 15-days simulation of CWT12. Air quality limit for hourly NO2: 200 (μg/m3).

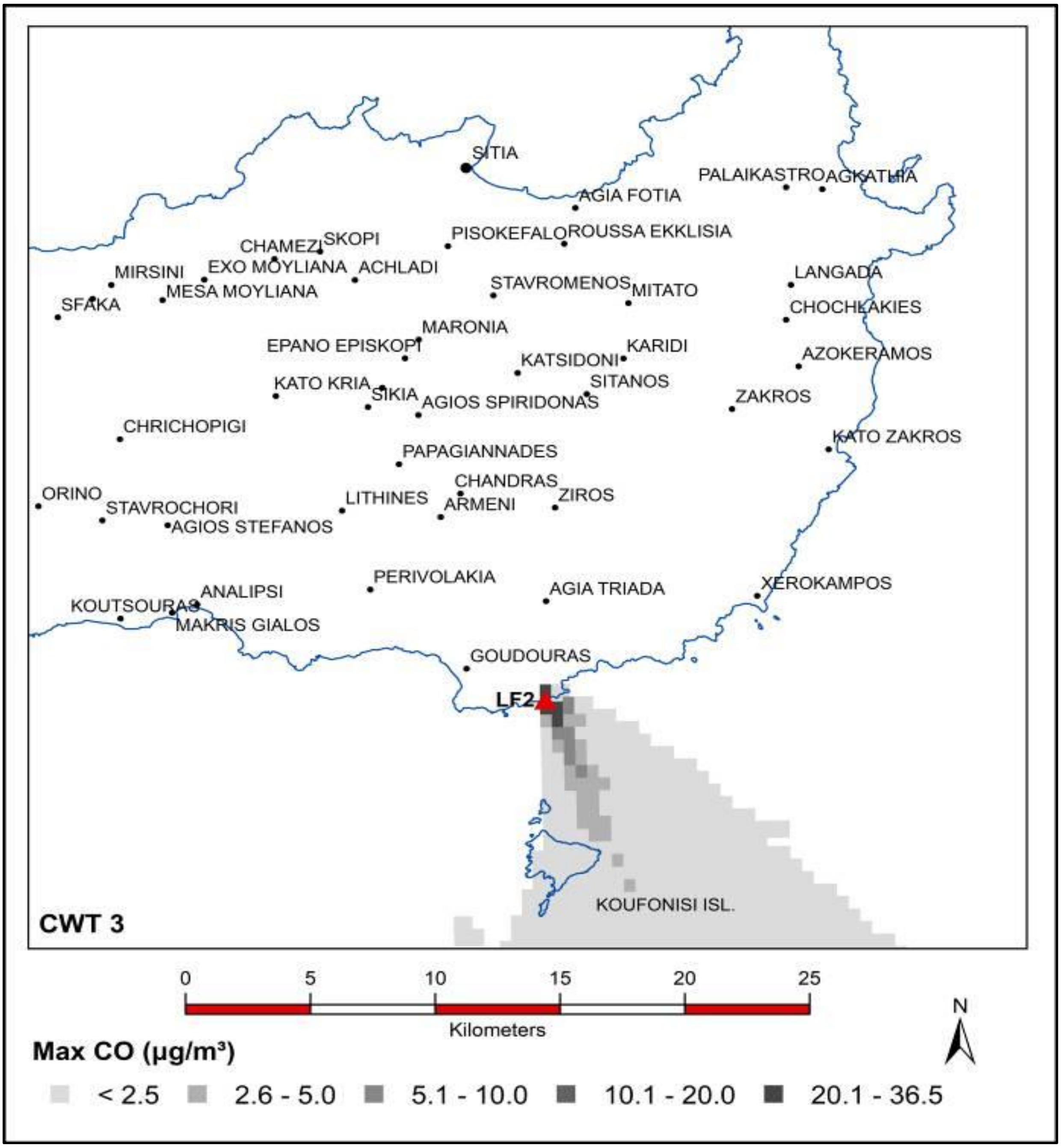

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Figure F1- 7 Modelled near surface calculated 8-hour running mean concentration values of CO (μg/m3), resulted from 15-days simulation of CWT3. Air quality limit for 8-hour CO: 10000 (μg/m3).

