



# CCAM GUI INSTRUCTION MANUAL FOR TAPM USERS (v1004t)

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## 1. INTRODUCTION

This document describes the use of the Conformal-Cubic Atmospheric Model (CCAM) and its Graphical User Interface (GUI) for generating weather forecasts and how that data can be transferred to The Air Pollution Model (TAPM). Please note that this version of CCAM will only output TAPM synoptic files for a fixed region (e.g., Australia). As a result, some functions are disabled on the GUI since they have no effect in this version of CCAM.

CCAM is a global atmospheric model that is capable of producing 8 day weather forecasts. CCAM is very efficient in its use of CPU and memory resources, to the extent that the CCAM software can be run on a standard laptop computer. The purpose of the CCAM GUI is to facilitate the preparation, running and post-processing of CCAM weather forecasts. The GUI is designed to run continually on its designated machine (i.e. left running whenever possible). In this way, the CCAM software will automatically update its forecasts and synoptic files for TAPM.

This manual is focused on the operation of the CCAM GUI and the creation of TAPM synoptic files. The manual is divided into four sections as outlined below:

- Section 2 provides instructions for installing CCAM;
- Section 3 provides an introduction to basic CCAM capabilities. This section is applicable for new users;
- Section 4 describes configuration options and advanced functions with CCAM. This section is relevant for advanced users;
- Section 5 provides some CCAM background information. While not required for running CCAM, the discussion is of use when employing advanced CCAM features.

The information in this manual should not be considered a detailed discussion of the numerical techniques employed by CCAM, nor an in-depth description of meteorology. Rather, this document concentrates on the use of CCAM (via the GUI) so as to enable the user to verify that a forecast has completed correctly and to diagnose technical problems if they should occur (e.g. internet connection problems).

The author would like to thank Julie Noonan and Mary Edwards for their constructive comments during the writing of this manual.

### 1.1 CCAM version history

The following list describes the history of changes made to the latest version of CCAM

#### 1.1.1 CCAM v1001

- Implemented SEA-ESF radiation scheme
- Reinstated Autorun option in Output menu;
- Fixed sea ice bug when using data from previous forecast.

#### 1.1.2 CCAM v910

- Improved dynamical balancing of top atmospheric level when initialising CCAM;
- Improved coupling to the CABLE land-surface scheme;
- Improvements to the CCAM convection scheme;
- Inclusion of a mixed layer ocean scheme;

- Soil & ocean data is archived so that manual forecasts can reproduce results of automatic forecasts;
- Frequency of calls to radiation scheme can be changed by the user;
- Implemented TKE-eps turbulence closer for vertical mixing;
- Modified horizontal diffusion to use Smagorinsky formulation;
- Improved soil dataset;
- Improved estimate of screen level diagnostics for CABLE;
- Code optimisation to orography and analysis processing routines.

### 1.1.3 CCAM v810

- Removal of menu options which are not applicable to TAPM uses (e.g., nudging options, minimum forecast scale, GIF animation output, etc.)
- Removal of rarely used options from the Parameters screen (Configure menu), including Percent Bar update time and Map File Name. These options can still be changed in ccamset.dat;
- Limit the maximum time interval to 12 hours in the Parameters screen (Configure menu), which prevents the user from accidentally eliminating the diurnal cycle in TAPM synoptic files;
- Inclusion of multiprocessor options for CCAM (Configure menu), described in Section 4.2.3;
- Replacement of the SiB/Graetz (120 km/6 km), Ecosystems (1 km) and SiB (1 km) land-surface dataset options with the standard land-surface scheme and CABLE land-surface scheme options (Configure menu), described in Section 4.2.5;
- Replacement of the hindcast option with the dynamic balancing initialisation option (Configure menu), described in Section 4.2.6;
- Inclusion of 27 (vertical) levels option in addition to the original 18 levels option (Configure menu), described in Section 4.2.7;
- Ability to download analyses 2 times per day and 4 times per day (Download menu);
- Removal of unused option for custom generation of land-use data (Output menu);
- Removal of the autorun program after forecast option (Output menu). This option can still be accessed from the guiset.dat file in the c:\ccam directory;
- Removal of the rarely used reporting of the output grid size and spacing option (GUI menu). This option can still be changed in guiset.dat;
- Improvements to the CCAM convection scheme;
- Improvements to the Helmholtz solver which reduces the total running time;
- Improvement of cloud overlap properties in CCAM radiation scheme

## 2. INSTALLING CCAM

Before starting the CCAM GUI, users will need to install the CCAM software. This is achieved by running the CCAM setup.exe installation program.

- After double clicking on the setup.exe, a window similar to that in Figure 2.1 will appear.

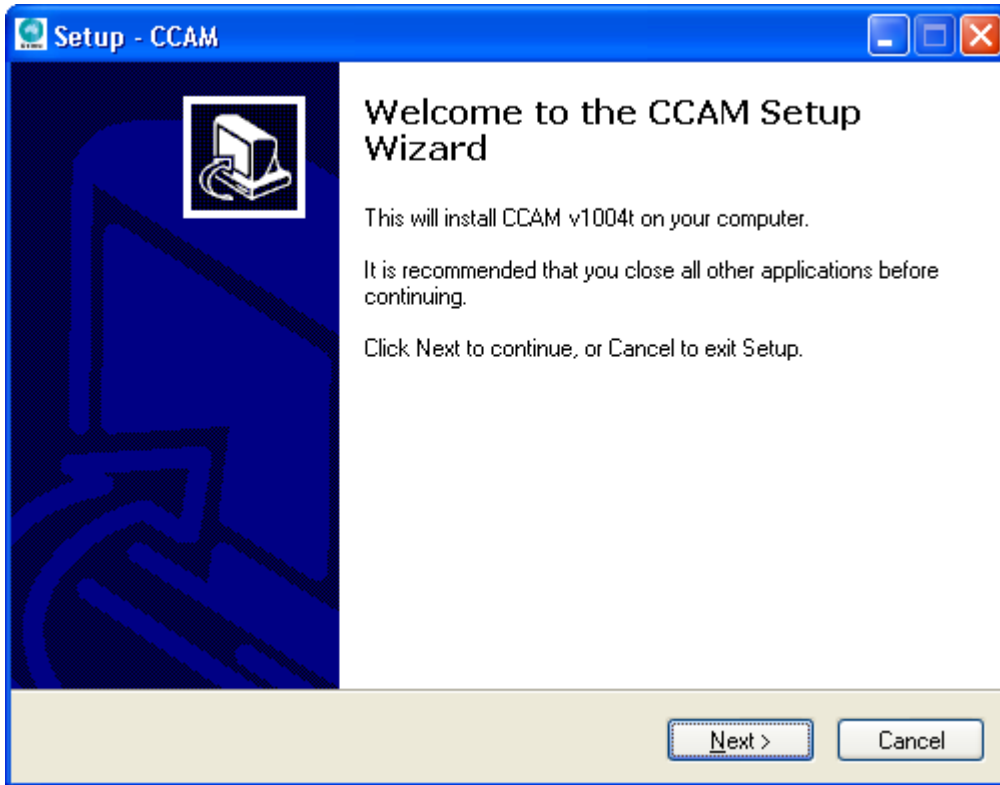


FIGURE 2.1: Example of the CCAM setup window which appears after double clicking on the setup.exe CCAM installation software.

