

manual

CCWeatherGen **Climate change weather file generator**

Version 1.1.2

Sustainable Energy Research Group

August 2009

UNIVERSITY OF
Southampton
School of Civil Engineering
and the Environment

1.	Introduction	2
2.	Preparing the CCWeatherGen tool for use	2
2.1.	Obtaining CIBSE/Met Office TRY/DSY weather files	2
2.2.	Obtaining the UKCIP02 climate change scenario data	4
3.	Creating climate change weather files from present day weather data	5
3.1.	Permitting macros in Microsoft® Excel	5
3.2.	Getting started	5
3.3.	Selecting a UKCIP02 climate change scenario	6
3.4.	Selecting a CIBSE/Met Office weather file	7
3.5.	Morphing a CIBSE/Met Office weather file	8
3.6.	Generating a TMY2 or an EPW weather file	8
3.7.	Generating an 'unmorphed' TMY2 or EPW file	8
4.	Underlying methodology of the CCWeatherGen tool	9
5.	Troubleshooting	9
6.	Known issues with the tool in simulation programs	10
7.	Copyright and licensing notes	10
8.	Disclaimer of warranties	10
9.	Acknowledgements	11
10.	References	11

COVER PICTURE:

The picture on the front cover of this manual was created with the Educational Version of Graphisoft® ArchiCAD.

Climate change weather file generator - CCWeatherGen

1. Introduction

The climate change weather file generator (CCWeatherGen) uses the 2002 climate change scenario predictions provided by UKCIP (1). It enables you to generate climate change weather files ready for use in building performance simulation programs. The tool is Microsoft® Excel based and transforms CIBSE/Met Office TRY/DSY weather files into climate change TMY2 or EPW weather files which are compatible with the majority of building performance simulation programs.

The underlying weather file transformation routines of this tool are based on the so-called 'morphing' methodology for climate change transformation of TRY/DSY weather files, which was developed by Belcher, Hacker and Powell (2,3). The CCWeatherGen tool includes further calculation routines for parameters that are not originally supplied by DSY/TRY files (such as for example: horizontal infrared sky radiation, daylighting parameters, dew point temperature, humidity parameters, soil temperature). These parameters are required for generating simulation ready TMY2 and EPW files.

The CCWeatherGen tool allows you to generate TMY2 or EPW climate change weather files with a few mouse clicks. You can produce 'morphed' climate change as well as 'unmorphed' present day TMY2 and EPW files from the original CIBSE/Met Office DSY/TRY format files. The tool is made available free of charge. However, it is solely distributed **WITHOUT** the required baseline weather files and/or climate change scenario data! (Please view sections 2.1 and 2.2 for information on where to obtain the required baseline data.) The functionality of this tool is restricted to sites in the UK only.

Basic requirements for running the CCWeatherGen tool

- (a) A valid installation of Microsoft® Excel on your local hard drive. CCWeatherGen has been tested with the 2003 and 2007 versions. (However, the authors do not take responsibility for any compatibility issues on these or other platforms.)
- (b) A licensed copy of a CIBSE/Met Office TRY and/or DSY file. (see section 2.1)
- (c) A licensed copy of the UKCIP02 climate change scenario data files, which can be downloaded free of charge. (see section 2.2)

2. Preparing the CCWeatherGen tool for use

After downloading the file '*CCWeatherGen.exe*' please run it for installation of the CCWeatherGen tool. The file is self-extracting. It is **NOT RECOMMENDED** to change the default installation path ('*C:\CCWeatherGen*'). A program folder called CCWeatherGen is added to the Windows Start Menu during installation.

The CCWeatherGen tool can be launched right after installation. However, before being able to use it, you need to make sure that you are in possession of a licensed TRY or DSY file and have obtained the required UKCIP02 data.

2.1. Obtaining CIBSE/Met Office TRY/DSY weather files

'Present day' hourly weather data files in TRY and DSY format can be purchased from CIBSE, either as a bundle or as individual weather sites. For more details on prices and licensing issues please consult the CIBSE Bookshop website.

The direct link to the CIBSE bookshop, TRY/DSY hourly weather data set is:
<http://www.cibse.org/index.cfm?go=publications.view&item=332>

Manual

Abbreviations used in this document

CIBSE	Chartered Institution of Building Services Engineers
DSY	Design Summer Year
EPW	Energy Plus / EPSr Weather
TMY2	Typical Meteorological Year 2
TRY	Test Reference Year
UKCIP	UK Climate Impacts Programme
UKCIP02	UKCIP 2002 climate change scenarios

PLEASE NOTE:

The CCWeatherGen tool has been tested on computers running Microsoft® Windows XP and Microsoft® Windows Vista operating systems. However, the authors do not take responsibility for any compatibility issues on these or other platforms.

IMPORTANT - PLEASE NOTE:

The CCWeatherGen tool does not work without a present day CIBSE/Met Office TRY/DSY weather file!

Please only use the current CIBSE/Met Office TRY/DSY weather files for the CCWeatherGen tool. These files were released in 2005. Please do not use older file versions as these have not been tested for their compatibility with this tool.

