# User Guide

## Irish Pest Emergence Maps

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Department of Agriculture, Food and the Marine

Met Office

# Contents

# Introduction

The Irish Pest Emergence Maps (IPEM) webtool was designed for users to generate risk prediction maps of potential pests that may arrive on the island of Ireland using past climate data from 1991:present, the most recent thirty-year climate normal (1991:2020) and future climate scenarios. Users may view the predicted emergence date and the number of generations predicted to emerge for 12 developmental starting dates within a year.

Climate data for these maps is from Met Éireann's 1km gridded climate data, the future climate scenarios are provided by the TRANSLATE project. Further details may be found via https://www.met.ie/science/translate & https://www.met.ie/daily-rainfall-and-temperature-grids

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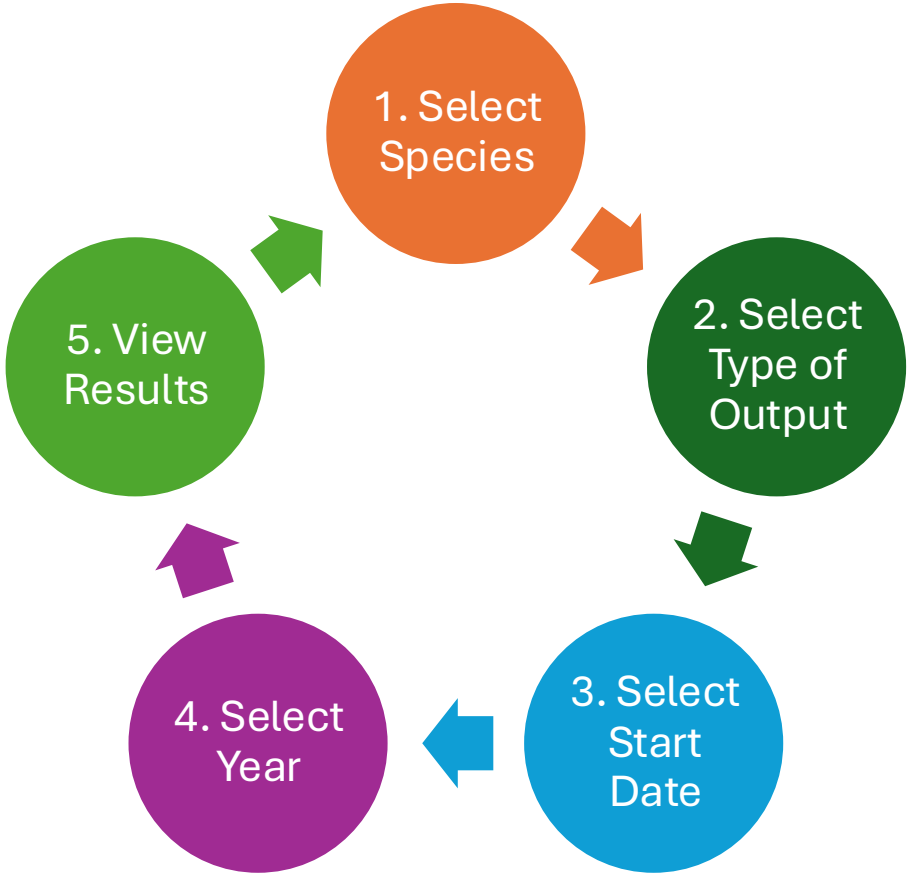
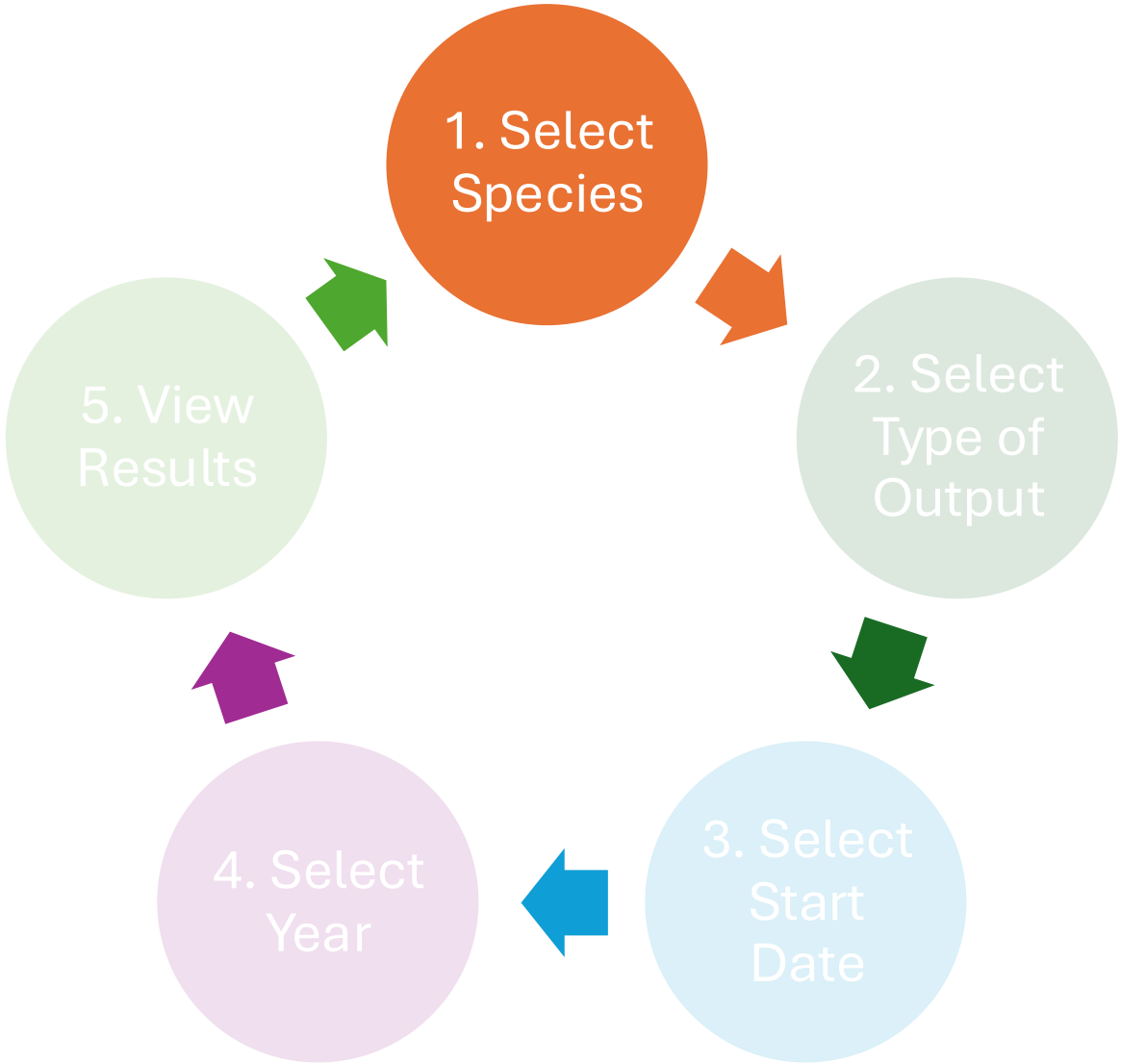
# Example of a typical workflow