- Follow the setup.exe prompts to install CCAM. Simply choosing 'Next' at each prompt will ensure that CCAM is installed with its default configuration.
- Once the Installation is finished, CCAM can be started by selecting the CCAM icon from the desktop, the CCAM folder under the Programs Menu (see Windows Start) or alternatively by starting STARTCCAM under the c:\ccam default directory.
- To use the 2 or 3 processor version of CCAM, the user must also install the following third-party software that is available on the CCAM installation CD
  - mpich2-1.0.5-win32-ia32.msi (for MPICH2)

**PLEASE NOTE: CCAM is designed to run only a single copy at a time. Running multiple copies of CCAM simultaneously can produce incorrect results.**

Details on the basic operation of the GUI are described in Section 3.

### 3. BASIC CCAM GUI FUNCTIONS

This section describes the basic CCAM capabilities. By following this section, the user should acquire sufficient basic skills to generate a CCAM weather forecast (e.g. in preparation for use by TAPM). More detailed information concerning advanced functions of the GUI can be obtained from Section 4.

In particular, this section concentrates on the following tasks:

- Components of the GUI (Section 3.1);
- Updating CCAM initial conditions (Section 3.2);
- Starting the CCAM weather forecast (Section 3.3);
- Aborting the forecast and exiting CCAM (Section 3.4);
- Locating the output TAPM synoptic files (Section 3.5).

Note that for this version of CCAM, the updating of initial conditions and the running of the forecast will happen automatically as long as the CCAM GUI is running. In this case it is only necessary for the user to locate the output TAPM synoptic files (see Section 3.5).

#### 3.1 Components of the CCAM GUI

CCAM can be started by selecting the CCAM icon from the desktop, the CCAM folder under the Programs Menu (see Windows Start) or alternatively by starting STARTCCAM under the c:\ccam default directory. After starting CCAM, an initialisation screen is displayed for a short period of time after which the main display will appear as depicted in Figure 3.1.

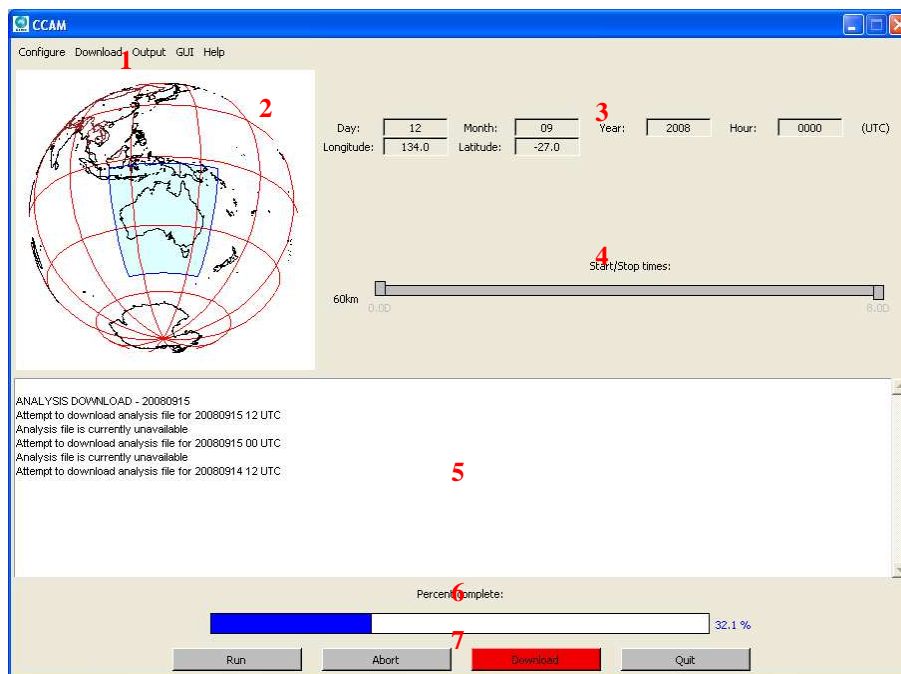


FIGURE 3.1: Example of the CCAM GUI. The red numbers indicate the different components of the GUI: (1) Menu options, (2) Map, (3) Analysis file date and longitude/latitude indicator, (4) Forecast start and stop time sliders, (5) Log, (6) Percent bar and (7) CCAM control buttons.

In Figure 3.1, there are seven numbers that indicate different components of the CCAM GUI. The purpose of these components is summarised in Table 3.1.



Number	Component
1	Menu options for configuring the CCAM GUI including features for advanced users.
2	The map display indicating the location of the CCAM weather forecast. The forecast location cannot be changed by the user in this version of CCAM.
3	Date, time and location indicators. The date and time correspond to the last analysis file downloaded (i.e. observed weather conditions. See Section 3.2). The longitude and latitude corresponds to the location shown by the map.
4	Sliders to control forecast start and stop times. In this version of CCAM the length of the forecast is fixed at 8 days.
5	Log containing text messages that describe the current status of the CCAM forecast.
6	Percent bar denoting what fraction of the forecast has been completed. This is also used to indicate the amount of analysis file that has been downloaded.
7	CCAM control buttons for starting the forecast, aborting, downloading analysis files and exiting the GUI.

TABLE 3.1: Summary of CCAM GUI components as shown in Figure 3.1. The analysis file contains observed weather conditions and is discussed in Sections 3.2 and 5.2.1.

Note that all messages that appear in the CCAM log window (item 5 in Figure 3.1) are also recorded in the text file `c:\ccam\ccam.log`. New log messages are continually appended to this file along with the date and time when the message occurred.

For TAPM users, the CCAM forecast length is fixed at 8 days and the forecast resolution is limited to 60 km (i.e. to be downscaled to higher forecast resolutions by TAPM). As a consequence, the slider controls are permanently disabled and the location of the CCAM forecast cannot be changed. Nevertheless, TAPM can still be used with CCAM forecast data for any location within the CCAM forecast domain (e.g., any location within Australia). Note that CCAM can be configured to forecast for locations other than Australia, although the forecast location needs to be specified when purchasing a CCAM license. Under these circumstances, the user will be supplied with a `topout0` file that, when placed in the `c:\ccam\newtop` directory, will reconfigure CCAM for the user specified forecast location.