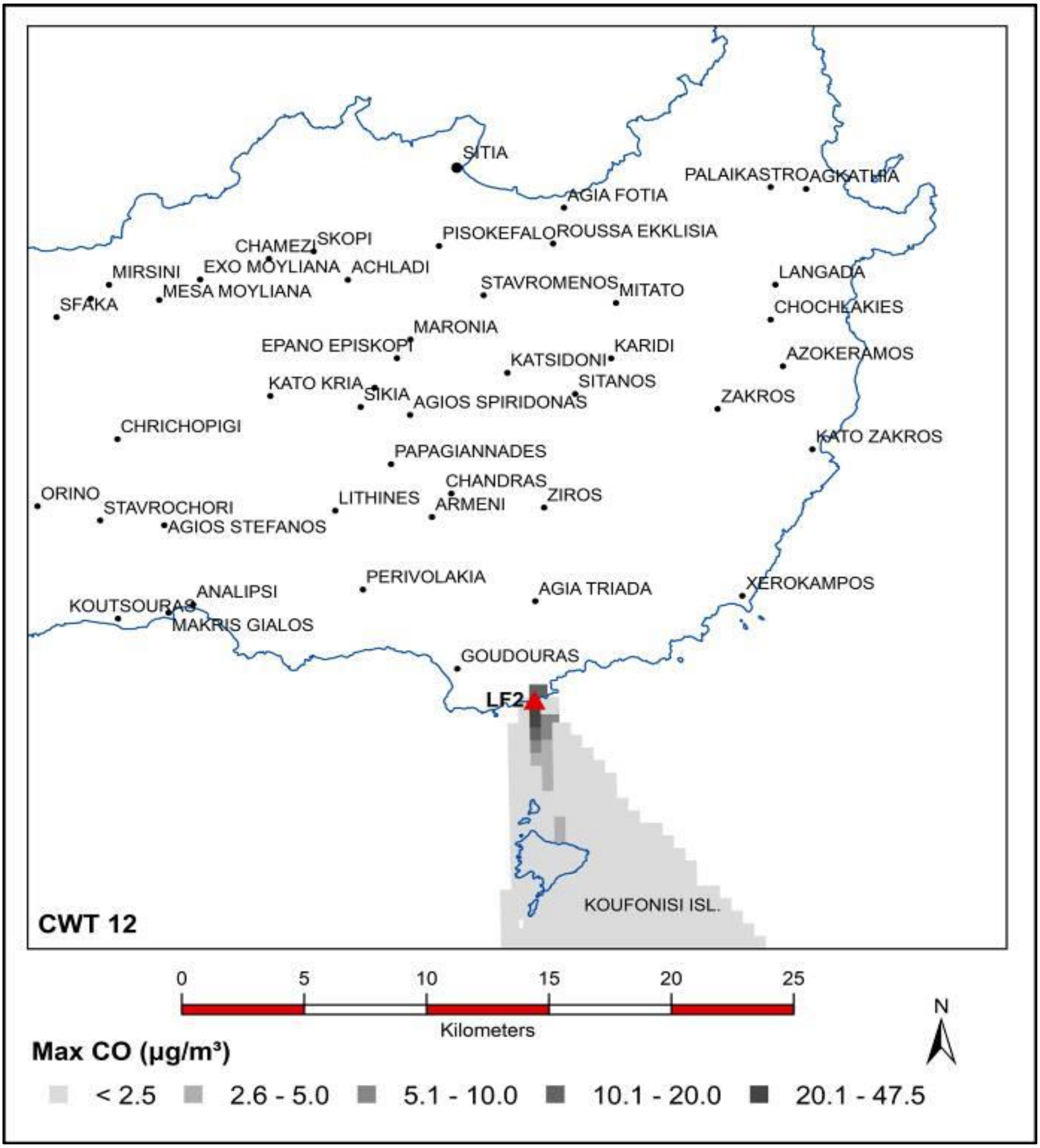

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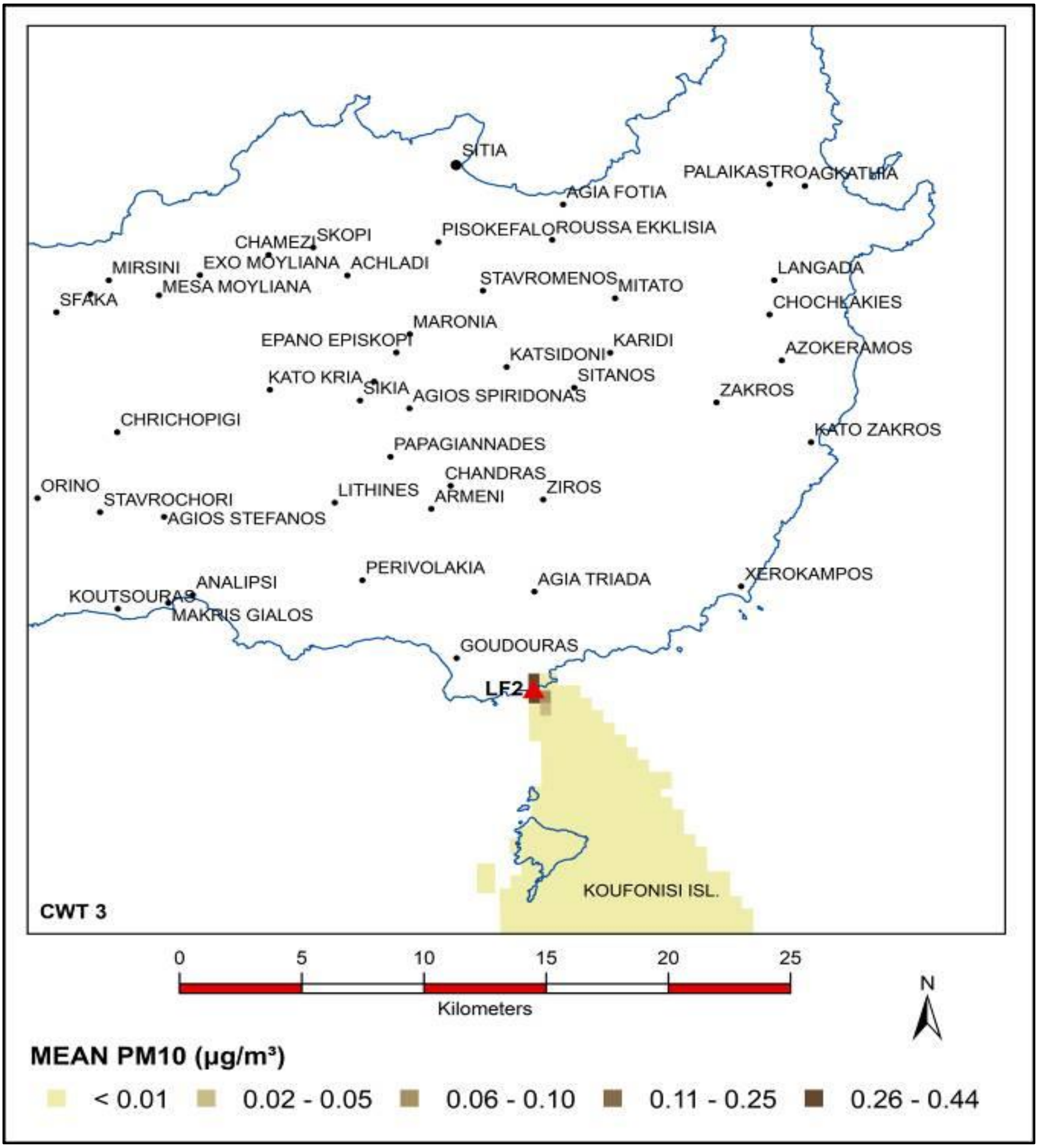