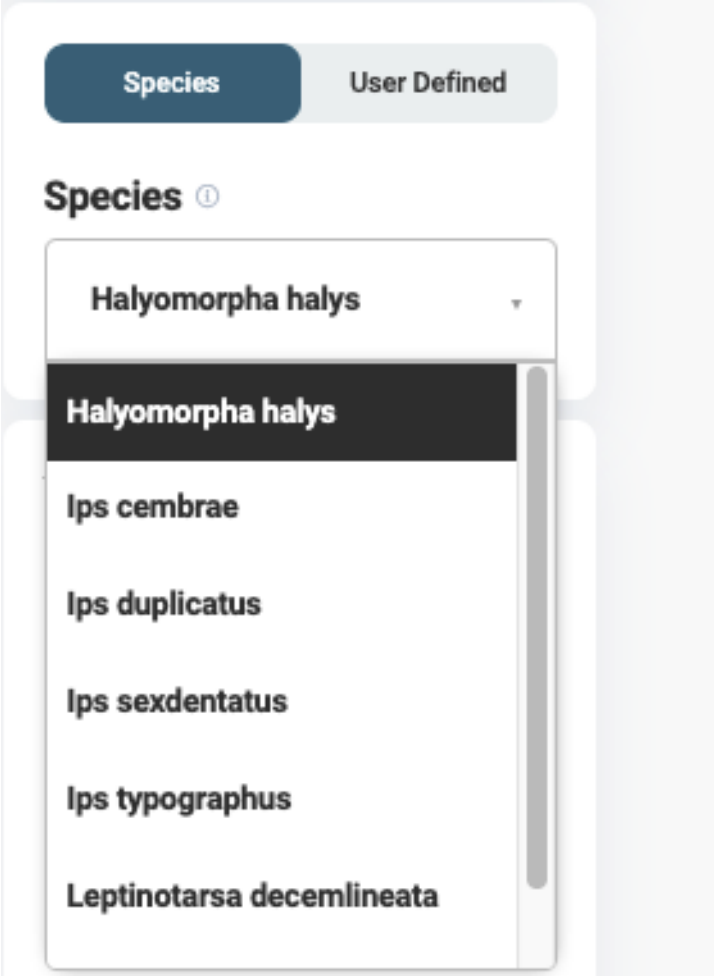


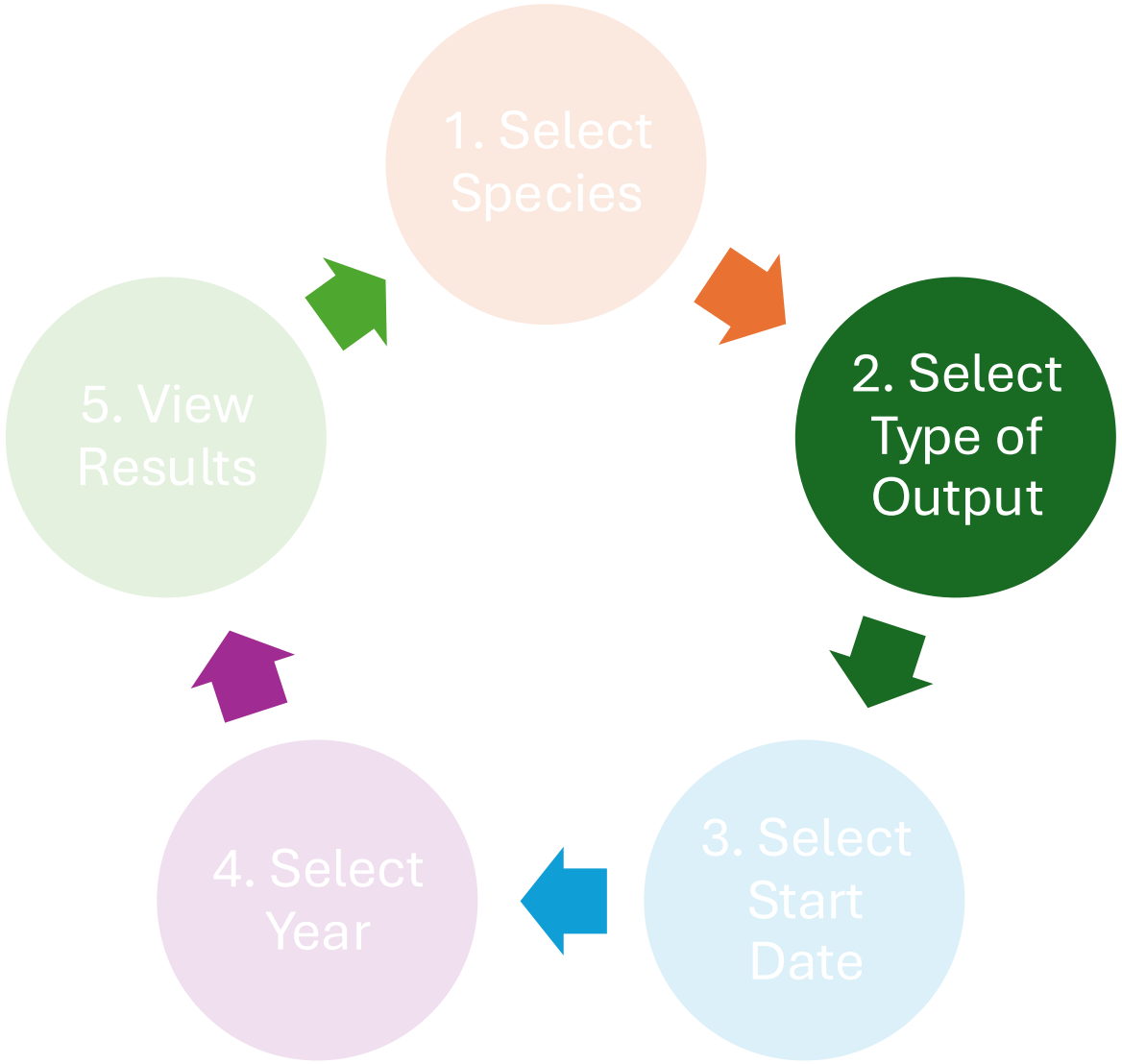



# 1. Select Species

Select species from the dropdown menu on the left hand side

The species are ordered alphabetically

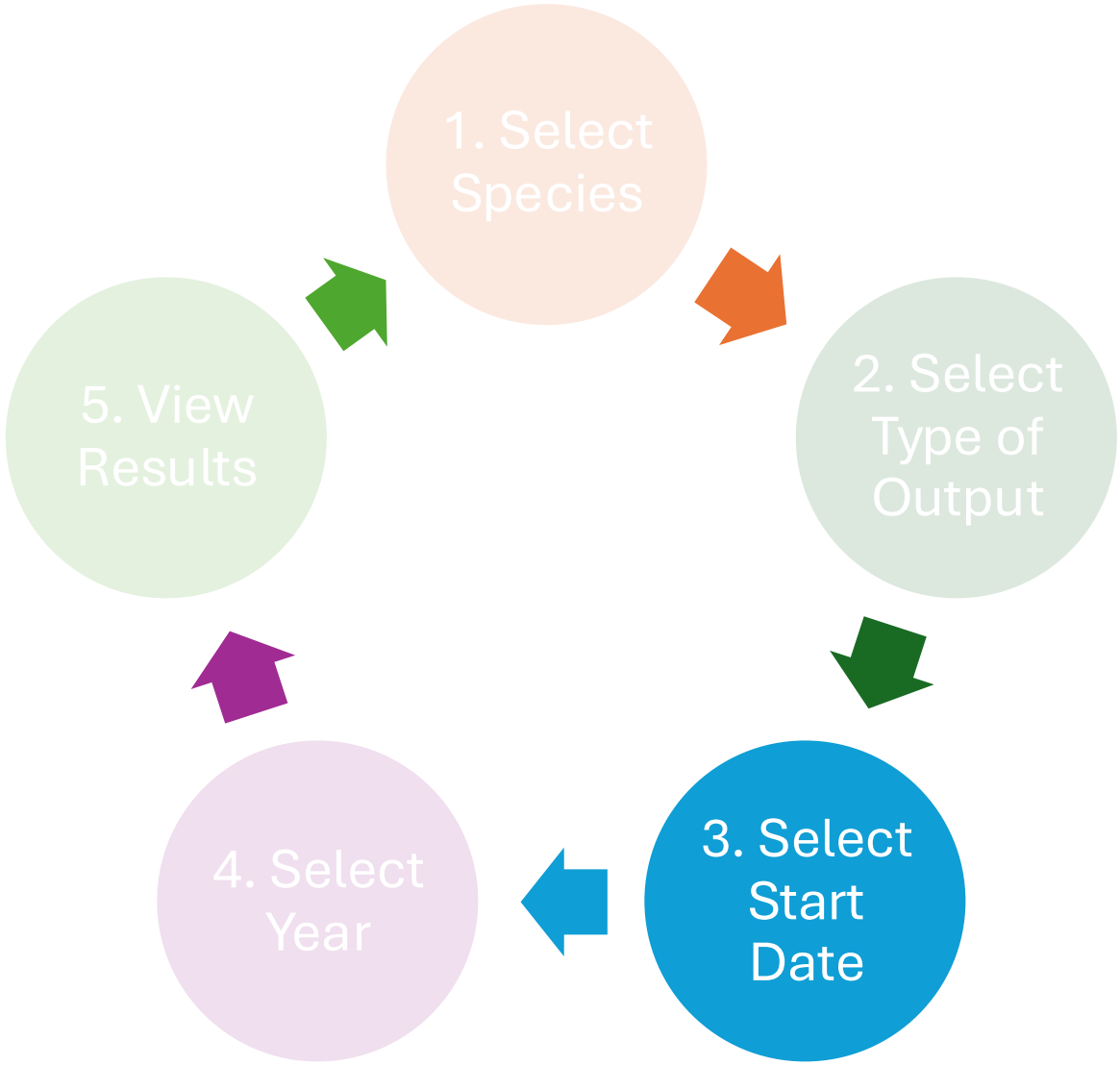





# 2. Select Type of Output

There are three choices of output:

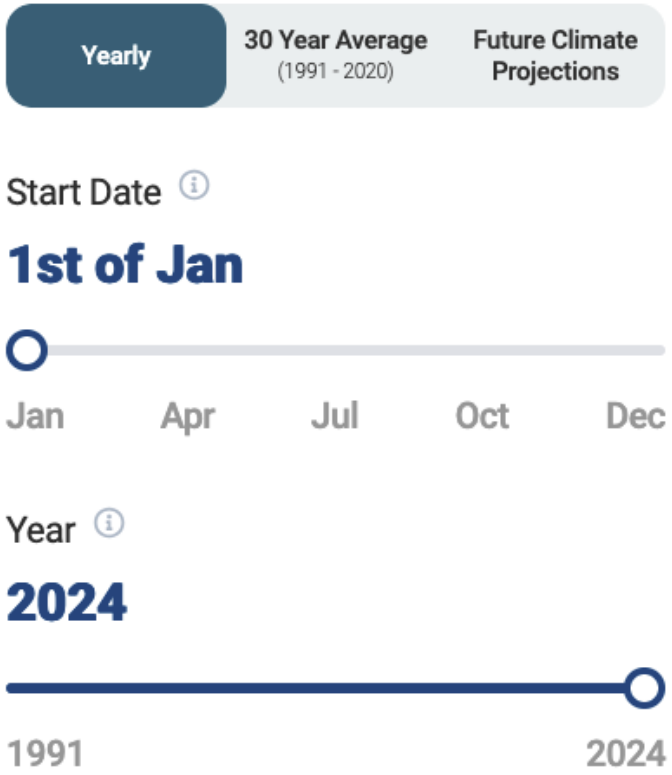
- Yearly
- 30 Year Average
- Future Climate Projections

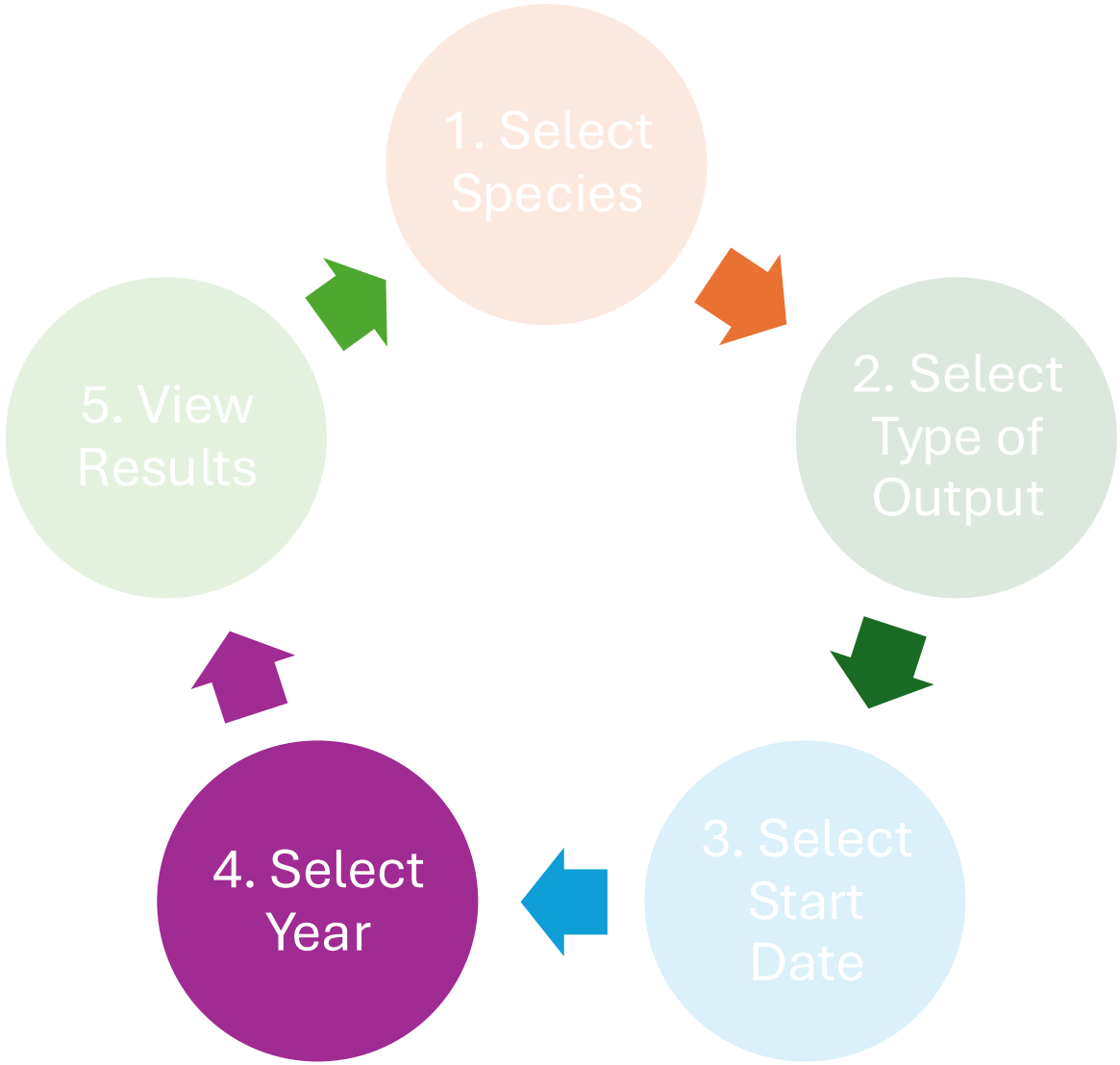



# 3. Select Start Date

Select start date from the slider
The 1st of January is the default

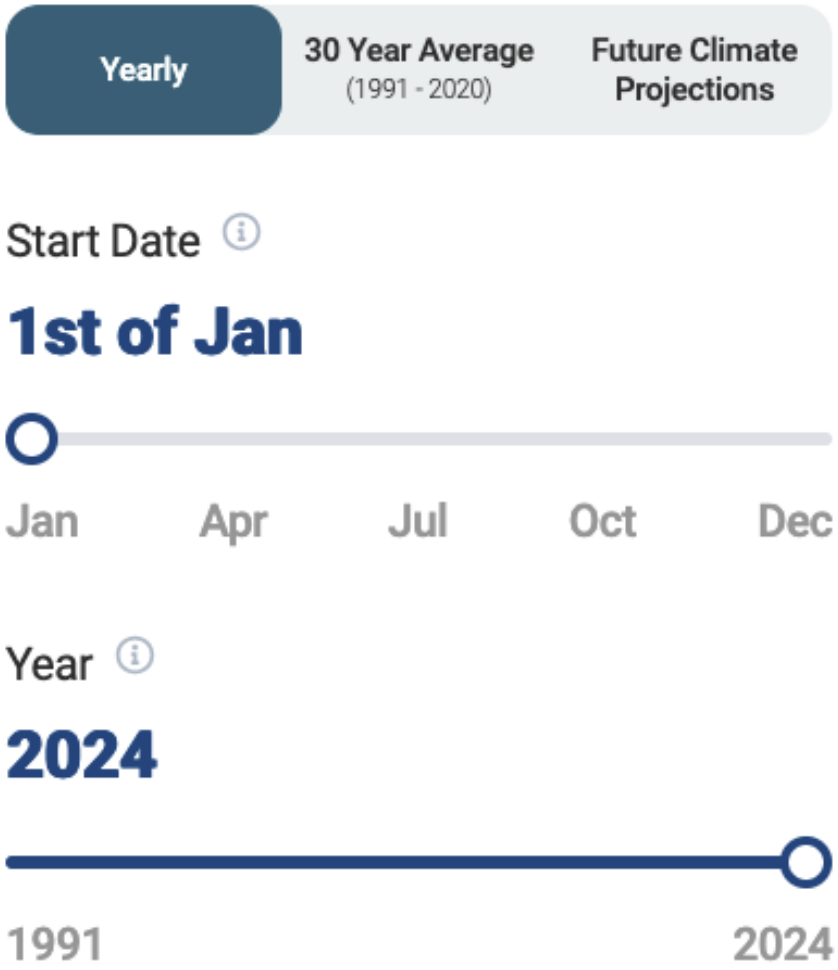
This can be used to evaluate if a species can develop within the current year