Before you start using the CCWeatherGen tool please make sure that you possess the CIBSE weather files in the correct file format. The files are sometimes provided in a different format to the original CIBSE files in order to suit a particular simulation program. Such files cannot be read by the CCWeatherGen tool. Please check the file structure by opening a file with a text editor such as Notepad. The first lines of a DSY / TRY file as they are provided directly by CIBSE look like the screens shown below:

```
Southampton_Southampton_w_c.dsy - Notepad
File Edit Format View Help
Design Summer Year DSY for: Southampton Southampton_w_c
Start Year = 1978. End Year = 2000. Selected Year = 1982.
Latitude = 50.9N. Longitude = 1.41W. Altitude = 3m.

Selection using third highest average temperature for the
summer months April-September inclusive.

Notation and units:
ID      = Station Identifier
PWC     = Present Weather Code
Cloud   = Cloud amount          1/8
DryT    = Dry Bulb Temperature  degrees C
WetT    = Wet Bulb Temperature  degrees C
Press   = Mean Sea Level Pressure hPa
WD      = Wind Direction        degrees
WS      = Wind Speed            knots
GIRad   = Global radiation      watts per sq. metre
DIRad   = Diffuse radiation     watts per sq. metre

ID Year Month Day Hour PWC Cloud DryT WetT Press WD WS GIRad DIRad
3865 1982 1 1 0 10 7 6.4 6.2 994.4 100 2 0 0
3865 1982 1 1 100 -1 7 6.4 6.2 994.4 90 2 0 0
3865 1982 1 1 200 -1 8 6.8 6.7 994.1 90 2 0 0
3865 1982 1 1 300 60 8 7.2 7.0 993.9 80 2 0 0
3865 1982 1 1 400 -1 8 7.1 6.7 994.1 20 2 0 0
3865 1982 1 1 500 -1 8 6.6 6.0 994.6 330 2 0 0
3865 1982 1 1 600 61 8 6.0 5.3 995.5 270 2 0 0
3865 1982 1 1 700 -1 8 5.3 4.7 996.6 250 2 0 0
3865 1982 1 1 800 -1 7 4.8 4.3 997.8 220 2 10 10
3865 1982 1 1 900 2 7 4.6 4.3 998.9 200 2 52 44
3865 1982 1 1 1000 -1 7 5.0 4.6 999.8 230 3 91 76
3865 1982 1 1 1100 -1 7 5.5 5.0 1000.7 260 3 112 94
3865 1982 1 1 1200 80 7 6.0 5.4 1001.6 290 4 115 96
3865 1982 1 1 1300 -1 7 6.2 5.7 1002.7 290 5 99 83
3865 1982 1 1 1400 -1 8 6.2 5.8 1003.8 300 6 31 31
```

```
Southampton_Southampton_w_c.try - Notepad
File Edit Format View Help
Test Reference Year TRY for: Southampton Southampton_w_c
Start Year = 1978. End Year = 2000.
Latitude = 50.9N. Longitude = 1.41W. Altitude = 3m.

Selection using FS method with equal weighting for Cloud, DryT and WS.
Selected years for each month are:
January: 1982
February: 1999
March: 1983
April: 1988
May: 1985
June: 1995
July: 1981
August: 1987
September: 1988
October: 1987
November: 1987
December: 1982

Notation and units:
ID      = Station Identifier
PWC     = Present Weather Code
Cloud   = Cloud amount          1/8
DryT    = Dry Bulb Temperature  degrees C
WetT    = Wet Bulb Temperature  degrees C
Press   = Mean Sea Level Pressure hPa
WD      = Wind Direction        degrees
WS      = Wind Speed            knots
GIRad   = Global radiation      watts per sq. metre
DIRad   = Diffuse radiation     watts per sq. metre

ID Year Month Day Hour PWC Cloud DryT WetT Press WD WS GIRad DIRad
3865 1982 1 1 0 10 7 6.4 6.2 994.4 100 2 0 0
3865 1982 1 1 100 -1 7 6.4 6.2 994.4 90 2 0 0
3865 1982 1 1 200 -1 8 6.8 6.7 994.1 90 2 0 0
3865 1982 1 1 300 60 8 7.2 7.0 993.9 80 2 0 0
3865 1982 1 1 400 -1 8 7.1 6.7 994.1 20 2 0 0
3865 1982 1 1 500 -1 8 6.6 6.0 994.6 330 2 0 0
3865 1982 1 1 600 61 8 6.0 5.3 995.5 270 2 0 0
3865 1982 1 1 700 -1 8 5.3 4.7 996.6 250 2 0 0
3865 1982 1 1 800 -1 7 4.8 4.3 997.8 220 2 10 10
3865 1982 1 1 900 2 7 4.6 4.3 998.9 200 2 52 44
3865 1982 1 1 1000 -1 7 5.0 4.6 999.8 230 3 91 76
3865 1982 1 1 1100 -1 7 5.5 5.0 1000.7 260 3 112 94
3865 1982 1 1 1200 80 7 6.0 5.4 1001.6 290 4 115 96
3865 1982 1 1 1300 -1 7 6.2 5.7 1002.7 290 5 99 83
3865 1982 1 1 1400 -1 8 6.2 5.8 1003.8 300 6 31 31
```

IMPORTANT - PLEASE NOTE:

Your DSY / TRY files have to look like the adjacent screenshots. If they do not please contact your weather file provider for further details. Alternatively you may use the CCWeatherGen Basefile Creator to transform your data into the correct format. This tool is provided as a separate application with the CCWeatherGen package.

If the files you own do not look like the screenshots shown on page 3 you may need to purchase the files in their original format. Alternatively you may use the CCWeatherGen Basefile Creator tool to transform your data into the correct format.