### 3.2 Download mode

After the CCAM GUI has been started, the first task is to ensure that the initial weather conditions are up-to-date. Observed weather conditions are available from several meteorological centres in the form of an ‘analysis’. These analyses are data files that contain a self consistent description of the observed weather for the entire globe at a given time (see Section 5.2.1). However, different meteorological centres use different algorithms to integrate the observed weather data into an analysis and therefore analysis products can differ slightly between centres. The analysis files that CCAM can use include:

- GASP 1deg analysis provided by the Australian Bureau of Meteorology;
- GFS 1deg analysis from the U.S. National Centre for Environmental Protection (NCEP);
- GFS 0.5deg analysis from NCEP.

The latest analysis file can be obtained for CCAM by clicking on the Download button. This activates Download mode as indicated by the Download button flashing red (see Figure 3.1).

**PLEASE NOTE: CCAM users must make their own arrangements with the relevant government agencies to ensure that analyses data files are available for downloading. However, GFS analyses are provided by NCEP as a free service (see CCAM default download settings in Section 4.2.2).**

**PLEASE NOTE: Download mode searches for analysis files starting from the date specified by the computer’s clock. Therefore, it is important that the computer’s date setting is correct. CCAM will automatically add 12 hours to the computer’s clock time so as to compensate for different time zones.**

Download mode is also activated when the GUI is first started and every 60 mins thereafter (by default). Hence, as long as the GUI is left running, the analysis file will be kept up-to-date. CCAM

will not download a new analysis file if a forecast is currently running (see Section 3.3) or if a user specified analysis file is selected (see Section 4.3.1).

As CCAM searches for a new analysis file, its progress is reported in the log area of the GUI. Some examples of log text are shown in Figure 3.2.

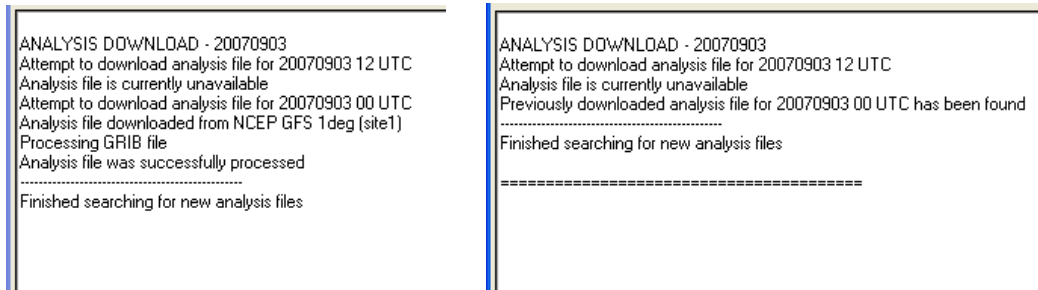


FIGURE 3.2: Examples of log text during Download mode. The left example describes when a new analysis file is found and downloaded. The right example shows the case where the existing analysis file is already up-to-date.

If a new analysis file is found, then the 'percentage bar' will begin to increase, indicating the fraction of the analysis file that has been downloaded so far (see Figure 3.1). Usually, a new analysis file is downloaded in a few minutes, depending on the speed of the internet connection. Once the downloading of the analysis file is complete, the Download button will stop flashing red.

### 3.3 Run mode

To start a CCAM forecast, click the Run button. The Run button will begin to flash green to signify CCAM is in Run Mode (see Figure 3.3). Note that if CCAM is currently in Download mode, the user must either wait for the download to finish, or abort the download (see Section 3.4).

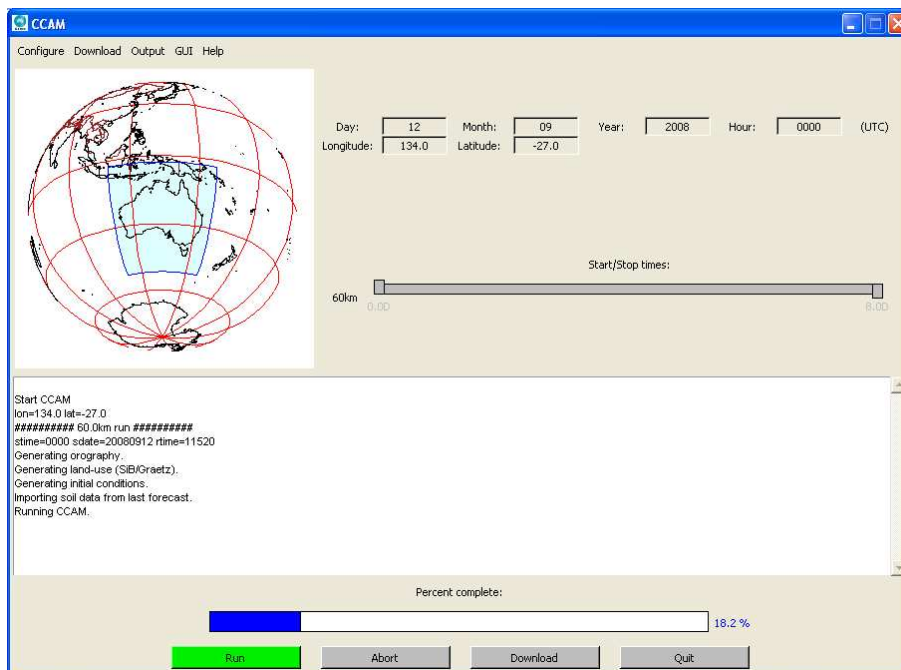


FIGURE 3.3: The CCAM forecast in Run mode. Note that the status of the forecast is indicated in the log area. Also fraction of the forecast which has completed is indicated by the percent bar.

The steps carried out during a CCAM forecast that are reported in the log are:

- Generate orography data;
- Generate land-use data;
- Generate initial conditions from the analysis file;
- Run CCAM to produce the weather forecast;
- Extract the forecast data;
- Store the data in TAPM synoptic database format.

Please note that warning messages may be generated during the forecast. For example, see Figure 3.4.

```
Start CCAM
lon=134.0 lat=-27.0
##### 60.0km run #####
stime=0000 sdate=20070903 rtime=11520
Generating topography.
Generating land-use (SiB/Graetz).
Generating initial conditions.
Importing soil data from climatology.
Running CCAM.
Time: 1844 seconds
Warning: Skipping zeroth time step in CCAM output
Postprocessing CCAM results.
```

FIGURE 3.4: Example of warning messages generated during the CCAM forecast. These warnings occur during normal operation and do not indicate errors.

These warning messages are part of the normal CCAM operation and do not indicate errors. The two main reasons for warning messages from CCAM are:

- The output file size has exceeded a user specified limit (so the resolution in time or space has been adjusted to reduce the file size);
- CCAM cannot optimise the start time of a forecast (see below).

Typically, CCAM begins its forecast prior to the prescribed start time so that it can update the physics calculations before having to output weather data. However, if the forecast start time is the same as the analysis time (as is the case of the 60 km forecast), then it is not possible for the CCAM forecast to start any earlier. In this case, a warning message is generated (as described in Figure 3.4) that informs the user that weather data will not be available for the initial time step. Note that, because the analysis is generally available 3 hours after the time it describes (see Section 5.2.1), the missing zeroth time step should never be needed for a real forecast.