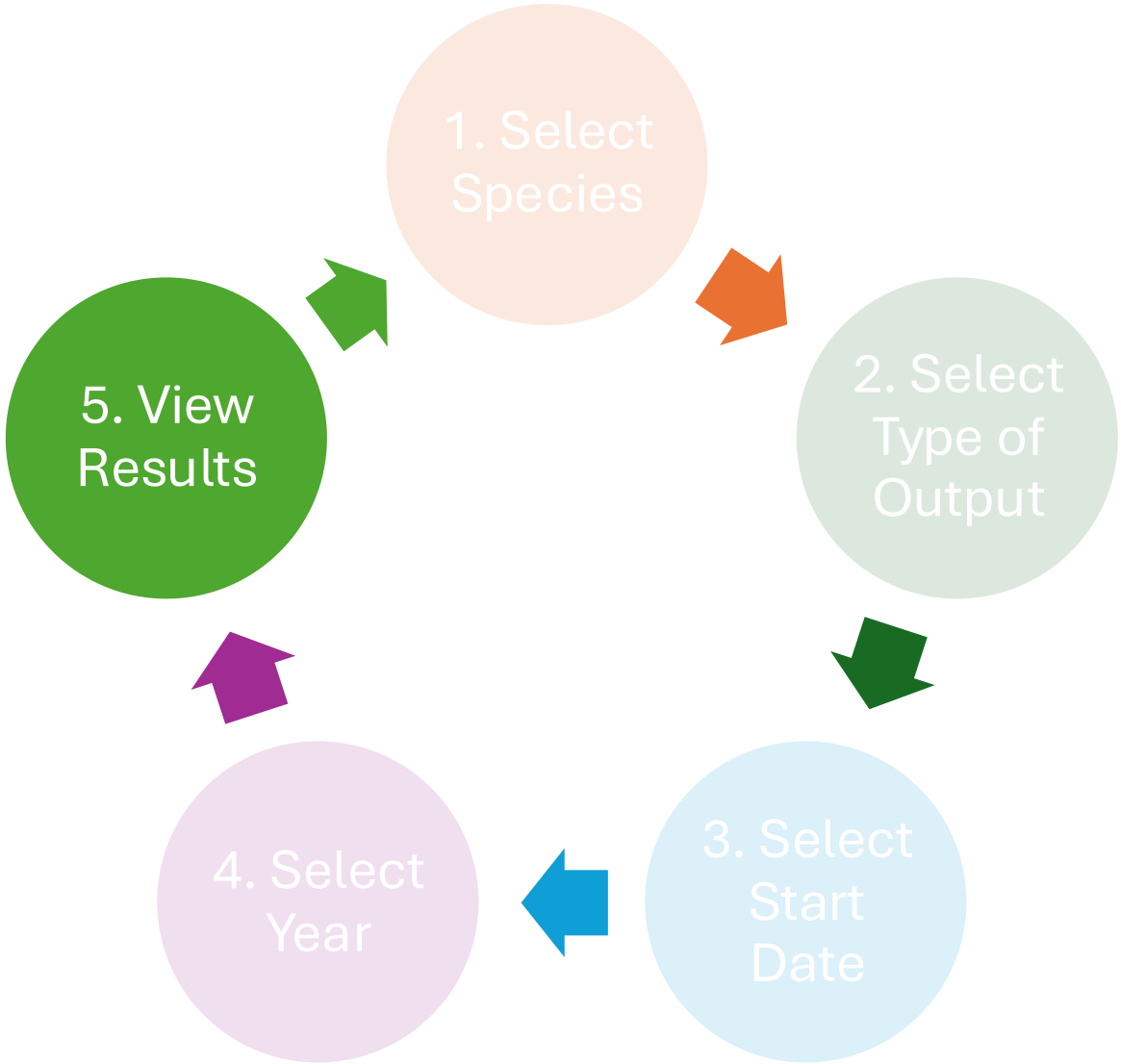





# 4. Select Year

Select year from the slider
The most recent year is the default



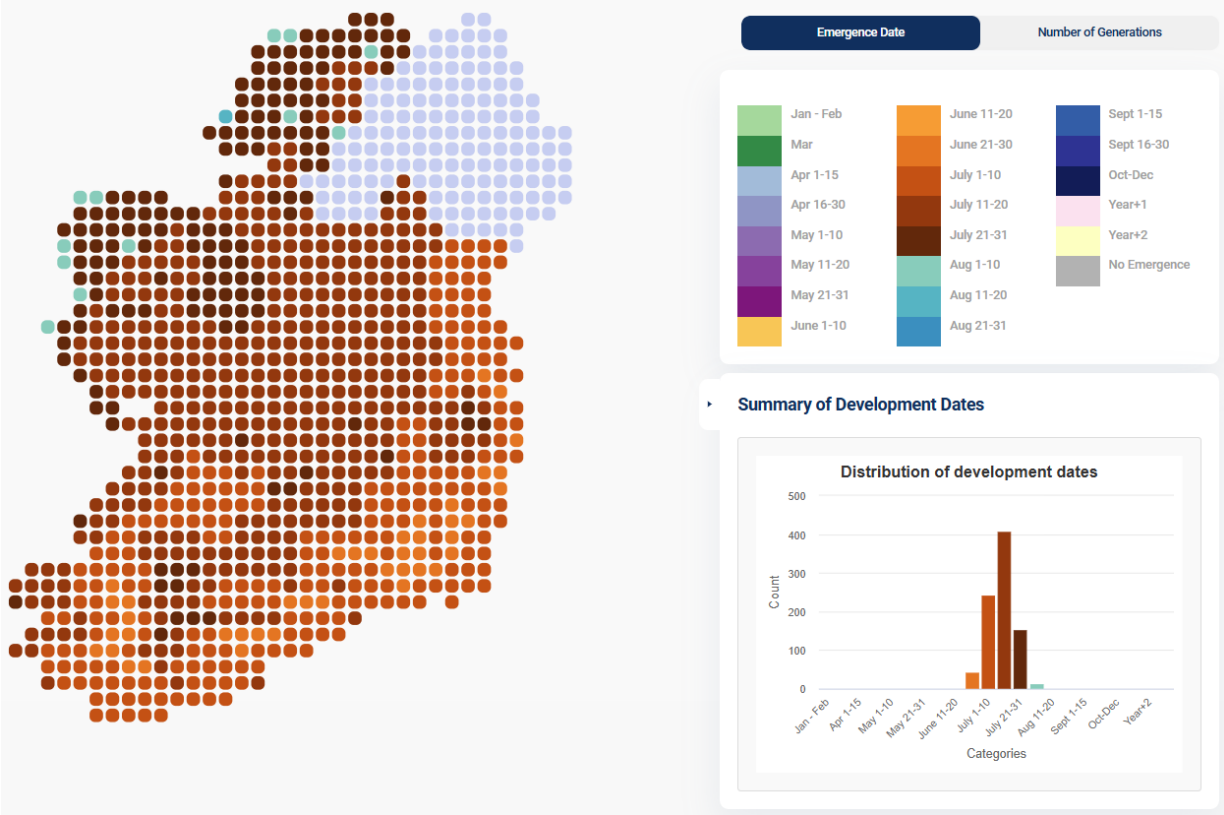



# 5. View Results

From here one may view the following:

- The emergence date (pictured below)
- The number of generations
- The anomaly for each of these

These results may also be exported

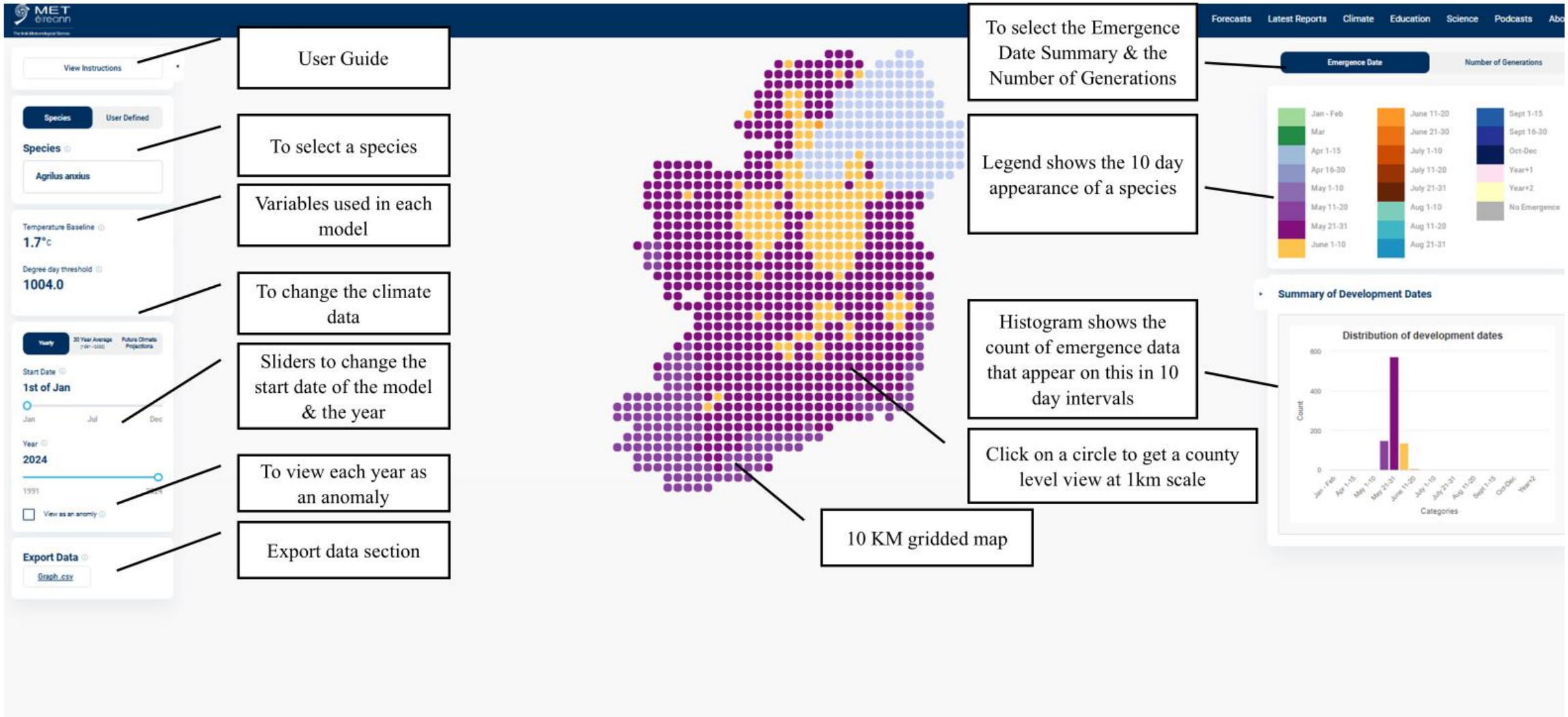


# Using the Pest Risk Tool

**Sections**

1. Home Page Guide
2. Selecting Model Output
3. Yearly Historical Climates
4. 30 year Climate Normals
5. Future Climates
6. User Defined Species
7. Data Export