2.2. Obtaining the UKCIP02 climate change scenario data

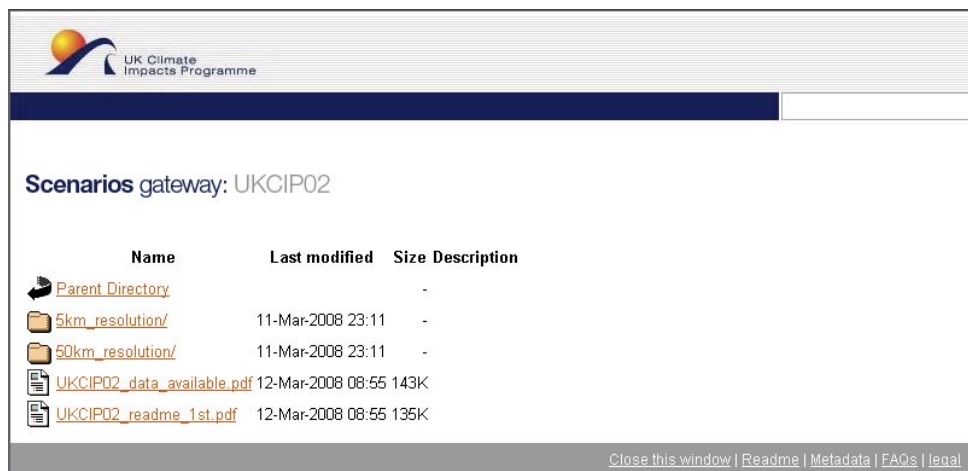
Please follow the steps below in order to download and install the required UKCIP02 data on your local hard drive.

Step 1 – Applying for a license

Open your web browser and go to <http://www.ukcip.org.uk/scenarios/> to open the UKCIP Scenarios Gateway website. Click on '**UKCIP02**' on the main menu and then select '**Underlying model output**' on the left hand side of the webpage. On the following screen please click '**License application form**' in on the left hand side. Please follow the instructions on the screen. It may take up to 24 hours to receive your license details. If you do not receive a license confirmation you can call UKCIP on 01865 285717.

Step 2 – Accessing the UKCIP02 Scenarios Gateway

Once your application has been successful and you have received a confirmation email from UKCIP please reopen <http://www.ukcip.org.uk/scenarios/>. Select '**UKCIP02 underlying model output**' from the '**UKCIP02**' menu. Then select '**Data archive**' on the left hand side of the screen. Enter your username and password as quoted in the email sent to you by UKCIP and click '**Login**'. Click the button '**Click here to enter the UKCIP02 Data Archive**' at the bottom of the next page. You should see the following screen:



Step 3 – Downloading the files required for the CCWeatherGen tool

Download the two pdf files from the root directory by moving the cursor over the files and pressing the right mouse button. Then select '**Save Target As ...**' and save the files in the folder '**UKCIPdata**' inside the directory '**CCWeatherGen**' on your local hard drive. (The installation default path is '**C:\CCWeatherGen\UKCIPdata**'.) The files to download from the root directory are:

- UKCIP02_data_available.pdf
- UKCIP02_readme_1st.pdf

After saving the two files specified above open the '**50km_resolution**' folder on the UKCIP scenarios gateway webpage. Save the following file from this directory to the '**UKCIPdata**' folder on your hard drive by using the method described above:

- UKCIP02_50km_grid.pdf

PLEASE NOTE:

The UKCIP02 license application is compulsory if you want to use the UKCIP02 data! Please view the terms and conditions document before applying. The license agreement is available from the UKCIP website.

QUICK GUIDE:

Step 1

- (a) Go to <http://www.ukcip.org.uk/scenarios/>
- (b) Select '**UKCIP02**' from the main menu
- (c) Click '**Underlying model output**' on the left
- (d) Click '**License application form**' on the left
- (e) Follow the instructions

Step 2

- (a) Wait for UKCIP confirmation email
- (b) Go to <http://www.ukcip.org.uk/scenarios/>
- (c) Select '**UKCIP02**' from the main menu
- (d) Select '**Underlying model output**' on the left
- (e) Select '**Data archive**' on the left
- (f) Enter your username and password and click '**Login**'
- (g) Select '**Click here to enter the UKCIP02 Data Archive**'

Step 3

- (a) Download the two pdf files from the root to the '**UKCIPdata**' folder
- (b) Download the pdf file from the '**50km_resolution**' folder to the '**UKCIPdata**' folder
- (c) Download all files ending with '**.txt**' from the subdirectories '**DSWF**, '**MSLP**, '**PREC**, '**RHUM**, '**SPHU**, '**TCLW**, '**TEMP**, '**TMAX**, '**TMIN**, '**WIND**' to the '**UKCIPdata**' folder
- (d) Verify that the '**UKCIPdata**' folder contains 133 files

Stay inside the '*50km_resolution*' folder on the UKCIP scenarios gateway webpage. Download all the data files with the extension '*txt*' inside the following subdirectories to the '*UKCIPdata*' folder on your hard drive by using the method described above: (Do not create subdirectories inside your '*UKCIPdata*' folder).

- DSWF/ - MSLP/ - PREC/ - RHUM/ - SPHU/
- TCLW/ - TEMP/ - TMAX/ - TMIN/ - WIND/

The files are provided in a format like this: '*DSWF_HI_2020s_50km_monthly.txt*'. Please do not change the file names as the CCWeatherGen tool will not be able to read changed file names. You do not need to download the files with the extension '*zip*' as these are not used by the CCWeatherGen tool. After completing your downloads you should have 133 files inside the '*UKCIPdata*' folder on your local hard drive.