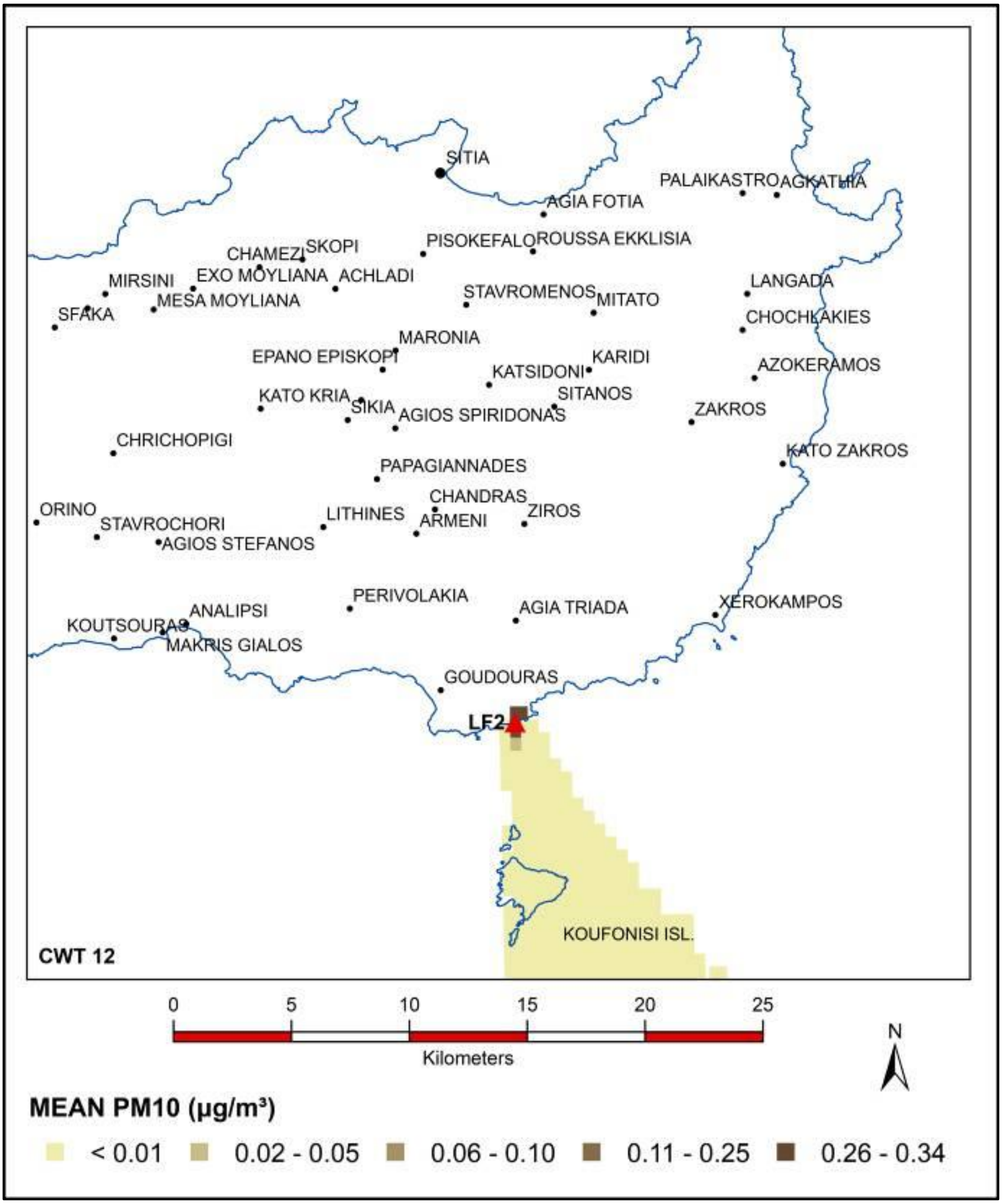
Figure F1- 8 Modelled near surface calculated 8-hour running mean concentration values of CO (μg/m3), resulted from 15-days simulation of CWT12. Air quality limit for 8-hour CO: 10000 (μg/m3).