# 1. Home Page Guide



## 2. Selecting Model Output

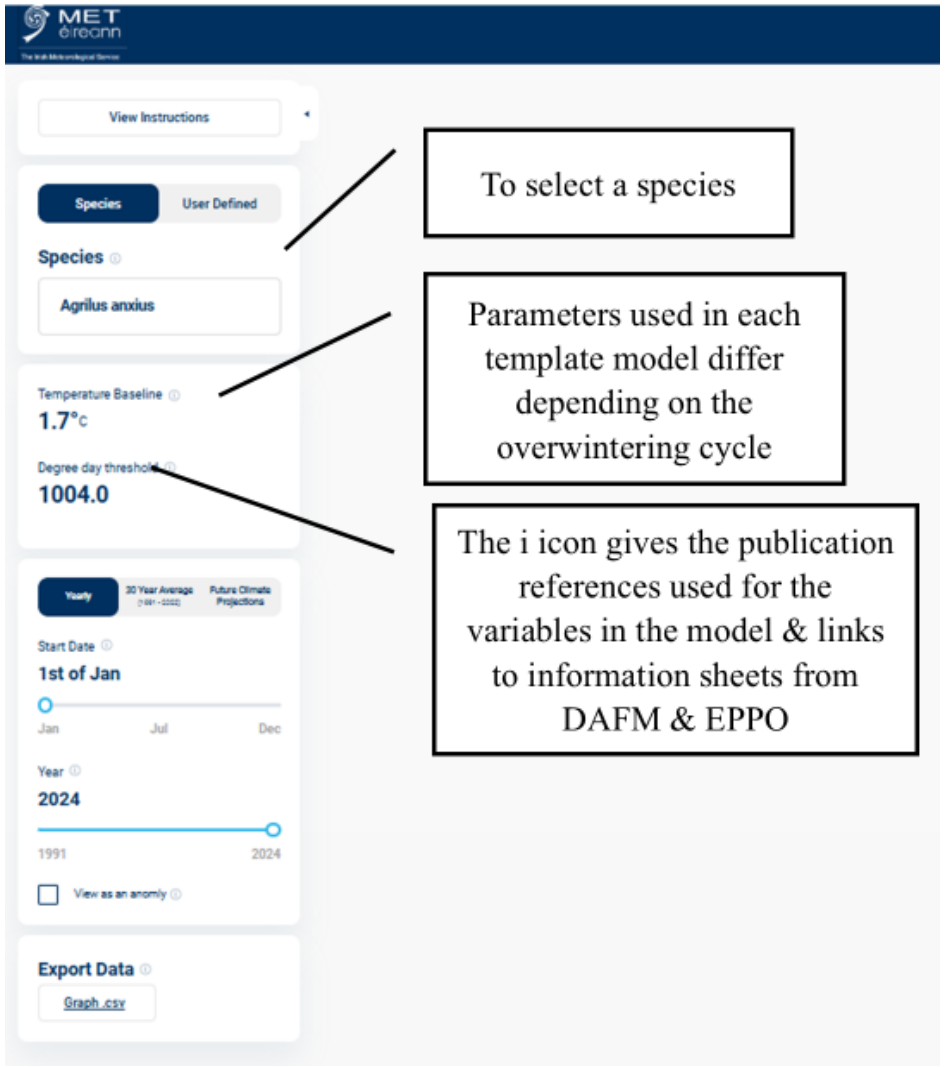
The parameters for each of the species models differ depending on the overwintering cycles:

- Quiescence (Temperature Baseline & Degree Day Threshold)
- Obligative Diapause (Temperature Baseline, Degree Day Threshold & Photoperiod)
- Facultative Diapause (Temperature Baseline, Degree Day Threshold, Photoperiod & Temperature Threshold)

This differs from species to species

Links to the reference publications, DAFM fact sheet and EPPO fact sheet (if available) are in the info box for the species (click on the "Species ❶" icon).

Quiescence example



## 2. Selecting Model Output Overview

Growing degree day models are use in the IPEM tool to predict developmental timings from Egg to Adult. The tool uses the triangle method to calculate growing degree days from daily maximum and minimum temperatures.

The IPEM tools also includes three models for overwintering.

- **Quiescence (no overwintering).**
  - Development continues throughout the year if temperatures are high enough
- **Obligate (overwintering determined by daylength)**
  - Development stops when daylength drops below a critical threshold
- **Facultative (overwintering determined by day length and daily temperature)**
  - Development stops when daylength drops below a critical threshold and daily mean temperature drops below a critical threshold

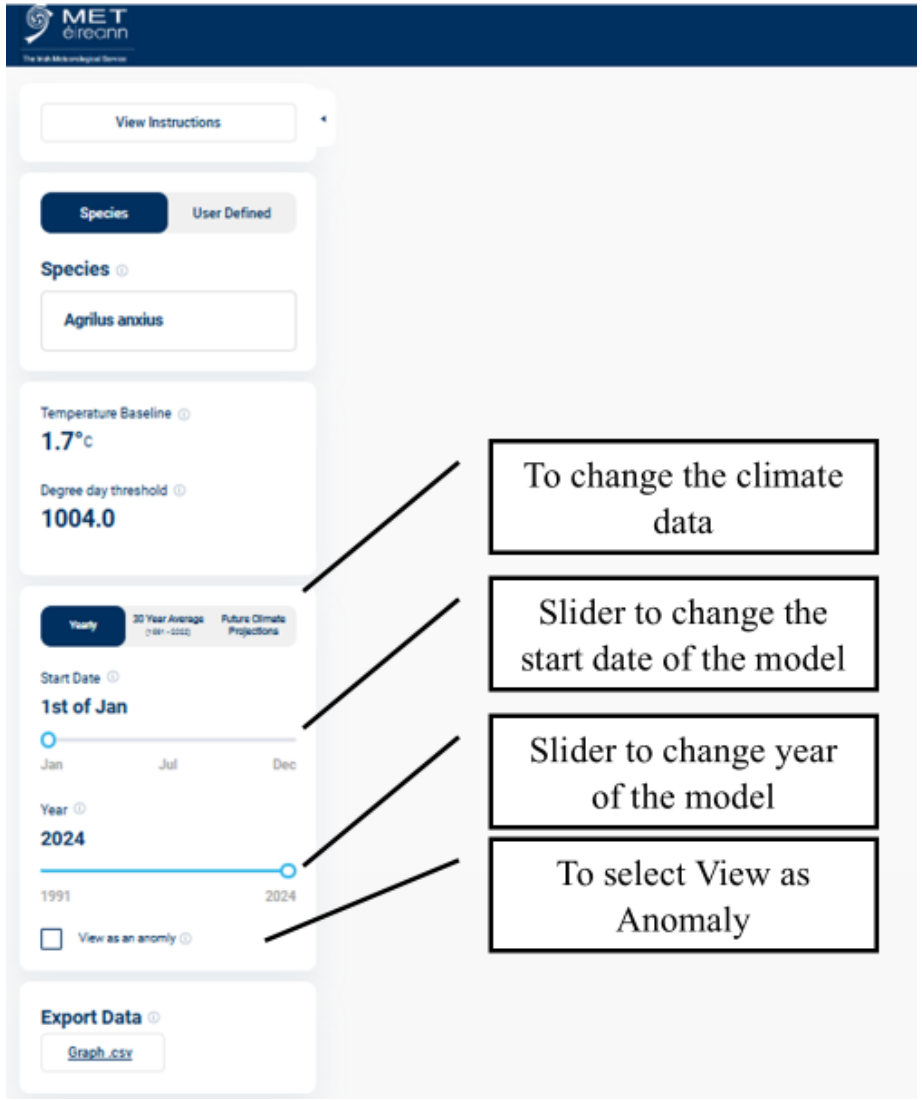
## 3. Yearly Historical Climates

The ability to change the yearly climate data from 1991:2024 for each 1km grid location.

The start date for each model is the 1st day of each month and the model will extend for up to 4 years. This was done as some species may not appear within a single season and could appear the subsequent year.

View as anomaly; will show the difference in the individual years to the most recent climate normal (1991:2020 climate normal).

Past Climate Data 1991: 2024



## 3. Yearly Historical Climates

The output for the Republic of Ireland is visualised on a 10km grid. The results shown for each 10km square is a “worst case” for all the 1km grids within the 10km square (i.e the earliest emergence date and the highest number of generations).

The output on a 1km grid is available by clicking on the respective circle for county.

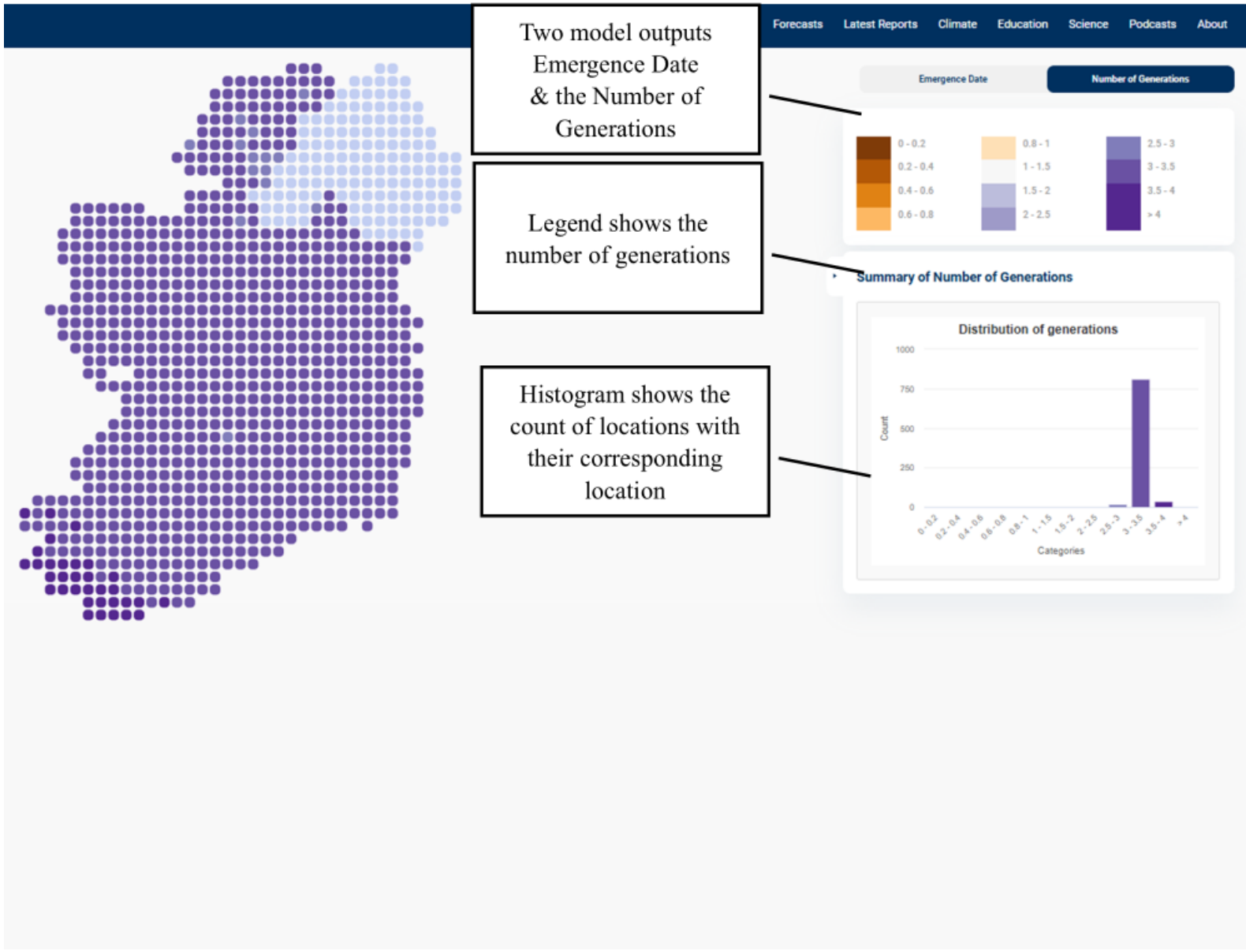
Results are visualised using a colour scale, and a histogram showing the number of grid squares with different emergence dates/number of generations

## 3. Yearly Historical Climates

The Number of Generations gives the number of completed generations that are predicted to emerge in the first year.