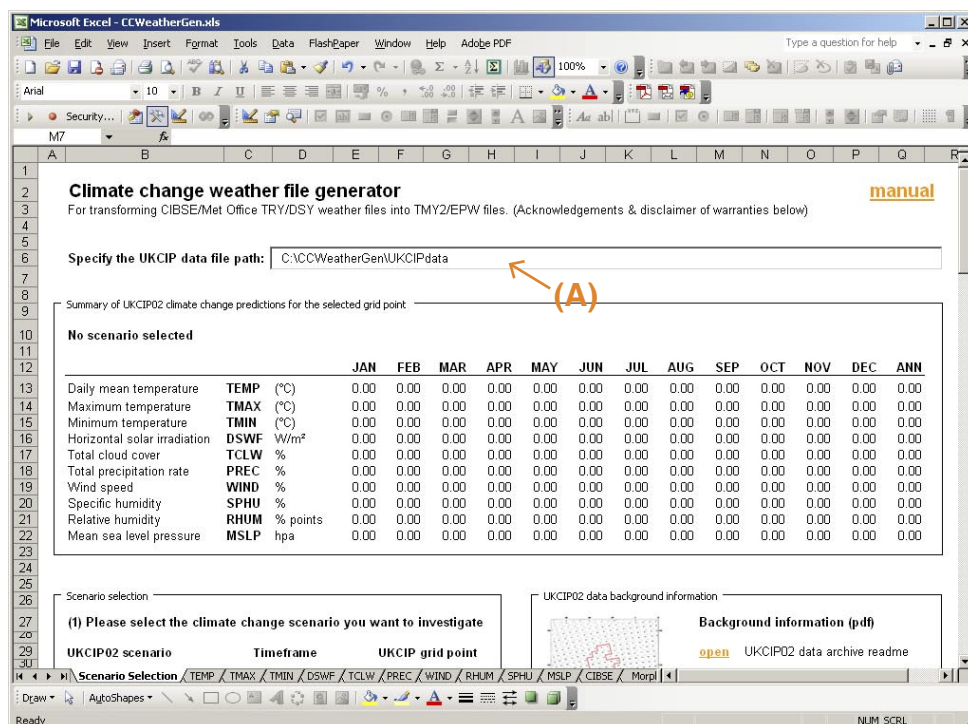
3. Creating climate change weather files from present day weather data

3.1. Permitting macros in Microsoft® Excel

Macros need to be permitted for CCWeatherGen to work. In Microsoft® Excel 2003 this needs to be done prior to opening CCWeatherGen. Please select '*Macro*' from the '*Tools*' menu. Select '*Security...*' and choose '*Low*' from the '*Security Level*' tab inside the message box. (You may wish to change the security level back after you have finished using the CCWeatherGen tool in order to prevent potentially unsafe macros from being executed on your system.) Now open CCWeatherGen. If you are using Microsoft® Excel 2007 please open CCWeatherGen and select '*Options...*' at the end of the '*Security Warning*' message in the task bar. Inside the following message box select '*Enable this content*' and click '*OK*'.

3.2. Getting started

After closing the entry splash-screen your screen should look as shown below. Please make sure that the UKCIP data file path (A) corresponds to the location to which you have downloaded the UKCIP02 data in section 2. (The default path is '*C:\CCWeatherGen\UKCIPdata*'.)



IMPORTANT - PLEASE NOTE:

The required UKCIP02 files cannot be downloaded in a bundle. You have to manually download them file by file as described in step 3. All UKCIP02 files specified in this document **MUST** be downloaded, otherwise the CCWeatherGen tool may not work! All files **NEED** to be inside the '*UKCIPdata*' directory on your local hard drive. Do not create subdirectories!

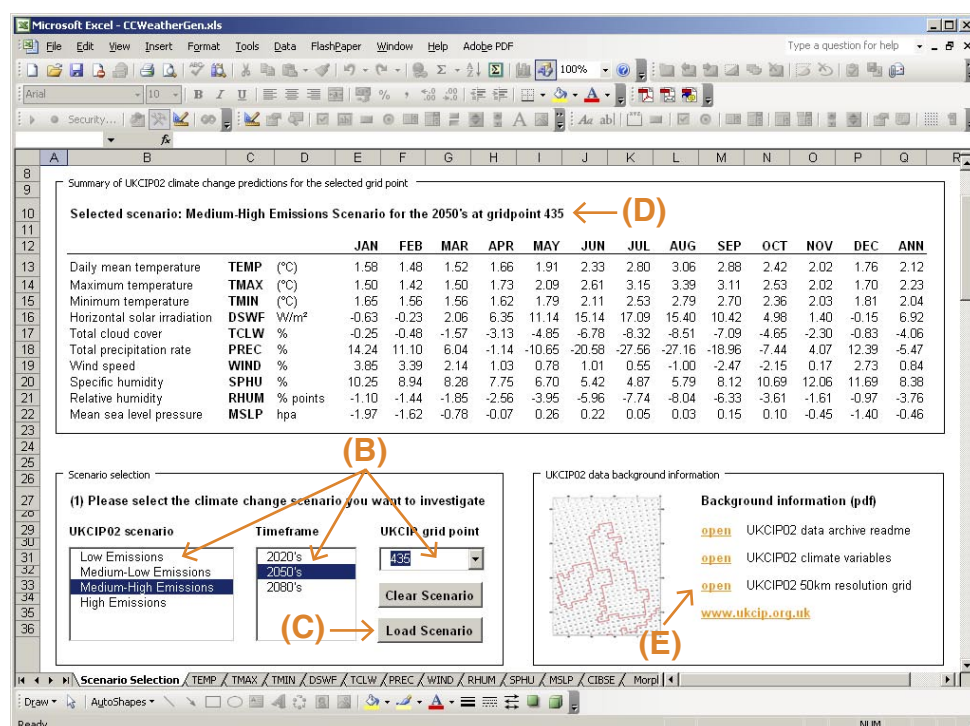
QUICK GUIDE:

(A)
Check whether the UKCIP data path is correct

3.3. Selecting a UKCIP02 climate change scenario

Select a UKCIP02 scenario and a timeframe in the '*Scenario selection*' box and choose the UKCIP grid point that corresponds to the CIBSE/Met Office weather station you want to use for transforming present day data into climate change data (B). Table 1 gives a list of the available CIBSE/Met Office weather stations and their corresponding UKCIP02 grid points. Click '*Load Scenario*' (C). The CCWeatherGen tool loads the required UKCIP02 data and returns the monthly climate change predictions for the selected grid point to the '*Summary*' box above the '*Scenario selection*' box (D). The example below shows the return values for Southampton for the medium-high emissions scenario in the 2050's.