As the CCAM weather forecast progresses, the fraction of the forecast that has completed is indicated by the percent bar. Forecasts are finished when the percent bar reaches 100% and the Run button stops flashing green.

### 3.4 Aborting the forecast and exiting CCAM

In addition to the Run and Download buttons, there is also an Abort button and a Quit button. The Abort button cancels Run or Download mode and changes CCAM back to Standby mode (i.e. no buttons are flashing). The Quit button aborts any current calculations and then exits the program. Using the Abort or Quit button results in the loss of any data created before quitting (i.e. a forecast cannot be continued from when it was aborted).

### 3.5 Locating synoptic data files for TAPM

By default, the synoptic data files created by CCAM for TAPM are stored under c:\CCAM\tapmout. Forecast files are labelled according to the forecast date and UTC time (i.e. always 00Z for TAPM) as

YYYYMMDD.glo

where YYYY is the year, MM is the month and DD is the day of the forecast (e.g. 20070714.glo for the 14<sup>th</sup> of July, 2007). Note that when a new forecast is run (e.g. the next day), the synoptic data files for TAPM are overwritten with the more recent forecast.

Once the TAPM synoptic files have been created by CCAM, TAPM users can follow the TAPM instructions (tapm\_v4\_forecasting\_guide.pdf) for importing these files into TAPM.

## 4. ADVANCED CCAM GUI FUNCTIONS

The CCAM GUI is designed to require the minimum intervention from the user and most operations can be understood from the basic tutorial in Section 3. However, under some circumstances, it may be necessary or advantageous to use some of the more advanced GUI options (e.g. a user specified analysis file for training purposes).

In this section we describe the advanced capabilities of the CCAM GUI in detail. In particular, this section describes:

- Configure menu (Section 4.2);
- Download menu (Section 4.3);
- Output menu (Section 4.4);
- GUI menu (Section 4.5);
- Help menu (Section 4.6);
- Basic CCAM trouble shooting (Section 4.7).

This section assumes that the user is familiar with the basic CCAM functions described in Section 3.

### 4.1 Using the menus

All CCAM options are accessible from the menus at the top left of the GUI (see Figure 4.1).

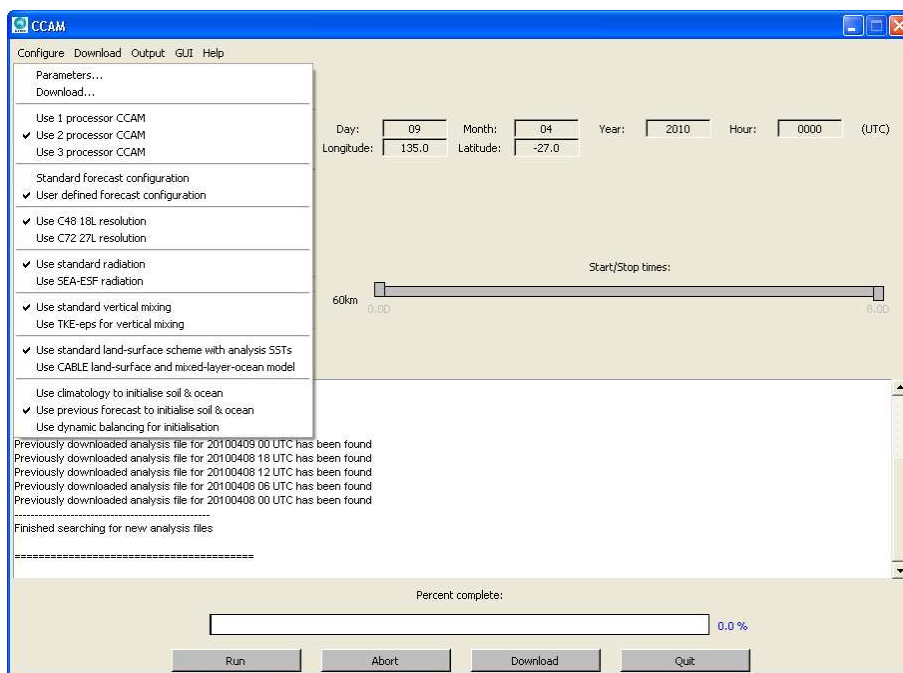


FIGURE 4.1: Example of the Configure menu. Note that all CCAM settings are available from the menus (located at the top left corner).

A tick to the left of an entry indicates the option specified by the entry is active. Entries ending in ‘...’ (e.g. ‘Parameters...’ under the Configure menu) will open a new window with additional controls for the user. The function of each entry in the menus is explained in Sections 4.2 to 4.5.

## 4.2 Configure menu

The Configure menu (see Figure 4.1) is used to access general parameters ('Parameters...') and download parameters ('Download...') windows. The function of these windows is explained in sections 4.2.1 and 4.2.2. The Configure menu also contains options for using multiprocessor versions of CCAM (Section 4.2.3) and for selecting either the standard or user defined forecast configuration (Section 4.2.4). When user defined forecast configuration is selected, the Configure menu allows the user to select land-use options (Section 4.2.5) and initialisation procedures (Section 4.2.6). Spectral nudging and minimum forecast resolution options are disabled since TAPM will be used to dynamically downscale the 60 km resolution CCAM forecast.

### 4.2.1 CCAM parameter settings

CCAM parameter settings can be accessed by selecting the 'Parameters...' entry under the Configure menu. Selecting the 'Parameters...' entry will open the parameters window as shown in Figure 4.2.

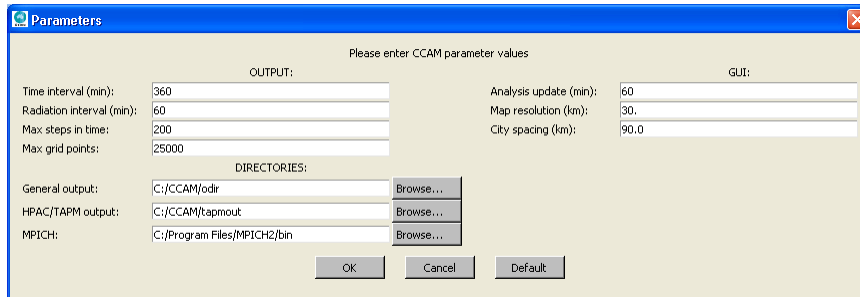


FIGURE 4.2: The parameters window used to change advanced CCAM configuration options. The parameters window is accessed by selecting the 'Parameters...' entry under the Configure menu.

The parameters window is only available while CCAM is in Standby mode (i.e., CCAM is not downloading an analysis or running a forecast). The parameters window is divided into three areas, indicated by OUTPUT, DIRECTORIES and GUI. At the bottom of the menu are OK, Cancel and Default buttons. The OK button closes the parameter window and stores any changes. The Cancel button also closes the window, but ignores any changes made after opening the parameters window. The Default button restores default settings for all entries in the parameters window.

