

# OUTPUT SPECIFICATION FOR MEAN CONCENTRATION AND DEPOSITION FLUXES

CERC<sup>1</sup>

## 1. **Introduction**

The Output Specification describes the user-specified output points and the calculation grid used in short term average (real event mode) and long term average (average of short term means) calculations. Output points may be specified in Cartesian co-ordinates defined with respect to fixed north-east co-ordinates, or cylindrical polar co-ordinates.

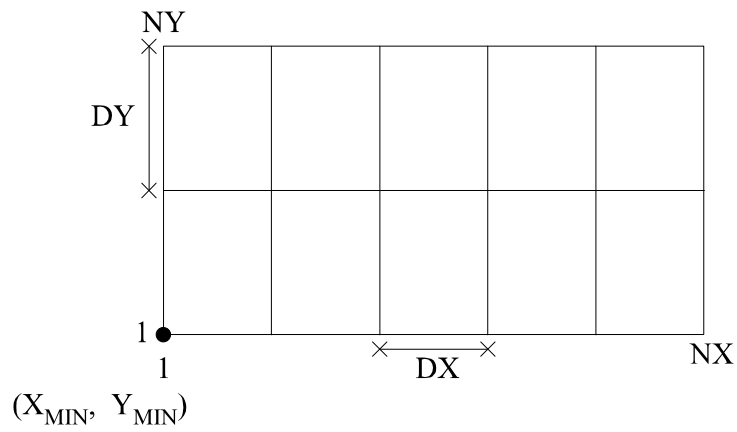
## 2. **Output Points**

### 2.1 **Gridded**

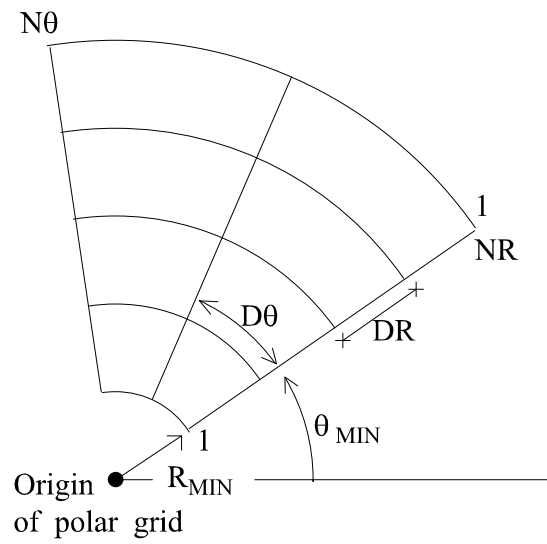
The user may define a grid which has regularly or variably spaced values of X and Y for a Cartesian grid, or R and  $\theta$  for a cylindrical polar grid. The results are calculated at one user-defined height,  $z$ . (Specified point output can be used to investigate output at different heights, as described in Section 2.2.) Figures 1 to 4 illustrate the grid options.

When a polar grid is used the origin of the grid must be specified, as the source locations are entered in Cartesian co-ordinates which may be 6 figure National Grid co-ordinates or 7 figure UTM co-ordinates.  $\theta=0^\circ$  defines a line west-east aligned and  $\theta$  is then measured anticlockwise according to the usual mathematical description. Note however that whereas the output  $\theta$  is measured anticlockwise from the east, the wind direction is measured clockwise from the north and care must be taken in interpreting the results.

**Figure 1** Regular Cartesian Grid



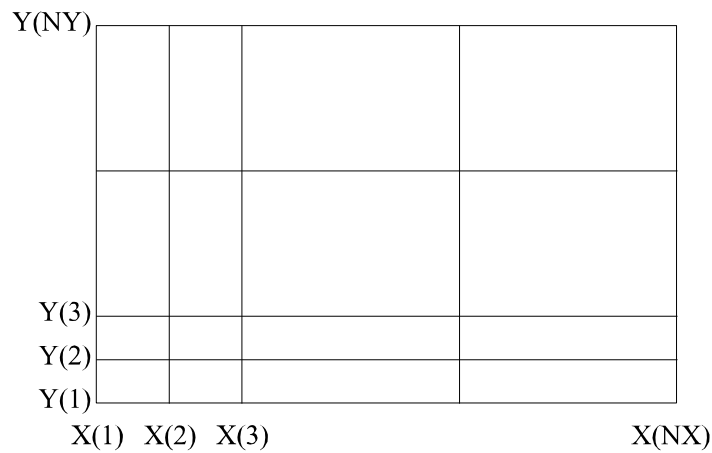
**Figure 2** Regular Polar Grid



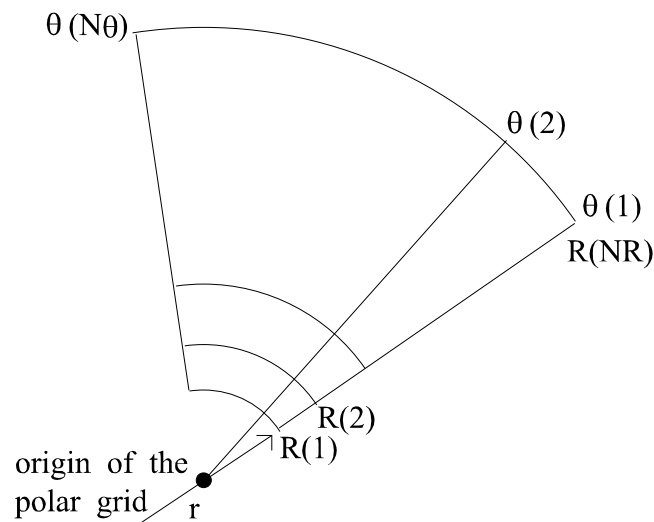
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**Figure 3** Variable Cartesian Grid



**Figure 4** Variable Polar Grid



## 2.2 Specified Points

Up to 100 points may be defined with respect to Cartesian co-ordinates ( $X$ ,  $Y$ ,  $Z$ ), or cylindrical polar co-ordinates ( $R$ ,  $\theta$ ,  $Z$ ). The points may be at different heights,  $z$ , and must be in the same co-ordinate system as the gridded output if both gridded and specified output points are being used. Each receptor may be given a name of up to 20 characters.