For more information on the UKCIP02 data please open the pdf links specified inside the '*UKCIP02 data background information*' box to the right of the '*Scenario selection*' box (E).



PLEASE NOTE:

Instead of selecting a UKCIP02 grid point that corresponds to a CIBSE/Met Office weather station you may also select the UKCIP02 grid point that corresponds to your true location. However, this method is **NOT RECOMMENDED**.

QUICK GUIDE:

(B) Select UKCIP02 scenario, timeframe and UKCIP02 grid point

(C) Click '*Load Scenario*' to load scenario data

(D) Monthly predictions for climate change are returned to the '*Summary*' box

(E) Optional: Open help files for background information on UKCIP02 data

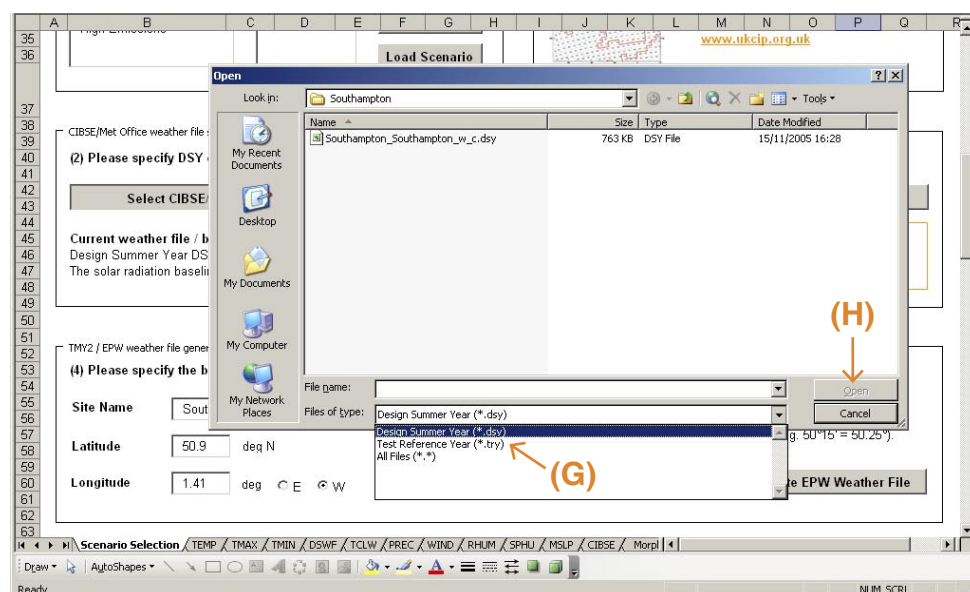
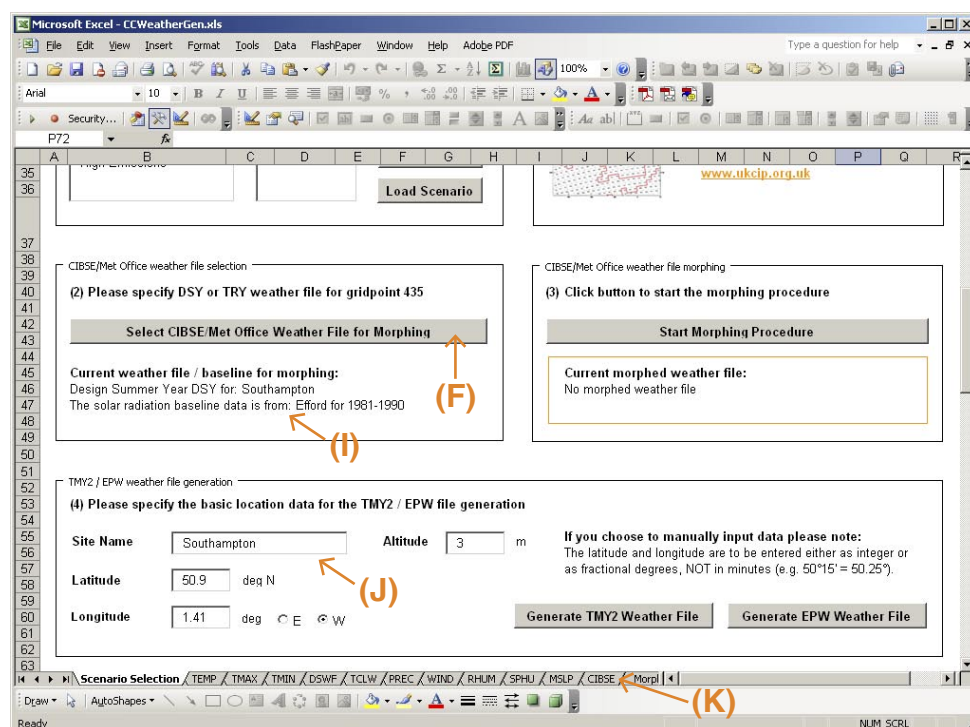
Table 1 - CIBSE/Met Office weather stations and corresponding UKCIP02 grid points

City	Met Office weather station	Latitude [°]	Longitude [°]	Corresponding UKCIP02 grid point
Belfast	Aldergrove	54.66 N	6.22 W	232
Birmingham	Elmdon	52.45 N	1.74 W	353
Cardiff	Rhoose	51.40 N	3.34 W	390
Edinburgh	Turnhouse	55.95 N	3.35 W	198
Glasgow	Abbotsinch	55.87 N	4.43 W	197
Leeds	Leeds w.c.	53.80 N	1.56 W	296
London	Heathrow	51.48 N	0.45 W	415
Manchester	Ringway	53.36 N	2.28 W	314
Newcastle	Newcastle w.c.	54.98 N	1.60 W	257
Norwich	Coltishall	52.76 N	1.36 E	357
Nottingham	Nottingham w.c.	53.01 N	1.25 W	334
Plymouth	Plymouth w.c.	50.35 N	4.12 W	431
Southampton	Southampton w.c.	50.90 N	1.41 W	435
Swindon	Boscombe Down	51.16 N	1.75 W	392