The histogram shows the count of locations with the respective number of generations.

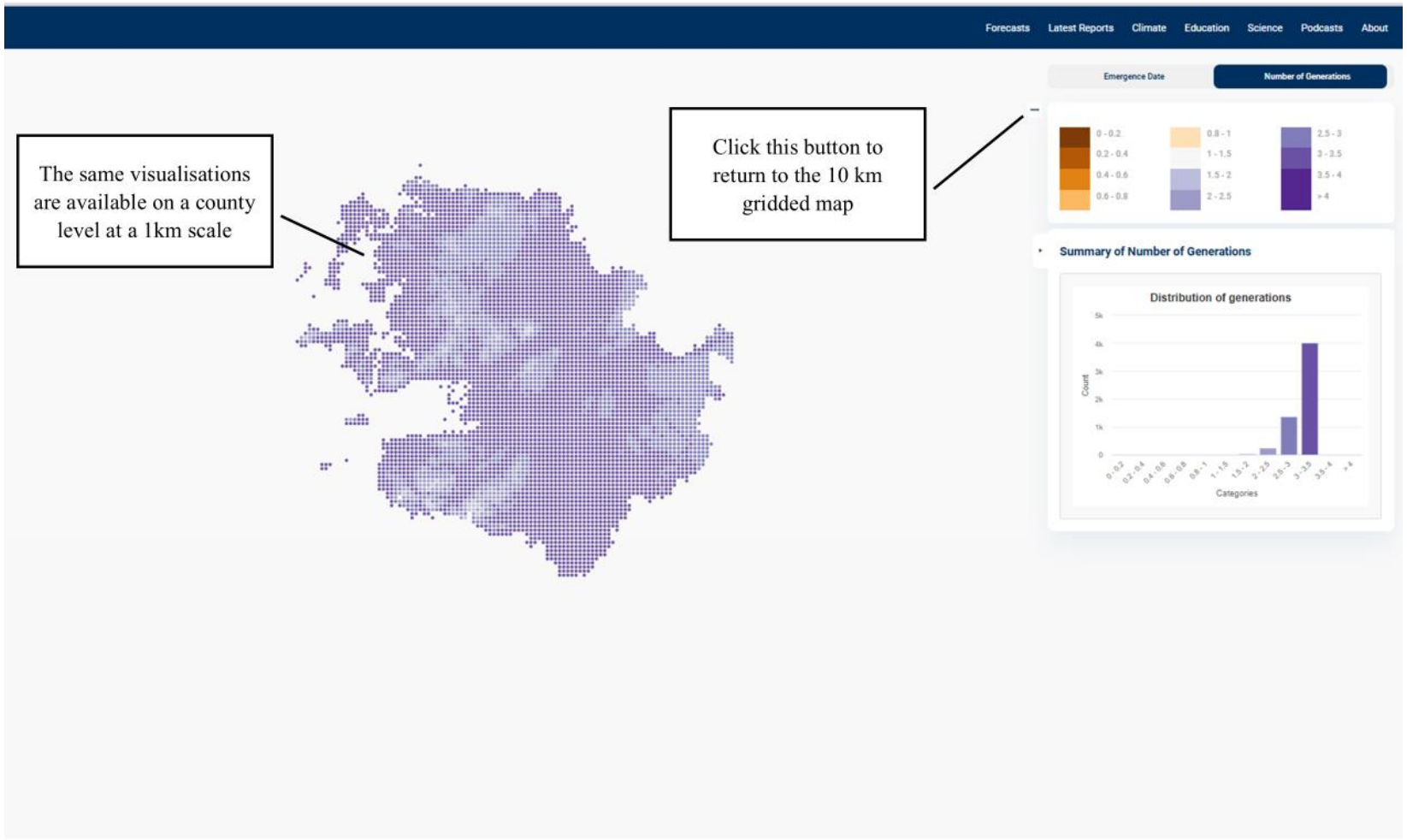
The output on a 1km grid is available by clicking on the respective circle for county



## 3. Yearly Historical Climates

The Number of Generations states the number of completed generations that are predicted to emerge that year in total. The histogram below shows the count of locations with the respective number of generations.

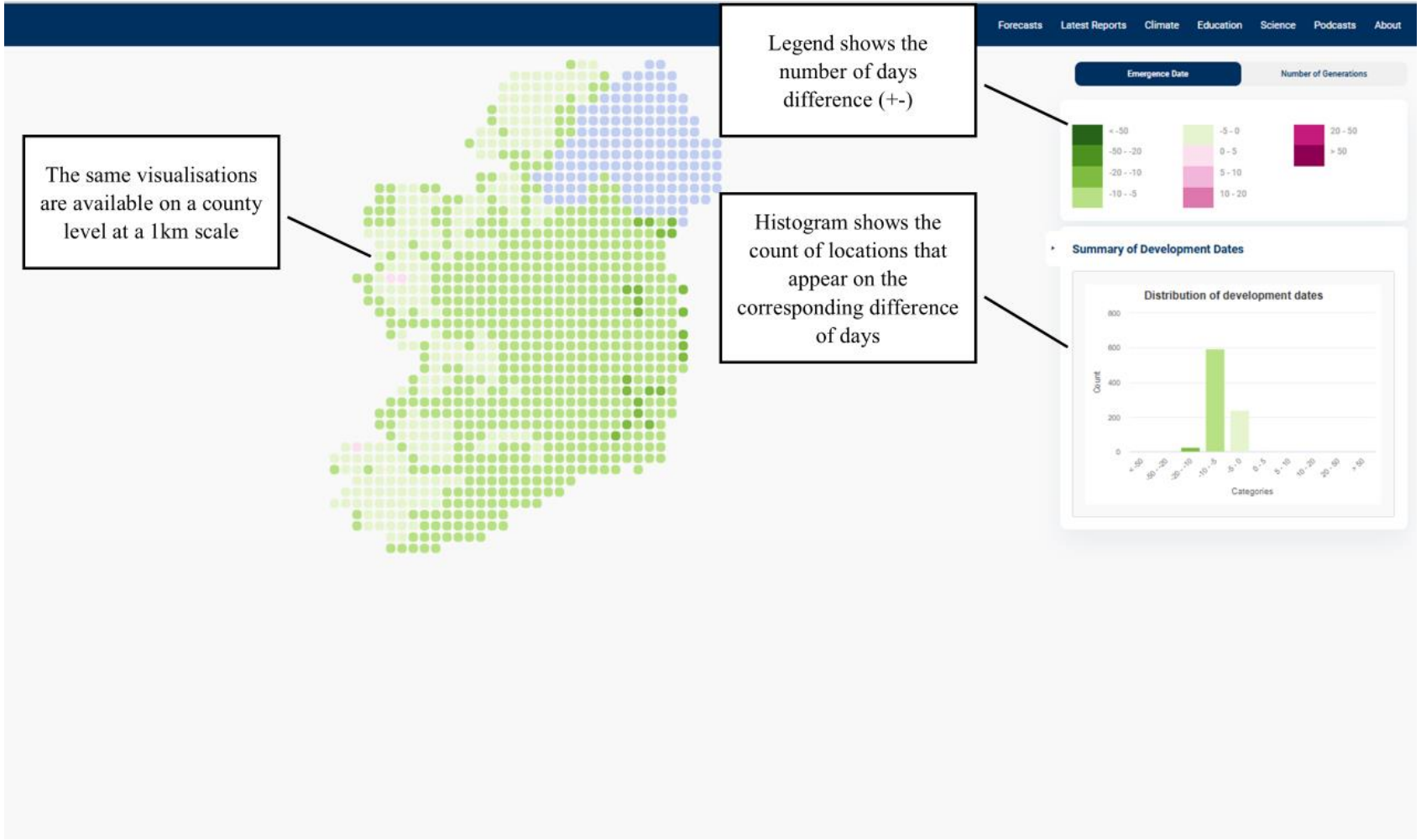
The output on a 1km grid is available by clicking on the respective circle for county



## 3. Yearly Historical Climates

View as anomaly; will show the difference in the individual years to the most recent 30 year climate average (1991-2020).

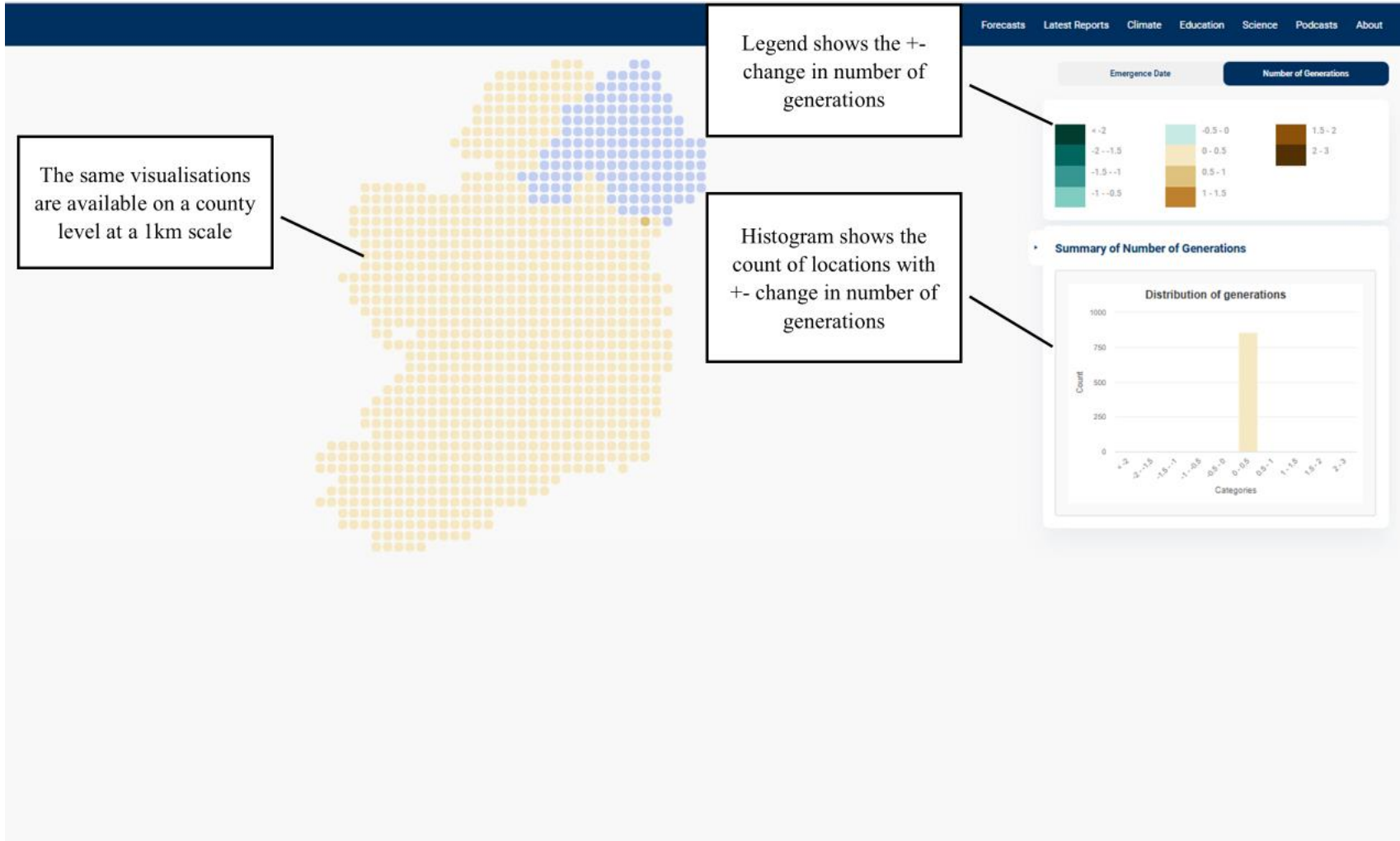
The output on a 1km grid is available by clicking on the respective circle for county



## 3. Yearly Historical Climates

View as anomaly; will show the difference in the individual years to the most recent 30 year climate average (1991-2020).