For most entries contained in the parameters window the value must be typed. If an invalid value is entered into a parameter entry, the entry will briefly flash (black and white). However, in the case of directories, the adjacent Browse button can be used to open a 'Browse for Folder' dialogue.

In the following Sections we describe the function of each entry in the parameters window.

#### *Time interval*

This entry determines the times for which the CCAM will store weather data at multiples of the 'time interval'. For example, if the time interval is 60 mins, then CCAM will store forecast data at 60 minute intervals from the start of the forecast.

Note that CCAM will only use time intervals from the list in Table 4.1.

Valid time intervals
1 min
5 min
15 min
30 min
1 hour
3 hours
6 hours
12 hours

TABLE 4.1: List of valid time intervals that can be used by CCAM.

**NOTE: TAPM will only use output time intervals of 1 hour or greater. CCAM will still run with a smaller output time interval, but only hourly data will be stored in the TAPM synoptic files.**

If necessary, CCAM will adjust the time interval to the nearest valid value listed in Table 4.1. For example, if a time interval of 72 mins is entered, then CCAM will modify the time interval to 60 mins and issue a warning message.

If the ‘max steps in time’ is exceeded (see the next sub-section), then CCAM will automatically increase the time interval so that the number of steps in time is less than the maximum limit. In this event, CCAM will write a warning message to the log area of the GUI. Note that the adjusted time interval must be selected from the list of valid values shown in Table 4.1. If CCAM cannot identify a valid time interval that is consistent with the ‘max steps in time’, the ‘max steps in time’ will be increased and a warning message displayed in the CCAM log.

CCAM may also adjust the time interval (with accompanying warning message) to resolve internal inconsistencies in the forecast or to improve the forecast speed. Any changes made to the time interval are indicated by a warning message in the log area of the GUI.

### *Radiation interval*

The ‘Radiation interval’ entry determines the frequency of calls to the radiation scheme. By default, the radiation scheme is called once per hour. Nevertheless, the user can increase the frequency of calls to the radiation scheme by reducing the radiation interval. Note that CCAM will adjust the specified radiation interval to be consistent with the simulation time step. For this reason, we recommend using radiation intervals which are multiples of 20 mins (e.g., 60, 40 and 20 mins). The maximum valid radiation interval is 60 minutes.

### *Max steps in time and max grid points*

The ‘max steps in time’ and ‘max grid points’ fields are used to limit the size of the CCAM output files. The ‘max steps in time’ field denotes the maximum number of times CCAM will write data to an output file. If the ‘max steps in time’ is exceeded then CCAM will increase the time interval so as to reduce the file size. For example, in the case of an 8 day forecast, CCAM will increase the time interval to at least 3 hours if the maximum steps in time is set to 64 (i.e. 3 hrs x 64 = 8 days). In cases where CCAM cannot determine a valid time interval that is consistent with the ‘max steps in time’, then ‘max steps in time’ will be increased and a warning message will be displayed in the log area of the GUI. In a similar way the ‘max grid points’ entry limits the number of horizontal grid points (i.e. at the surface) in the output file. Normally, ‘max grid points’ is set at 20000 points and is only likely to be exceeded when running a forecast near the poles. Note that both the ‘max steps in time’ and ‘max grid points’ only effect the CCAM output and do not have any effect of the accuracy of the CCAM simulation itself.

## Directories

The general output and HPAC/TAPM output directories denote the location of data that is created by CCAM. The location of these directories can be changed by clicking the respective 'Browse...' button and then selecting a new directory. Note that directory entries are also used to specify the location of the GrADS, Image Magick and MPICH2 software packages (for generating animations of the forecast and for running CCAM on multiple processors), if the user has (optionally) installed these programs on their computer.

## Analysis update time

The 'analysis update time' field determines the frequency with which CCAM checks for new analysis files. Normally, the analysis update is set so that CCAM will search for new analysis files every 60 minutes. Decreasing this value will result in more frequent checks for the analysis files, but will also increase the amount of internet access. The minimum possible update time is 1 minute.

## Map resolution and city spacing

These options control the coastline resolution and density of displayed cities in the map graphic. Since the forecast location is fixed, these options have no significant effect in this version of CCAM.

### 4.2.2 CCAM download settings

The origin of the analysis files used by CCAM can be specified by selecting the 'Download...' entry under the Configure menu (see Figure 4.1). Selecting the 'Download...' entry will open the download window as shown in Figure 4.5.

The screenshot shows a window titled "Download" with a subtitle "Please enter CCAM download settings". The window is divided into six sections, labeled SITE 1 through SITE 6. Each section contains fields for Name, Command, Login, Directory, File name, and File type. SITE 1 and SITE 2 are configured for NCEP GFS 1deg data. SITE 3 is configured for NCEP GFS 0.5deg data. SITE 4, SITE 5, and SITE 6 are currently set to "Disabled". At the bottom of the window are buttons for "OK", "Cancel", and "Default".

Site	Name	Command	Login	Directory	File name	File type
SITE 1	NCEP GFS 1deg (site1)	ftp -in tgftp.ncep.noaa.gov	user ftp ftp	/pub/data/nccf/com/gfs/prod/gfs.%YYYY%MM%DD%-%H	gfs.t%HH%z.pgrbf00.grib2	GRIB
SITE 2	NCEP GFS 1deg (site2)	ftp -in tgftp.nws.noaa.gov	user ftp ftp	/SL.us008001/ST.opnl/MT.gfs_CY.%HH%/RD.%YYYY%MM%	fh.0000_ti.press_gr.1p0deg	GRIB
SITE 3	NCEP GFS 0.5deg	ftp -in tgftp.nws.noaa.gov	user ftp ftp	/SL.us008001/ST.opnl/MT.gfs_CY.%HH%/RD.%YYYY%MM%	fh.0000_ti.press_gr.0p5deg	GRIB
SITE 4	Disabled					NetCDF
SITE 5	Disabled					NetCDF
SITE 6	Disabled					NetCDF

FIGURE 4.5: The download window used to specify the source of analysis files. The download window is accessed by selecting the 'Download...' entry under the Configure menu.

The download window is divided into six areas, corresponding to six possible FTP sites for analysis files. Like the parameters window, the download window is only available while CCAM is in standby mode. Also, at the bottom of the menu are OK, Cancel and Default buttons which perform the same functions as described in Section 4.2.1.



In the following Sections we describe the function of each entry in the download window.

### *Name*

The name entry describes the origin of the analysis file. This text will appear in the Download menu (see Section 4.3.3) when the user specifies which of the four sites to use. By convention, unused sites are given the name 'Disabled'.