3.4. Selecting a CIBSE/Met Office weather file

Click the button '*Select CIBSE/Met Office Weather File for Morphing*' in the '*CIBSE/Met Office weather file selection*' box (F). The standard 'Open' window appears. Choose the type of weather file you want to load in the '*Files of Type*' dropdown list at the bottom of the 'Open' window. Possible file types are '*Design Summer Year (*.dsy)*' and '*Test Reference Year (*.try)*' (G). Select a weather file from your hard drive that corresponds to your selected UKCIP02 grid point and click the '*Open*' button (H). Loading the file may take a few minutes as some calculations are conducted while loading.

Basic information on the loaded file such as weather station name and file type is displayed in the '*CIBSE/Met Office weather file selection*' box (I). The exact location details of the weather station (latitude, longitude, altitude) are displayed in the '*TMY2/EPW weather file generation*' box (J). The loaded weather file data may be viewed by clicking the '*CIBSE*' worksheet tab (K).



PLEASE NOTE:

If, in section 3.3, you have not selected the UKCIP02 grid point that corresponds to the loaded CIBSE/Met Office weather station but have chosen to use an individual UKCIP grid point, then you **NEED** to enter your location specific site name, latitude, longitude and altitude in the '*TMY2/EPW weather file generation*' box. Otherwise the calculations performed for TMY2 and/or EPW weather file generation will not be correct!

QUICK GUIDE:

(F) Click '*Select CIBSE/Met Office Weather File for Morphing*' to load a weather file

(G) Choose which file type you want to load: DSY or TRY

(H) Click '*Open*' to load the selected weather file

(I) Basic weather file information is returned to the '*CIBSE/Met Office weather file selection*' box

(J) Exact weather station location details are returned to '*TMY2/EPW weather file generation*' box

(K) Optional: Click the '*CIBSE*' worksheet tab to view the loaded weather data

3.5. Morphing a CIBSE/Met Office weather file

Before you are able to create a TMY2 or an EPW file, the original CIBSE/Met Office weather file needs to be 'morphed' using the loaded UKCIP02 scenario data. In order to start this procedure click the button '*Start Morphing Procedure*' in the '*CIBSE/Met Office weather file morphing*' box (L). The morphing calculations may take several minutes.

Basic information on the morphed weather file such as weather station name, file type and climate change scenario information is displayed in the '*CIBSE/Met Office weather file morphing*' box (M). The morphed weather data may be viewed by clicking the '*Morphed Weather*' worksheet tab (N).

QUICK GUIDE:

(L)
Click '*Start Morphing Procedure*' to start morphing

(M)
Basic information about the morphed weather file is returned to the '*CIBSE/Met Office weather file morphing*' box

(N)
Optional: Click the '*Morphed Weather*' worksheet tab to view the morphed weather data

(O)
Click '*Generate TMY2 Weather File*' or '*Generate EPW Weather File*' to create a TMY2 or an EPW file ready for use in simulation programs

3.6. Generating a TMY2 or an EPW weather file

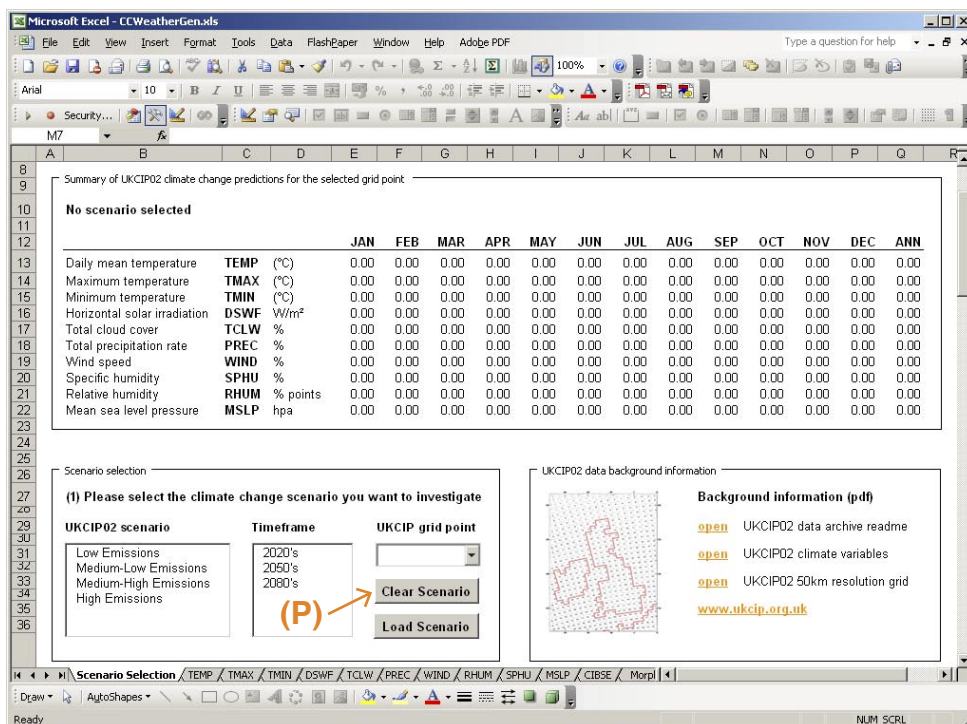
Please click '*Generate TMY2 Weather File*' or '*Generate EPW Weather File*' in the '*TMY2/EPW weather file generation*' box (O). The weather file generation may take several minutes. On completion you will be prompted whether you want to save the weather file. It is recommended to save the file as suggested and to accept the proposed filename. Your TMY2 or EPW file is now ready for use with standard building performance simulation software packages.