The output on a 1km grid is available by clicking on the respective circle for county

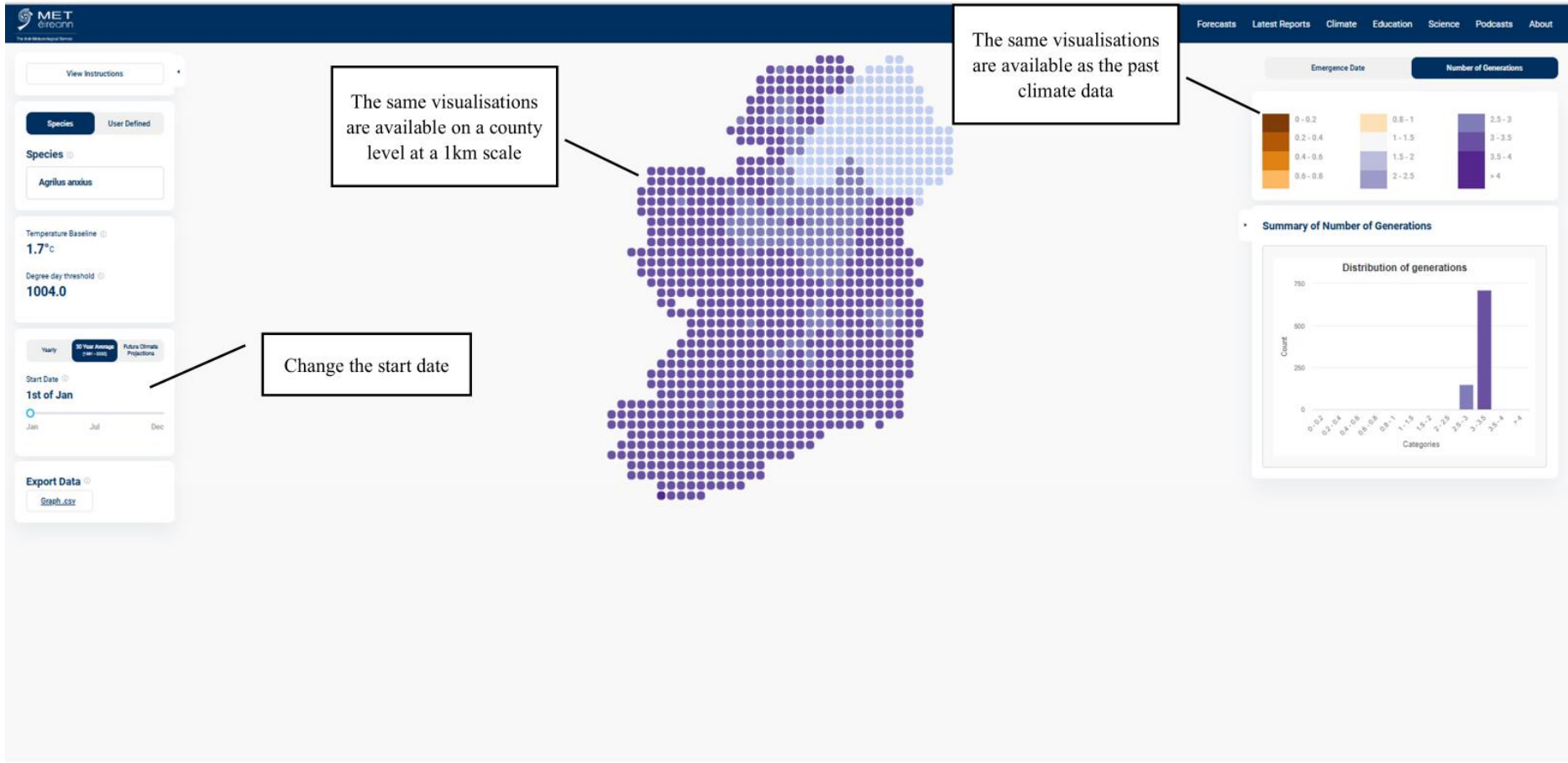


## 4. 30 year Climate Normals

The 30 year climate average is the mean emergence date and mean number of generations for each 1 km across 1991 - 2020.

The start date can be changed in this instance.

3. Selecting Model outputs – 30 year climate normal



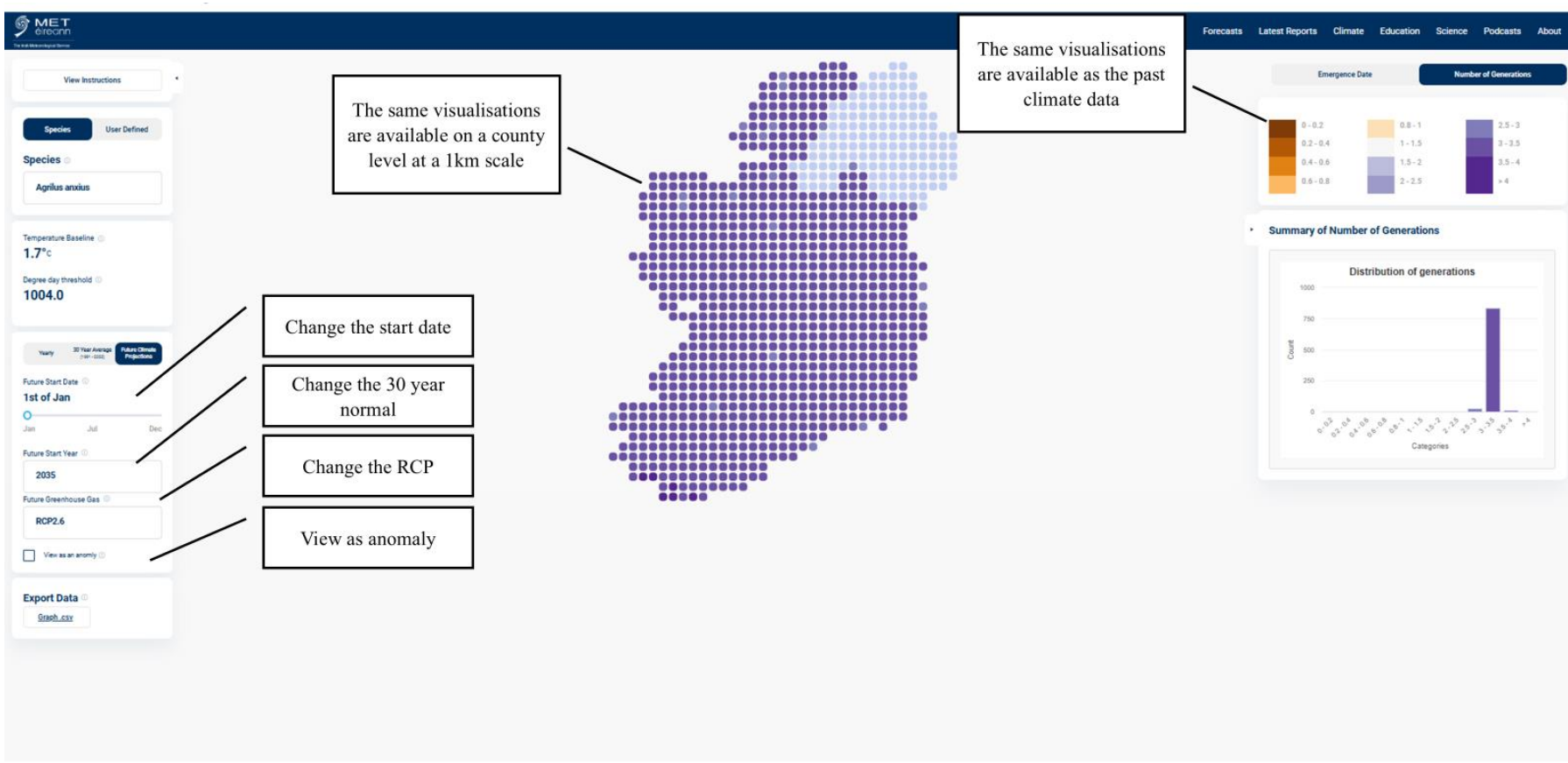
# 5. Future Climates

Within this section, one can select two thirty-year future climate projections 2020:2050 & 2040:2070.

For each future climate projections, one can select the Representative Concentration Pathway (RCP) 2.6, 4.5 and 8.5.

The start date can be changed

The anomaly in this instance is the difference to the 1991-2020 30 year climate average.



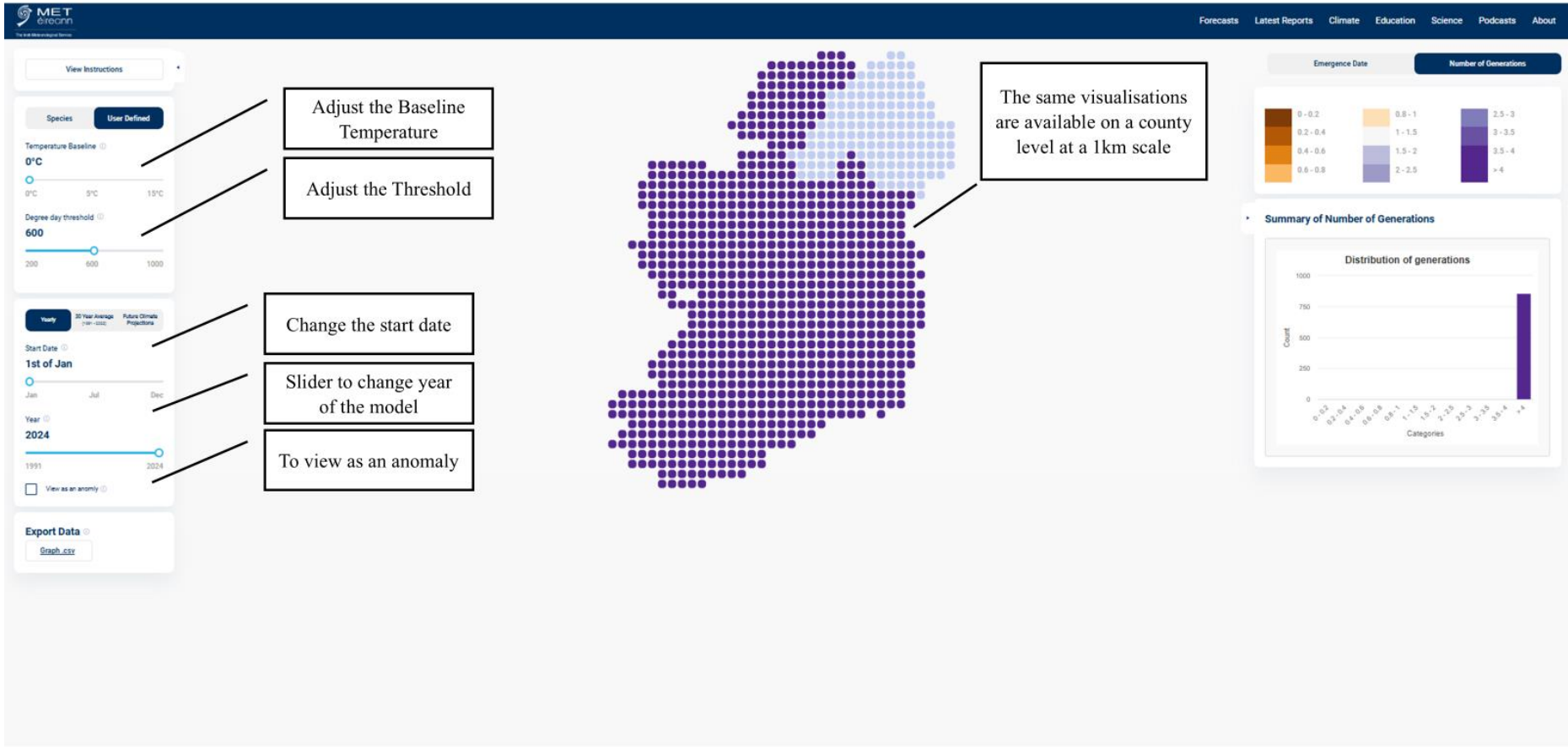
## 6. User Defined Species

Within this tab: you can adjust

- Temperature Baseline in 1-degree increments from 0 to 12°C
- degree day threshold in 50 degree increments from 0 to 1000 degree days.