### *Command and login*

The command and login entries are used to specify the location of the File Transfer Protocol (FTP) server from which the analysis can be downloaded. The command field describes the command used to open a FTP connection with a server, i.e.

```
ftp -in ftp.ccam.au
```

would open a FTP connection to ftp.ccam.au. The login field describes the command used to login to the FTP sever, i.e.

```
user ftp ftp
```

It is useful to replace the second 'ftp' with a legitimate email address since then the user can be kept informed of changes made to the FTP server (e.g. changes to directory names), e.g.

```
user ftp john.smith@ccamworld.au
```

### *Directory and filename*

The directory and filename entries are used to specify the location of the analysis file on the FTP server. The directory should be described using the normal FTP conventions (e.g. a '/' to separate names along a directory path).

Sometimes it is necessary to include the date or time in the directory or filename. In this case the following tokens can be used as shown in Table 4.2:

Token	Description
%YYYY%	A four digit year (e.g. 2001).
%YY%	A two digit year (e.g. 01).
%MM%	A two digit month of year (e.g. 07 for July).
%DD%	A two digit day of month (e.g. 06).
%HH%	A two digit hour in UTC.
%BM%	Use BoM product code (e.g. 01007 for 06Z)

TABLE 4.2: Description of tokens that can be used in the directory or filename entries.

When a token from Table 4.2 appears in a directory or filename, the GUI will replace the token with an appropriate date or time when searching for a new analysis file. For example, the directory name

```
/pub/data/nccf/com/gfs/prod/gfs.%YYYY%MM%DD%HH%
```

will be converted to the following on the 25<sup>th</sup> January, 2005 at 12Z:

```
/pub/data/nccf/com/gfs/prod/gfs.2005012512
```

## *File type*

The entry for the file type is a drop down menu. To open the menu, left click on the menu box. There are two file types that can be selected:

- NetCDF
- GRIB

The type should be chosen to match the file format of the analysis to be downloaded. Incorrectly matched file types will generate error messages or corrupted data. The correct file type can be determined by contacting the appropriate FTP site administrator.

### **4.2.3 Multiprocessor options**

This option specifies the number of processors to use when running CCAM. This option is designed to allow the user to take advantage of dual processor or quad processor machines and requires MPICH2 to be installed on the computer (see CCAM installation CD). CCAM weather forecasts will run faster if more processors are used. Note that CCAM will still run if more processors are selected than exist on the computer, but instead CCAM will run slower due to the additional communication overhead between processors. Also, since the conformal cubic grid used by CCAM has six faces (see Section 5.1), there is no four processor version of CCAM.

### **4.2.4 Standard and user defined forecast configurations**

The Configure menu specifies two methods for optimising CCAM weather forecasts. Usually the Standard forecast configuration is selected which produces a forecast that is reasonably accurate while taking a reasonable period of time to calculate. Alternatively, User defined forecast configuration enables the user to specify their own land-use, downscaling and soil initialisation options which are explained in Sections 4.2.5 to 4.2.8. Note that the configuration options are arranged so that in each group of options the fastest (and sometimes less accurate) option is listed at the top of a group while the slowest option is listed at the bottom of a group.

### **4.2.5 Radiation schemes**

CCAM employs two radiation schemes from GFDL with the standard radiation scheme based on Lacis-Hansen (shortwave) and Schwarzkopf and Fels (longwave). It is also possible to use the more advanced GFDL SEA-ESF radiation scheme following Freidenreich and Ramaswamy (shortwave) and Schwarzkopf and Ramaswamy (longwave). The SEA-ESF radiation scheme is more effective with the CABLE land-surface scheme.

## 4.2.6 Vertical and horizontal resolution

By default, CCAM employs 18 vertical levels with a C48 grid (48x48x6 horizontal grid points) for modelling the atmosphere (see Section 5.1). However, it is possible to run CCAM with 27 vertical levels and a C72 grid (72x72x6 horizontal grid points) by selecting this option from the Configure menu and may improve the forecast in some circumstances (e.g., improving the forecast accuracy after the 4<sup>th</sup> simulation day). Note that CCAM takes approximately 400% longer to run with a 27 level C72 grid selected compared to running CCAM with an 18 level C48 grid.

## 4.2.7 Vertical mixing schemes

CCAM employs two vertical mixing schemes with the standard vertical mixing scheme derived from stability dependent K-theory with counter-gradient terms based on mixed-layer scaling. It is also possible to simulate vertical mixing with turbulence closure based on prognostic turbulent-kinetic-energy (TKE) and eddy-dissipation (eps). This TKE-eps scheme also employs a mass-flux approach for calculating the counter-gradient terms in the vertical mixing.

## 4.2.8 Land and ocean surface schemes

CCAM currently supports two schemes to model the fluxes from the land and ocean. The standard land-surface scheme employs the SiB/Gratez (120 km/6 km) land-use dataset and is known to produce reliable forecast results. In this configuration, SSTs are obtained from the analysis used to initialise the model.

Alternatively, it is possible to select the more advanced CABLE land-surface scheme, which employs the USGS/MODIS (1 km) land-surface dataset. The CABLE land-surface scheme is more effective with the SEA-ESF radiation scheme. When the CABLE scheme is selected, CCAM will also use a one-dimensional mixed-layer-ocean scheme that simulates (approximately) the top 1,000 m of the ocean. The mixed-layer-ocean model is nudged towards analysis SSTs at the start of every forecast.

## 4.2.9 Initialisation options

The configuration menu provides three initialisation options that can be selected by the user. The first option 'Use climatology to initialise soil' defines the initial soil temperature and moisture according to a 1 degree resolution soil climatology dataset and interpolates the initial condition of the atmosphere from the analysis. The main drawback with this option is that it cannot take into account previous rainfall and air temperature which would have modified the initial soil properties.

To avoid this problem, 'Use previous forecast to initialise soil' is selected by default where the soil data from a previous CCAM forecast is used for the soil initial condition instead of the soil climatology dataset. This option typically produces more realistic initial conditions since the initial soil data can improve with each forecast. However, running a forecast for a date before the start of the last forecast, or running a forecast for a date after the end of the last forecast will result in the previous soil data being lost. In this situation the soil data will be initialised using the 1 degree resolution climatology dataset with a corresponding message displayed in the CCAM log. Therefore, users who wish to use previous forecasts to initialise the soil data will need to ensure that CCAM is run regularly (e.g. once per day).

The CCAM forecast can be improved in some circumstances by using the dynamic balancing option for initialising the atmosphere. This option is most effective when CCAM cannot be run regularly so that soil data from a previous forecast cannot be used. When selected, the dynamic balancing option first

runs CCAM at 60 km resolution for the previous 24 hours, but with the simulation nudged towards analyses every six hours (or part of the previous 24 hours if not all analyses are available). The output from the dynamic balancing run is then used to initialise the CCAM forecast. The dynamic balancing run helps improve the soil initial conditions by simulating the weather for the previous 24 hours, as well as initialising the atmosphere in a more (quasi-)balanced state. Please note that CCAM will only start downloading/caching the additional analyses needed for the dynamical balancing run after the option is selected. This means that the user may need to initiate a download before starting a dynamic balancing run.