3.7. Generating an 'unmorphed' TMY2 or EPW file

The CCWeatherGen tool allows you to transform CIBSE/Met Office TRY/DSY weather files into TMY2 and EPW files without 'morphing' them according to climate change predictions. To do this please make sure that no climate change scenario is loaded! (The '*Summary*' box needs to contain 0 values.) To unload a climate change scenario click '*Clear Scenario*' in the '*Scenario selection*' box (P). Then follow the instructions of sections 3.4 to 3.6 to generate your 'unmorphed' weather file. (This includes the instructions of section 3.5 as some essential calculations are conducted when clicking the button '*Start Morphing Procedure*'.)

TIP - PLEASE NOTE:

The Department of Architecture and Urban Design at the University of California, Los Angeles provides a free tool that can be used to graphically display EPW weatherfile information. This tool termed Climate Consultant 3 can be downloaded from: <http://www2.aud.ucla.edu/energy-design-tools/>



4. Underlying methodology of the CCWeatherGen tool

The intention of this manual is to describe the use of the CCWeatherGen tool. The core calculation methodology used for this tool is based on previous work published by CIBSE (2,3). Some basic information on key literature used for creating the CCWeatherGen tool can be found in the acknowledgements and references at the end of this document. A journal paper detailing the underlying methodology of the weather file generation tool was published in December 2008 in 'Energy and Buildings':

Jentsch MF, Bahaj AS, James PAB. Climate change future proofing of buildings – Generation and assessment of building simulation weather files. Energy and Buildings 2008; 40 (12): 2148-2168.

Please contact the authors if you require more information or check the publications section on the website of the Sustainable Energy Research Group at the University of Southampton (<http://www.energy.soton.ac.uk>).

5. Troubleshooting

(a) I cannot click any button or field in the 'Scenario Selection' worksheet!

Macros are not permitted. Please follow the descriptions in section 3.1 to permit macros. If you are using Microsoft® Excel 2003 you need to close the CCWeatherGen tool and reopen it after permitting macros.

(b) I receive an error message whilst loading the UKCIP02 weather data!

Close the error message. Check whether you have downloaded all the required UKCIP02 data and whether the path indicated at the top of the 'Scenario Selection' worksheet is correct. If you answer 'yes' to both of these points then click through the worksheets 'TEMP' to 'MSLP'. The first worksheet containing 0 values only is the parameter that causes the failure. Check inside the 'UKCIPdata' directory on your hard drive whether the required UKCIP02 file has been downloaded and whether it has got the correct filename. (To download the file, follow the descriptions in section 2.2.)

QUICK GUIDE:

(P)

Click 'Clear Scenario' to unload previous climate change data (applies if you want to create an 'unmorphed' weather file)

IMPORTANT - PLEASE NOTE:

The baseline timeframe to which the relative changes of the UKCIP climate change scenarios compare is the time period from 1961 to 1990 (1). However, the current CIBSE/Met Office TRY/DSY weather data set, which dates from 2005, was compiled from weather data of the years 1983 to 2004 (13). This means that the weather files resulting of the CCWeatherGen tool will **OVERESTIMATE** climate change impacts since the changes of the UKCIP02 scenarios relative to the 1970's are used on weather data from the 1990's. Therefore, the resulting files can be expected to represent time-slices later than the UKCIP climate change timeframes. However, it was decided to keep the UKCIP timeframe labels to avoid confusion. The user of this tool should be aware of this fact when using it.

(c) I clicked 'Cancel' after generating my TMY2/EPW file. How can I save the file now?

The file cannot be saved directly from the main workbook. Please click '*Generate TMY2 Weather File*' or '*Generate EPW Weather File*' a second time and save the file when prompted.

6. Known issues with the tool in simulation programs

(a) My simulation program shows different values for the direct normal radiation and the global radiation if I compare an 'unmorphed' CIBSE file generated with the CCWeatherGen tool to the CIBSE / Met Office file I normally use!

This issue is believed to be caused by small differences in the calculation routines that have been used to generate direct normal radiation by the CCWeatherGen tool as compared to your simulation program. This causes different values in particular for a low standing sun in the early and late hours of the day. Solar radiation calculations within this tool are based on CIBSE Guide J (13). A comparison of the differences in radiation data as shown by some simulation programs revealed a difference in the annual average of typically around 1%. This is considered to be acceptable.

(b) In my simulation program some parameters of the CCWeatherGen data (e.g. dry bulb temperature) appear to be one hour out of phase with the CIBSE / Met Office file I normally use!

The CCWeatherGen tool retains the data lines as provided in the original CIBSE / Met Office file. This means that, for example the dry bulb temperature and the global horizontal radiation given for a particular hour form the same pair as in the original CIBSE file. (Please note that the file convention of a CIBSE file is 0 to 23 hours and for a TMY2 / EPW file 1 to 24 hours. This means that a data point listed under 8.00 h in the original CIBSE / Met Office file will be listed under 9.00 h in the file generated by the CCWeatherGen tool.)

7. Copyright and licensing notes

The original TRY/DSY weather files used for generating climate change weather files with the CCWeathergen tool are copyrighted material from CIBSE/Met Office (<http://www.cibse.org> & <http://www.metoffice.gov.uk>). Therefore, generated weather files can only be used by persons or entities who possess the corresponding licensed CIBSE/Met Office weather files. The user of the CCWeatherGen tool takes the sole responsibility of complying with the terms and conditions of the 'CIBSE/Met Office Weather Data Licence Agreement'. TRY/DSY data/licenses can be purchased from the CIBSE bookshop via the CIBSE website. Furthermore, the user of the CCWeatherGen tool takes the sole responsibility of complying with the terms and conditions of the 'License Agreement of the UKCIP02 Climate Scenarios Dataset' which is available on UK Climate Impacts Programme (UKCIP) data archive website (<http://www.ukcip.org.uk/scenarios>).