This may be used to define stages of development and/or species not defined within the models

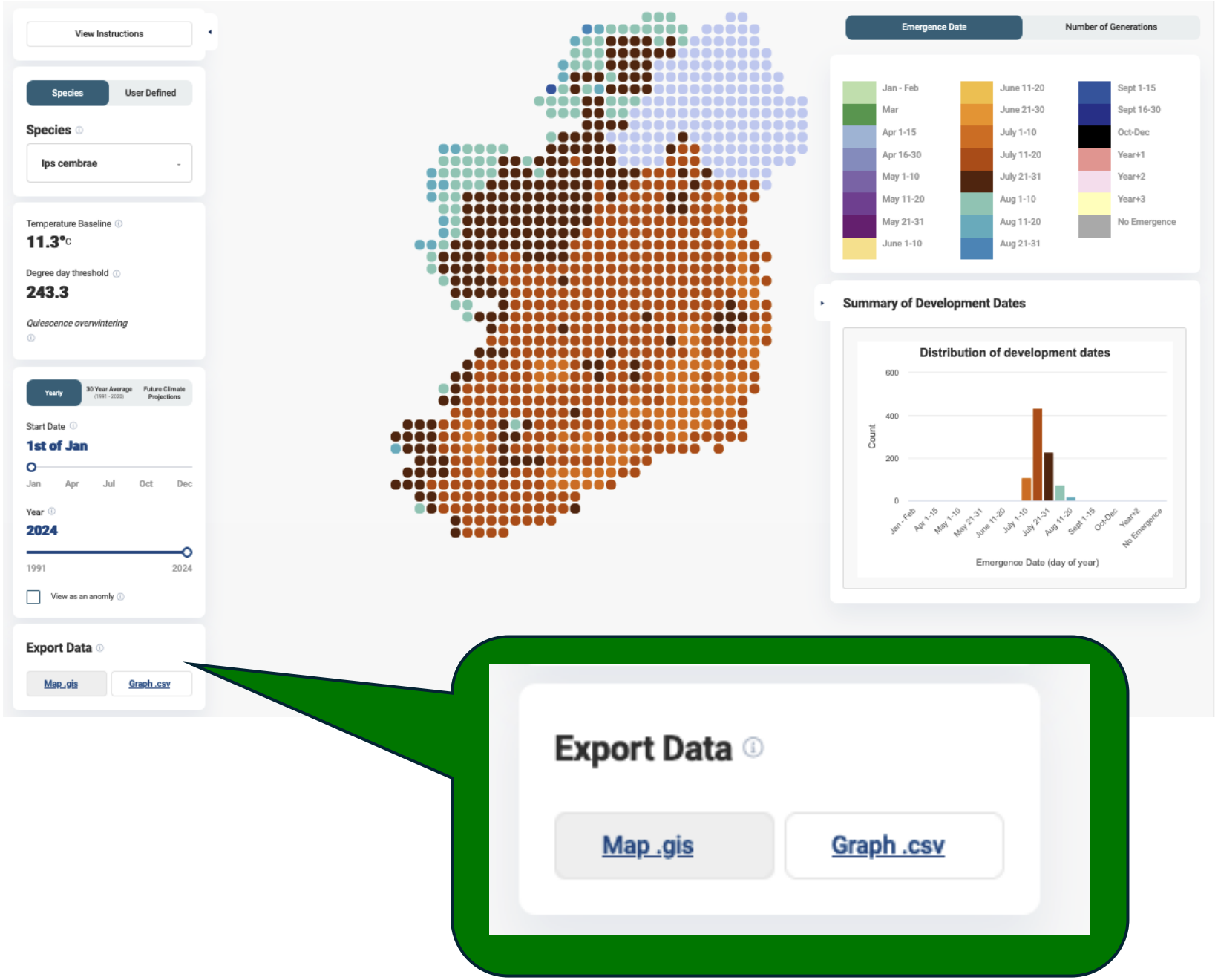
All these used-defined models use a quiescent overwintering model

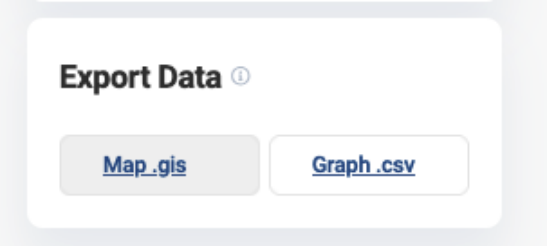


## 7. Data Export

The IPEM data can be downloaded in two formats:

1. **Map.gis**: a geoTIFF fil.e This file can be imported into any GIS software (Click on “Map.gis” button)
2. **Graph.csv:** a comma separated variable (CSV) file. This file can be imported into any spreadsheet or statistical software package.






# 7. Data Export (Map.gis)

The geoTIFF file can be downloaded by clicking on the Map.gis button.

The file contains a GIS raster data with 7 bands.

- Band 1, 3, 5: Day of year of pest emergence (band 1: specific year, band 3: 30 year average, band 5: anomaly)
- Band 2, 4, 6: Number of pest generations (band 1: specific year, band 3: 30 year average, band 5: anomaly)
- Band 7: County boundaries

The file uses the TM75 / Irish Grid (EPSG:29903) coordinate reference system.

All data are at a 1km spatial resolution

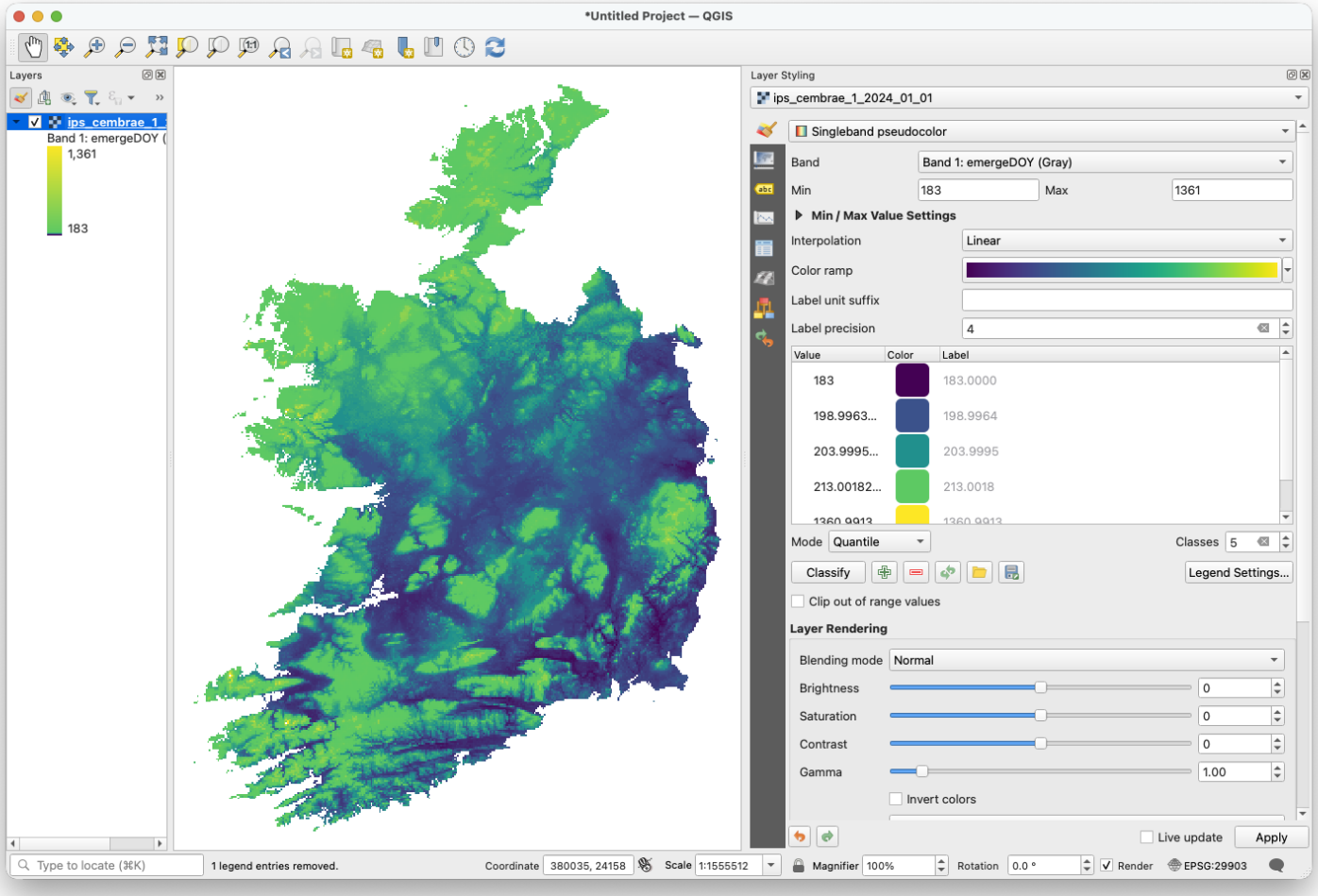
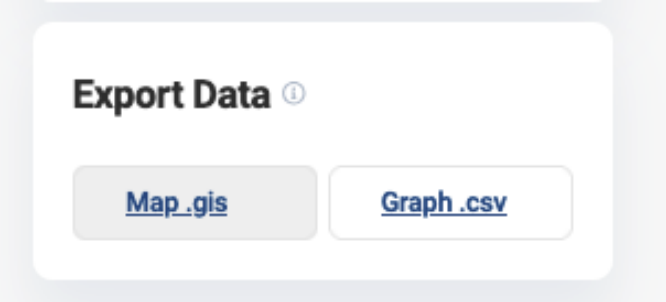



Figure: A geoTIFF file being visualised in QGIS software. The data being visualised is the emergence day of year for *Ips cembrae* for with a start date of 1st Jan 2024




## 7. Data Export (Graph.csv)

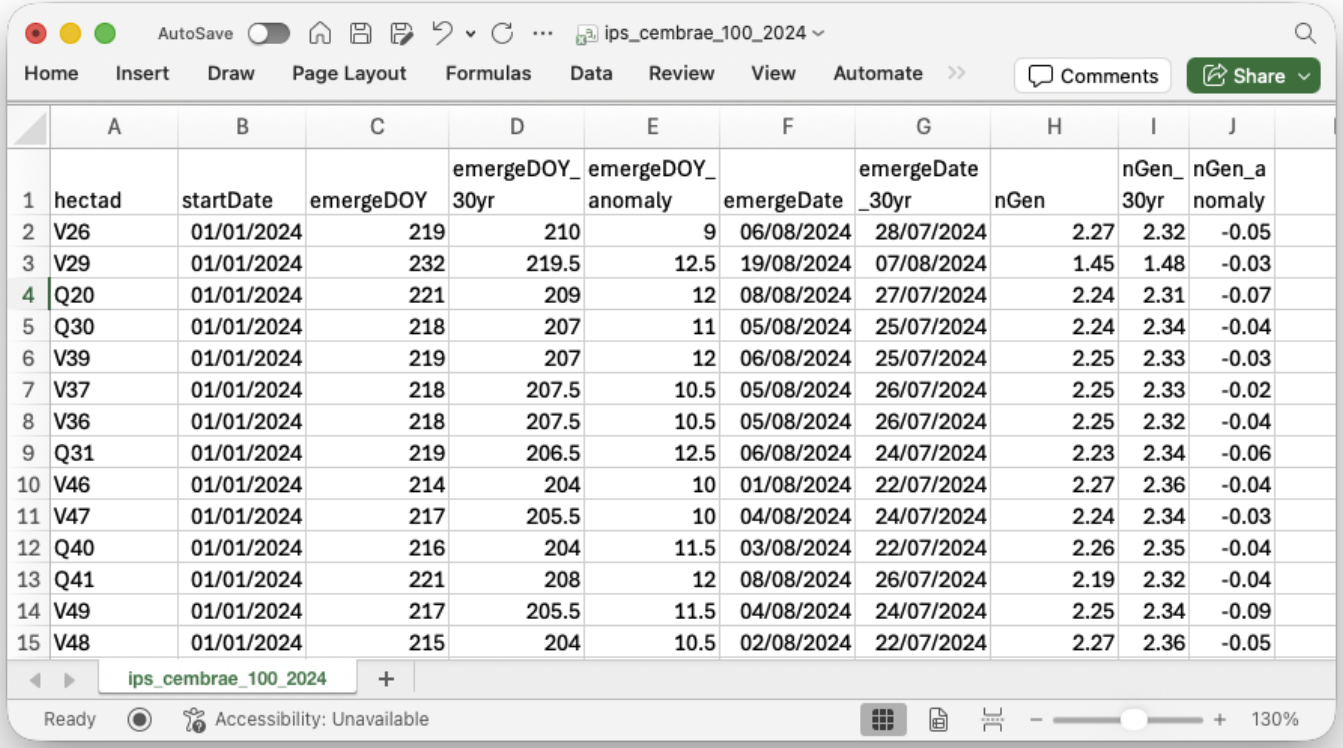
The CSV file can be downloaded by clicking on the Graph.csv button. The CSV file will contain the data being visualised by the IPEM webtool.