Finally, we note that if CCAM identifies compatible soil data in the analysis, then this soil data will automatically be used instead of soil climatology data or previous forecast soil data.

## 4.3 Download menu

The download menu (see Figure 4.6) determines which download options are activated in the CCAM GUI. This includes the number of downloads per day, which site to use for analysis files and whether to use current or historical analysis files. The download menu options are explained in Sections 4.3.1 to 4.3.4. Note that in this version of CCAM, the autorun forecast after download option is always active which ensures that the CCAM generated synoptic files for TAPM are always up-to-date.

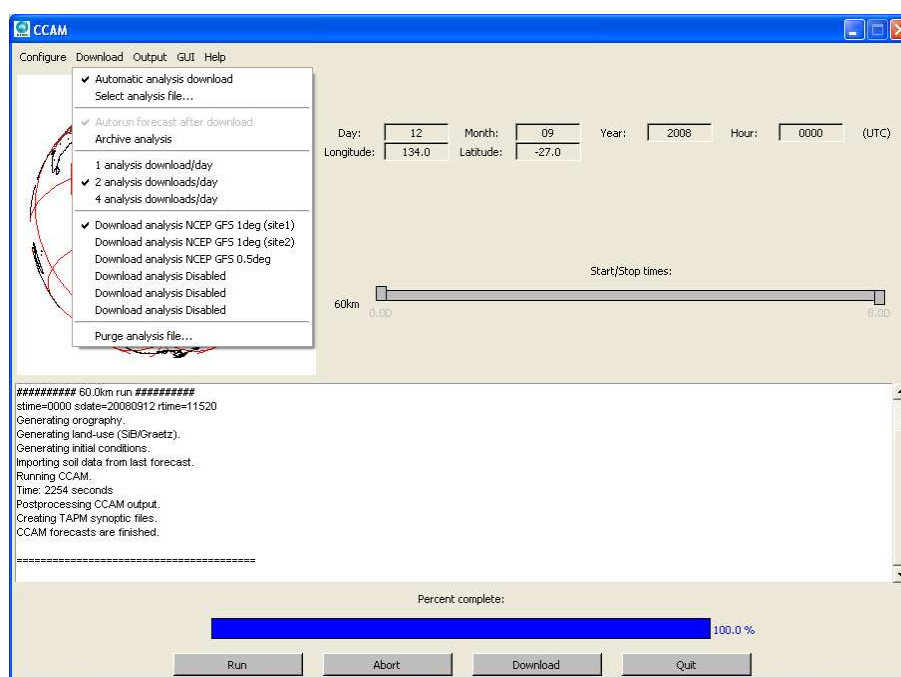


FIGURE 4.6: Options listed under the download menu.

### 4.3.1 Automatic analysis download or user selected analysis file

The analysis mode can be selected from the appropriate entry in the download menu. The possible options are:

- Automatic analysis download
- Select analysis file...

Automatic analysis download is the default option for which CCAM will continually download the latest analysis file available. This mode has been described in detail in Section 3.2. Alternatively, choosing the ‘Select analysis file...’ entry opens the analysis filename window, shown in Figure 4.7.

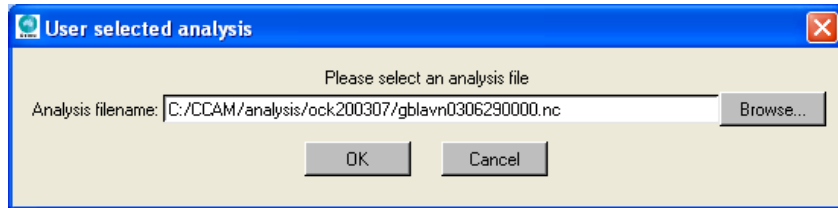


FIGURE 4.7: The analysis filename window. This window is opened by selecting the ‘Select analysis file...’ entry under the Configure menu. This window is used to specify an alternative analysis filename.

The analysis filename window allows the user to specify an alternative analysis file to use for initialising CCAM forecasts. The analysis filename can be changed by clicking on the Browse button and then selecting an appropriate analysis file. Usually, the analysis file will be selected from the analysis archive (see Section 4.4.1).

Once selected, pressing the OK button on the analysis filename window (Figure 4.7) will load the analysis file. Pressing Cancel will abort the choice of an analysis file. If an invalid analysis file is selected, an error will be reported in the CCAM log and CCAM will continue to use the last valid analysis file. When a valid analysis file is selected, the CCAM log will report that the analysis file was loaded successfully and the date and time indicators on the GUI will change to indicate the new analysis file.

Please note, when using a user specified analysis, no new analysis files can be downloaded (since the analysis file date has been fixed). A warning message will regularly appear on the CCAM log to alert the user when they are using a user specified analysis file (see Figure 4.8).

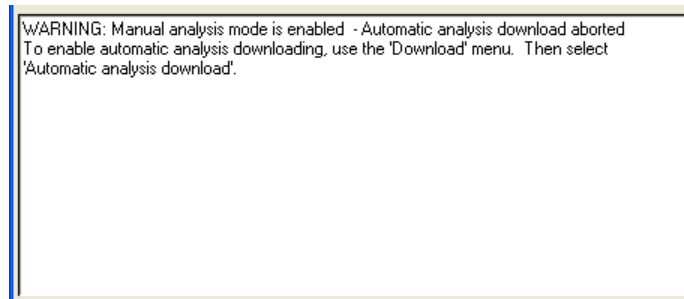


FIGURE 4.8: The CCAM log will periodically alert the user when using a user selected analysis file.

### 4.3.2 Archive analysis

The archive analysis option is toggled by selecting the ‘Archive analysis’ entry in the download menu. If selected, the archive analysis option will store all analysis files which are subsequently downloaded. These analysis files can be used for training or review exercises (see Section 4.3.1). When archiving, analysis files are stored in directories under the analysis directory (c:\ccam\analysis by default). Each analysis file is stored in a directory of the form:

anYYYYMM

where YYYY indicates the year and MM denotes the month. In the above directory, the analysis file is stored with a filename of the form:

anYYYYMMDDZZ.nc

where YYYY, MM, DD and ZZ indicate the year, month, day and hour (in UTC) of the analysis file.

### 4.3.3 Number of analysis downloads per day

The number of analysis files to be downloaded each day is specified by selecting the appropriate entry in the download menu. The available options are:

- 1 analysis download/day;
- 2 analysis downloads/day;
- 4 analysis downloads/day.

The corresponding analysis files which are downloaded are described in Table 4.3.

Option	Analysis files downloaded
1 analysis download/day	00Z
2 analysis downloads/day	00Z and 12Z
4 analysis downloads/day	00Z, 06Z, 12Z and 18Z

TABLE 4.3: A list of analysis files downloaded for the different download options.

The more analysis files downloaded per day, the more recent the initial conditions used by CCAM when generating the forecast (in general) and the greater the total amount of data downloaded per day. One analysis download per day is recommended when generating synoptic files for TAPM.