As well as entering up to 100 specified points in the interface, extra specified points may be defined using an 'additional specified points' file, which is a comma-separated text file with the extension *.asp* that contains a line of data for every extra specified point required. Each

line of data contains the point's name, X (or R) coordinate, Y (or  $\theta$ ) coordinate and Z coordinate, in that order. Each point must have a unique name. If required, the *.asp* file should be saved in the same directory, with the same name, as the *.apl* file. The number of regular grid points plus the number of points entered in the *.asp* file must not exceed 10201.

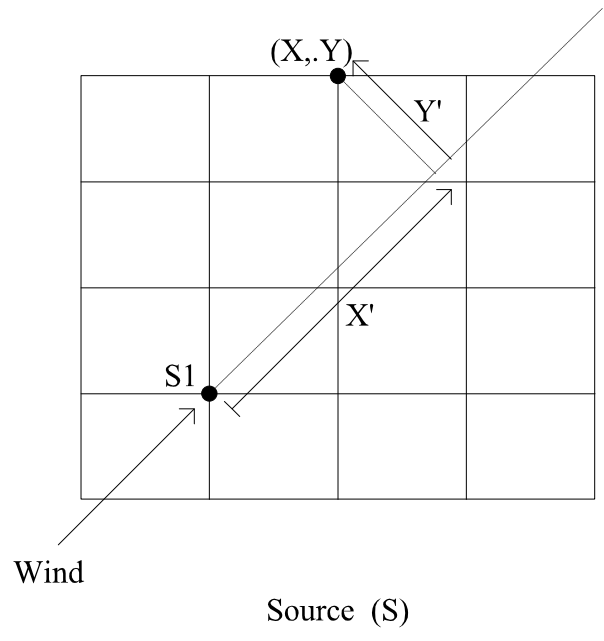
### 3. **Calculation Grids**

In order to calculate the concentration at each output point (X,Y), it is necessary to transform to a co-ordinate system centred on the source, with the x-axis aligned along the wind direction. An internal calculation grid is used to ensure that the results are independent of the resolution of the user-defined output domain. The internal calculation grid is given by

$$x(I) = x(I-1) 50,000^{1/249} \text{ for } I > 2, \text{ with } x(1) = 1 \text{ for convective conditions, and}$$
$$x(I) = x(I-1) 50,000^{1/199} \text{ for } I > 2, \text{ with } x(1) = 1 \text{ for stable and neutral conditions,}$$

where x is the downwind distance from the source in metres. Dispersion calculations can then proceed as described in P10/01&P12/01. As dispersion calculations only need to continue downstream until the downstream edge of the output domain is reached, the number of internal grid points at which calculations are carried out depends on the extent of the output domain.

Concentrations at the user-defined output points are calculated by transforming the output points to the wind-aligned co-ordinate system, so the new co-ordinates are (X', Y'), where X' is the downwind distance of the output point from the source, and Y' is the crosswind distance (Figure 5). The dispersion parameters from which the concentrations are calculated are obtained by interpolating from the internal calculation grid points.



**Figure 5** Original and wind-aligned co-ordinates of output point

## APPENDIX Maximum and Minimum Values of Output Parameters

### 1. Gridded Output

#### (i) Regular Cartesian Grid

XMIN, YMIN	min: -9,999,999m	max: 9,999,999m
NX, NY	min: 1	max: 101
ZMIN	min: 0.0m	max: 3,000m

#### (ii) Regular Polar Grid

RMIN	min: 0.0m	max: 9,999,999m
NR	min: 1	max: 101
$\theta$ MIN	min: 0.0°	max: 360°
N $\theta$	min: 1	max: 101
ZMIN	min: 0.0m	max: 3,000m

#### (iii) Variable Cartesian Grid

X(I), I=1, NX	min: -9,999,999m	max: 9,999,999m
Y(J), J=1, NY	min: -9,999,999	max: 9,999,999m
NX, NY	min: 1	max: 101
Z(K), K=1, NZ	min: 0.0m	max: 3,000m
NZ	min: 1	max: 1

#### (iv) Variable Polar Grid

R(I), I=1, NR	min: 0.0m	max: 9,999,999m
NR	min: 1	max: 101
$\theta$ (J), J=1, N $\theta$	min: 0.0°	max: 360°
N $\theta$	min: 1	max: 101
Z(K), K=1, NZ	min: 0.0m	max: 3,000m
NZ	min: 1	max: 1

### 2. Specified Point Output

#### (i) Cartesian co-ordinates

X, Y	min: -9,999,999m	max: 9,999,999m
Z	min: 0.0m	max: 3,000m

(ii) Polar co-ordinates

R	min: 1.0m	max: 9,999,999m
$\theta$	min: 0.0°	max: 360°
Z	min: 0.0m	max: 3,000m

3. Polar Grid Origin

X, Y	min: -9,999,999m	max: 9,999,999m
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