### 10km scale data:

If the Republic of Ireland is being viewed, the CSV file will contain data at a 10km spatial scale.

The file has 10 variables (10 columns). An example is shown in the figure.

Spatial coordinates use the Irish Grid Reference (TM75, EPSG 29903)



AutoSave ips_cembrae_100_2024

Home Insert Draw Page Layout Formulas Data Review View Automate Comments Share

| | A | B | C | D | E | F | G | H | I | J |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | hectad | startDate | emergeDOY | emergeDOY_30yr | emergeDOY_anomaly | emergeDate | emergeDate_30yr | nGen | nGen_30yr | nGen_anomaly |
| 2 | V26 | 01/01/2024 | 219 | 210 | 9 | 06/08/2024 | 28/07/2024 | 2.27 | 2.32 | -0.05 |
| 3 | V29 | 01/01/2024 | 232 | 219.5 | 12.5 | 19/08/2024 | 07/08/2024 | 1.45 | 1.48 | -0.03 |
| 4 | Q20 | 01/01/2024 | 221 | 209 | 12 | 08/08/2024 | 27/07/2024 | 2.24 | 2.31 | -0.07 |
| 5 | Q30 | 01/01/2024 | 218 | 207 | 11 | 05/08/2024 | 25/07/2024 | 2.24 | 2.34 | -0.04 |
| 6 | V39 | 01/01/2024 | 219 | 207 | 12 | 06/08/2024 | 25/07/2024 | 2.25 | 2.33 | -0.03 |
| 7 | V37 | 01/01/2024 | 218 | 207.5 | 10.5 | 05/08/2024 | 26/07/2024 | 2.25 | 2.33 | -0.02 |
| 8 | V36 | 01/01/2024 | 218 | 207.5 | 10.5 | 05/08/2024 | 26/07/2024 | 2.25 | 2.32 | -0.04 |
| 9 | Q31 | 01/01/2024 | 219 | 206.5 | 12.5 | 06/08/2024 | 24/07/2024 | 2.23 | 2.34 | -0.06 |
| 10 | V46 | 01/01/2024 | 214 | 204 | 10 | 01/08/2024 | 22/07/2024 | 2.27 | 2.36 | -0.04 |
| 11 | V47 | 01/01/2024 | 217 | 205.5 | 10 | 04/08/2024 | 24/07/2024 | 2.24 | 2.34 | -0.03 |
| 12 | Q40 | 01/01/2024 | 216 | 204 | 11.5 | 03/08/2024 | 22/07/2024 | 2.26 | 2.35 | -0.04 |
| 13 | Q41 | 01/01/2024 | 221 | 208 | 12 | 08/08/2024 | 26/07/2024 | 2.19 | 2.32 | -0.04 |
| 14 | V49 | 01/01/2024 | 217 | 205.5 | 11.5 | 04/08/2024 | 24/07/2024 | 2.25 | 2.34 | -0.09 |
| 15 | V48 | 01/01/2024 | 215 | 204 | 10.5 | 02/08/2024 | 22/07/2024 | 2.27 | 2.36 | -0.05 |

ips_cembrae_100_2024 +

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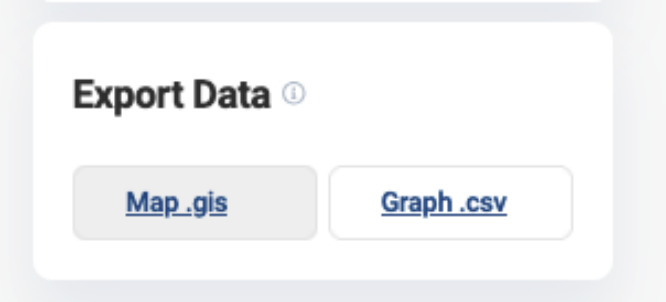
Figure: CSV file for IPEM data at 10km spatial scale with 10 variables, being viewed in Excel. Variables are: hectad grid reference, start date, emergence day of year (specific year, 30 year average, anomaly), emergence date (specific year, 30 year average), number of generations (specific year, 30 year average, anomaly).




## 7. Data Export (Graph.csv)

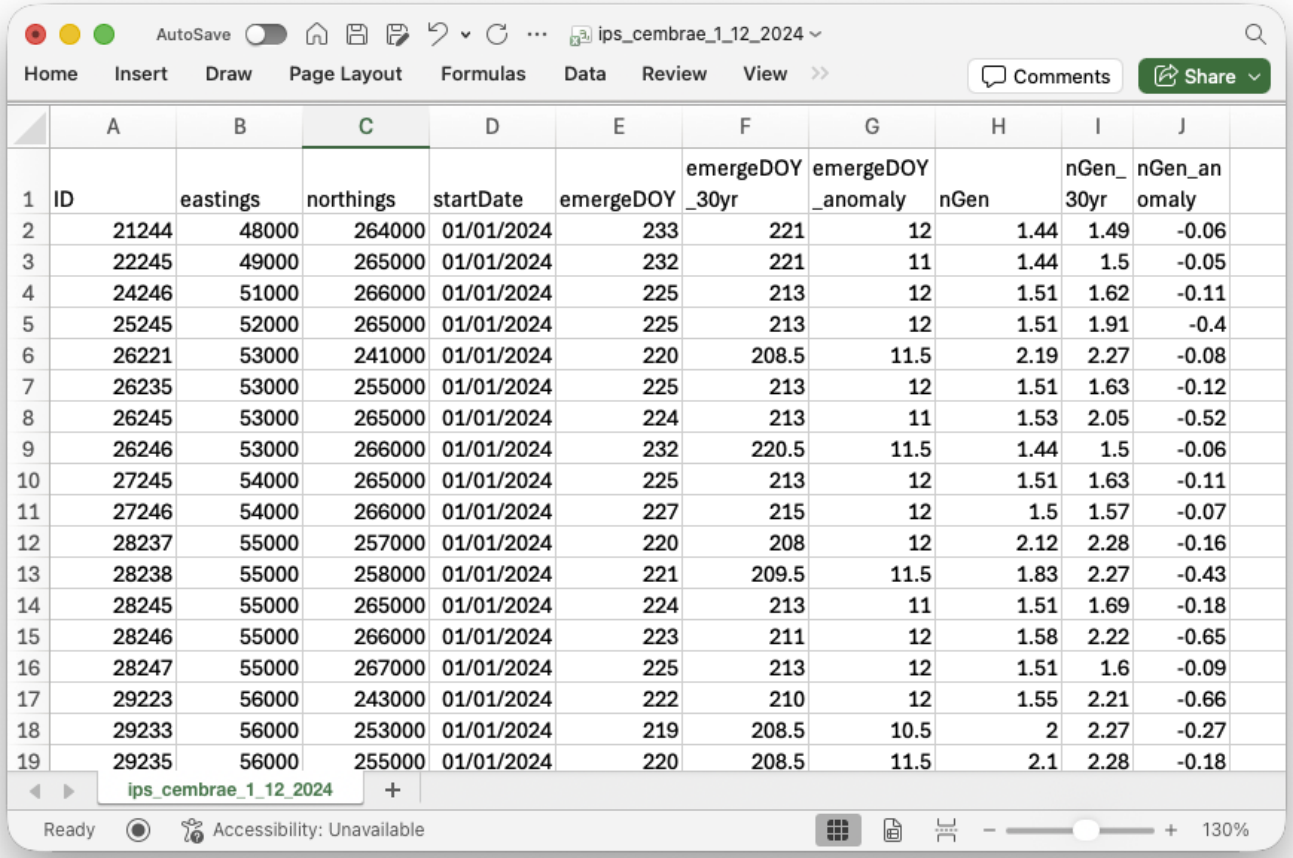
The CSV file can be downloaded by clicking on the Graph.csv button. The CSV file will contain the data being visualised by the IPEM webtool.

### 1km scale data:

If a county in Ireland is being viewed, the CSV file will contain data at a 1km spatial scale.

The file has 10 variables (10 columns). An example is shown in the figure.

Spatial coordinates use the Irish Grid Reference (TM75, EPSG 29903)




| | A | B | C | D | E | F | G | H | I | J |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | ID | eastings | northings | startDate | emergeDOY | emergeDOY_30yr | emergeDOY_anomaly | nGen | nGen_30yr | nGen_anomaly |
| 2 | 21244 | 48000 | 264000 | 01/01/2024 | 233 | 221 | 12 | 1.44 | 1.49 | -0.06 |
| 3 | 22245 | 49000 | 265000 | 01/01/2024 | 232 | 221 | 11 | 1.44 | 1.5 | -0.05 |
| 4 | 24246 | 51000 | 266000 | 01/01/2024 | 225 | 213 | 12 | 1.51 | 1.62 | -0.11 |
| 5 | 25245 | 52000 | 265000 | 01/01/2024 | 225 | 213 | 12 | 1.51 | 1.91 | -0.4 |
| 6 | 26221 | 53000 | 241000 | 01/01/2024 | 220 | 208.5 | 11.5 | 2.19 | 2.27 | -0.08 |
| 7 | 26235 | 53000 | 255000 | 01/01/2024 | 225 | 213 | 12 | 1.51 | 1.63 | -0.12 |
| 8 | 26245 | 53000 | 265000 | 01/01/2024 | 224 | 213 | 11 | 1.53 | 2.05 | -0.52 |
| 9 | 26246 | 53000 | 266000 | 01/01/2024 | 232 | 220.5 | 11.5 | 1.44 | 1.5 | -0.06 |
| 10 | 27245 | 54000 | 265000 | 01/01/2024 | 225 | 213 | 12 | 1.51 | 1.63 | -0.11 |
| 11 | 27246 | 54000 | 266000 | 01/01/2024 | 227 | 215 | 12 | 1.5 | 1.57 | -0.07 |
| 12 | 28237 | 55000 | 257000 | 01/01/2024 | 220 | 208 | 12 | 2.12 | 2.28 | -0.16 |
| 13 | 28238 | 55000 | 258000 | 01/01/2024 | 221 | 209.5 | 11.5 | 1.83 | 2.27 | -0.43 |
| 14 | 28245 | 55000 | 265000 | 01/01/2024 | 224 | 213 | 11 | 1.51 | 1.69 | -0.18 |
| 15 | 28246 | 55000 | 266000 | 01/01/2024 | 223 | 211 | 12 | 1.58 | 2.22 | -0.65 |
| 16 | 28247 | 55000 | 267000 | 01/01/2024 | 225 | 213 | 12 | 1.51 | 1.6 | -0.09 |
| 17 | 29223 | 56000 | 243000 | 01/01/2024 | 222 | 210 | 12 | 1.55 | 2.21 | -0.66 |
| 18 | 29233 | 56000 | 253000 | 01/01/2024 | 219 | 208.5 | 10.5 | 2 | 2.27 | -0.27 |
| 19 | 29235 | 56000 | 255000 | 01/01/2024 | 220 | 208.5 | 11.5 | 2.1 | 2.28 | -0.18 |

Figure: CSV file for IPEM data at 1km spatial scale with 10 variables, being viewed in Excel. Variables are: unique ID for each 1km square, eastings and northing of the 1km square (bottom-right corner), start date, emergence day of year (specific year, 30 year average, anomaly), number of generations (specific year, 30 year average, anomaly).