8. Disclaimer of warranties

The entire risk as to the quality, accuracy and performance of the climate change weather data calculated with the CCWeatherGen tool is with you. In no event will the authors of the weather file generation tool be liable to you for any damages, including without limitation any lost profits, lost savings, or other incidental or consequential damages arising out of the use or inability to use the tool and/or its generated data.

9. Acknowledgements

The authors gratefully acknowledge the UKCIP02 climate change scenario data by the UK Climate Impacts Programme (UKCIP) (1) which is required for this tool and can be downloaded from the UKCIP data archive website (<http://www.ukcip.org.uk/scenarios>). (© Crown Copyright 2002. The UKCIP02 Climate Scenario data have been made available by the Department for Environment, Food and Rural Affairs (DEFRA). DEFRA accepts no responsibility for any inaccuracies or omissions in the data nor for any loss or damage directly or indirectly caused to any person or body by reason of, or arising out of any use of, this data.)

The TRY/DSY weather file morphing methodology for generating climate change weather data developed by Belcher, Hacker and Powell (2,3) which formed the basis for this weather file generator tool is gratefully acknowledged. Special thanks go to Linda Lawrie and Drury Crawley for providing guidance on the appropriate ground temperature equations for generating EPW files. Furthermore the work of the following people / institutions that was key to compiling this weather file generator tool is also gratefully acknowledged: the ASHRAE psychrometric formulae (4), the TMY2 weather file manual by Marion and Urban (5), the EPW weather data description by Crawley, Hand and Lawrie (6), the all sky model for calculating downwelling longwave radiation by Crawford and Duchon (7), the models for calculating illuminance and sky luminance parameters from radiation data by Perez, Ineichen, Seals, Michalsky and Stewart (8), the Meteonorm weather software version 6.0 which was used to generate average monthly global horizontal radiation baseline data for the CIBSE/Met Office weather sites (9), the ground temperature equation by Kusuda and Achenbach (10), the paper on TRY / DSY file generation by Levermore and Parkinson (11), the optical air mass tables provided by Kasten and Young which were used for calculating illuminance and sky luminance parameters (12) and CIBSE Guide J which was used for calculating direct normal solar radiation (13).

The self extracting download file was generated using FreeExtractor v1.44 (14).

Aspects of this work were undertaken within the Sustainable Urban Environment (SUE) programme funded by the UK Government Engineering and Physical Sciences Research Council (EPSRC). Project: Innovation in Design, Construction & Operation of Buildings for People (IDCOP), Partners: ARUP, University of Greenwich, University of Reading, University of Southampton.

10. References

- (1) Hulme M, Jenkins GJ, Lu X, Turnpenny JR, Mitchell TD, Jones RG, Lowe J, Murphy JM, Hassell D, Boorman P, McDonald R, Hill S. *Climate Change Scenarios for the United Kingdom: The UKCIP02 Scientific Report*. Norwich, UK: Tyndall Centre for Climate Change Research, School of Environmental Sciences, University of East Anglia, 2002.
- (2) Belcher SE, Hacker JN, Powell DS. Constructing design weather data for future climates. *Building Services Engineering Research and Technology* 2005; 26 (1): 49-61.
- (3) CIBSE. *Climate change and the indoor environment: impacts and adaptation, CIBSE TM36*, London: The Chartered Institution of Building Services Engineers, 2005.
- (4) ASHRAE. *Chapter 6 - Psychrometrics. ASHRAE Handbook - Fundamentals*. Atlanta: American Society of Heating Refrigerating and Air-Conditioning Engineers, 2005.
- (5) Marion W, Urban K. *User's Manual for TMY2s - Typical Meteorological Years*. Golden, Colorado, USA: National Renewable Energy Laboratory 1995.

CONTACT DETAILS:

University of Southampton
School of Civil Engineering and
the Environment
Sustainable Energy Research Group

Highfield
Southampton, SO17 1BJ, UK

Email: serg@soton.ac.uk
Web: www.energy.soton.ac.uk

AUTHORS:

Mark F. Jentsch
AbuBakr S. Bahaj
Patrick A.B. James

-
- (6) Crawley DB, Hand JW, Lawrie LK. Improving the weather information available to simulation programs. *Building Simulation '99 Conference*. Kyoto, Japan; 1999.
- (7) Crawford TM, Duchon CE. An improved parameterization for estimating effective atmospheric emissivity for use in calculating daytime downwelling longwave radiation. *Journal of Applied Meteorology* 1999; 38 (4): 474-480.
- (8) Perez R, Ineichen P, Seals R, Michalsky J, Stewart R. Modelling Daylight Availability and Irradiance Components from Direct and Global Irradiance. *Solar Energy* 1990; 44 (5): 271-289.
- (9) Meteororm 6.0. Meteotest. <http://www.meteotest.ch>
- (10) Kusuda T, Achenbach PR. Earth temperature and thermal diffusivity at selected stations in the United States. *ASHRAE Transactions* 1965; 71 (1): 61-74.
- (11) Levermore GJ, Parkinson JB. Analyses and algorithms for new Test Reference Years and Design Summer Years for the UK. *Building Services Engineering Research and Technology* 2006; 27 (4): 311-325.
- (12) Kasten F, Young AT. Revised optical air mass tables and approximation formula. *Applied Optics* 1989; 28 (22): 4735-4738.
- (13) CIBSE. *CIBSE Guide J - Weather, solar and illuminance data*. London: The Chartered Institution of Building Services Engineers, 2002.
- (14) FreeExtractor v1.44. Disoriented Labs. <http://www.disoriented.com>