Prepared by: Demokritos on behalf of ASPROFOS, 2022.

Figure F1- 9 Modelled near surface, maximum daily average concentrations of PM10, resulted from 15-days simulation of CWT3. Air quality limit for daily average PM10: 50 (μg/m3).



Prepared by: Demokritos on behalf of ASPROFOS, 2022.

Figure F1- 10 Modelled near surface, maximum daily average concentrations of PM10, resulted from 15-days simulation of CWT12.Air quality limit for daily average PM10: 50(μg/m3).

9F.1.5 SUMMARY – CONCLUSIONS

The aim of the current study was to investigate the dispersion of NO_x , CO and PM10 emissions from the pre-commissioning activities of the EastMed Pipeline Project, at landfall location LF2, at southeast location of Lasithi (eastern Crete). The study was performed with the 3-dimensional computer modelling tools and appropriate methodology used and developed by the Environmental Research Laboratory (EREL) of the NCSR "Demokritos. The dimensions of the modelling domain were large enough to include sufficiently the residential areas within a reasonable distance from the LF2 location. Thus, the domain size for the modelling calculations was set to 40 × 40 km^2. For the modelling needs, the initial meteorological data were retrieved from the European Centre for Medium-Range Weather Forecasts (ECMWF) ERA-5 climate *high-resolution reanalysis* of 3-hours, covering in total eleven (11) years. The atmospheric dispersion calculations for the pre-commissioning test were performed for 2 characteristic weather types CWT3 and CWT12 that had resulted in the maximum concentration values of NOx and CO in the domain during the simulations of emissions from the Gas Compressor Stations (CS2 & CS2N).

For the air dispersion calculations, the atmospheric dispersion model HYSPLIT (Hybrid Single Particle Lagrangian Integrated Trajectory Model) was employed. The simulations were carried out with a 1-hour resolution. The modelling was based on the technical information available at the stage of the study by ASPROFOS SA. The ambient concentrations of NO_x , CO and PM10 were not considered in the modelling study as the field measurements in the area surrounding the industrial field were found to be significant low and negligible for a meaningful assessment.

The near-surface hourly average NO_x concentrations as well as the 8-hour running mean CO values and maximum daily (mean) PM10 concentrations were calculated in order to be comparable to the respective air quality limits as set by the legislation in force (MD 14122/549/E.103/2011 "Measures to improve air quality in compliance with the provisions of Directive 2008/50/EC "on the air quality and cleaner air for Europe" the European Parliament and Council of the European Union of 21 May 2008").

Overall, the hourly mean NO_x concentrations were calculated to be lower than the air quality limits everywhere in the domain and during the worst CWTs (CWT3 and CWT12). Similarly, the CO and PM10 concentrations were calculated to be negligible compared to the air quality legislative limit. It must also be emphasised that no exceedances of the NO_2 ,CO and PM10 respective air quality limits were found over the populated settlements within a distance of approximately 25 km due to the emissions from the LF2. Conclusively, the modelling study yielded the following results:

- The maximum mean hourly NO_x concentration was found to be equal to ~24% of the air quality limit 200 μg/m^3 (during CWT12).
- The maximum 8-hour running mean CO concentration was found to be equal to ~0.47% of the air quality limit of 10000 μg/m^3 (during CWT12).
- The maximum daily average concentrations of PM10, was found to be equal to 0.88% of the air quality limit of 50 μg/m^3 (during CWT3).