### 4.3.4 Analysis file download site

The site from which to download the analysis file can be specified by selecting the appropriate menu entry. These entries are described by the name given to the site in the download settings window (see Section 4.2.2). In the event that a download site fails (e.g. the analysis file is several hours late) then an alternative site can be selected.

### 4.3.5 Purge analysis file

This option is only available when 'Automatic analysis download' is selected (see Section 4.3.1). Selecting this option will delete the current analysis file and attempt to download a new analysis from the specified FTP site. This option can be used if the downloaded analysis file is corrupted. In this situation, the 'Purge analysis file' option will remove the corrupted analysis and attempt to download a new copy.

## 4.4 Output menu

Since this version of CCAM will only generate TAPM synoptic files, there is only one output type listed under the Output menu. Users who wish to erase previously generated TAPM synoptic data (i.e., generate a new TAPM synoptic database), can do so by selecting the TAPM output purge option.

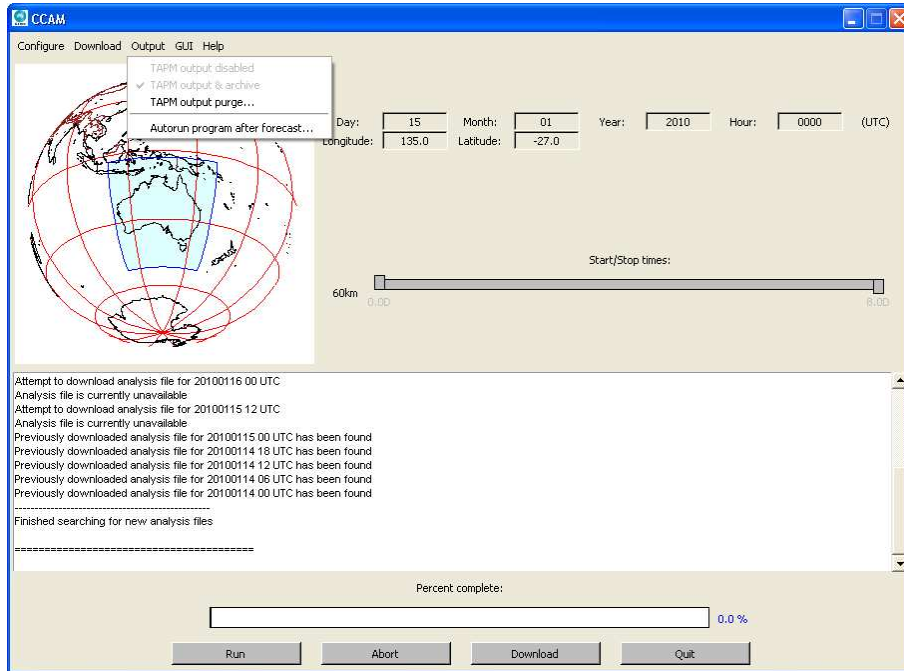


FIGURE 4.9: Options listed under the Output menu.

### 4.4.1 Aurun program after forecast

This option will run a user specified program after the CCAM forecast has finished. When selected, this option will open a dialog box for the user to specify the location of the program to run (see Figure 4.10). Output from the specified program is redirected to the log file `c:\ccam\runprog.log`. The aurun program option can be turned off again by reselecting the Aurun program after forecast entry. To change the aurun program, the user must first turn off the option and then re-select it again.

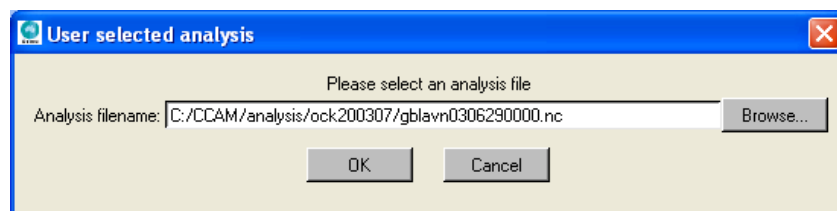


FIGURE 4.10: The aurun program window. This window is opened by selecting the 'Aurun program after forecast...' entry under the Output menu. This window is used to specify a program to run once the forecast is finished.

## 4.5 GUI menu

In versions of CCAM that allow the forecast region to be changed, the forecast location can be specified from the GUI menu. However, for most users of TAPM this option is disabled and the forecast location is fixed.

## 4.6 Help menu

The help menu provides two options. The first option 'Map help' allows the user to display instructions in the log area for using the CCAM GUI map control (see Section 3.1), although the forecast location cannot be changed in this version of CCAM. The second option 'About...' displays the CCAM version number and disclaimer message.

## 4.7 Basic CCAM trouble shooting

Generally CCAM will identify any errors with the system and report these in the log area of the GUI. Usually, CCAM will also suggest how the problem may be rectified. Persistent problems with CCAM should be reported to CSIRO Marine and Atmospheric Research (see contact details in Section 4.7.5). However, the trouble shooting notes below may be useful to advanced users for restoring CCAM to an operational state.

### 4.7.1 CCAM user settings and DAT files

When using CCAM, any user specified option is stored in a DAT file. These files all have the extension .dat and are located in the CCAM home directory (C:\ccam by default). The DAT files are:

- guiset.dat (specifies settings that affect the appearance of the GUI).
- ftpset.dat (specifies settings that affect the downloading of analysis files).
- dirset.dat (specifies the directories which contain data used by CCAM).
- ccamset.dat (specifies settings that control the CCAM weather forecast).

If any of the DAT files are deleted, then CCAM will use its default settings in place of the deleted data. In the case when a CCAM parameter setting results in the GUI becoming inoperable, then deleting all DAT files will reset CCAM so that it can be safely started again.

### 4.7.2 Corrupted analysis file

Corrupted analysis files are usually indicated by their small size or by CCAM being unable to process the file. A corrupted analysis file can be removed by using the 'Purge analysis file' option under the Download menu. CCAM will then attempt to download a new analysis file. If the corrupted analysis file persists, an alternative download site can be selected (from the Download menu).



### **4.7.3 FTP or internet failure**

Problems with FTP or the internet will be indicated by an analysis file that is significantly out-of-date. Usually the user can select an alternative analysis site from the download menu. However, if all sites fail, then it is possible that the internet connection has failed. In this case, internet connection problems will need to be repaired by the local system administrator.

### **4.7.4 Missing or incorrect CCAM data directories**

Usually CCAM will warn the user if essential CCAM data is missing. Using the default CCAM directories may fix the problem. Alternatively, CCAM can be reinstalled from the installation CD which will replace any missing data files. Note that it will also be necessary to select the CCAM default settings or to delete all DAT files.

### **4.7.5 Contact details for further assistance**

For assistance with other CCAM problems, please contact:

Dr Marcus Thatcher  
CSIRO Marine and Atmospheric Research  
Ph: +61 3 9239 4540  
Fax: +61 3 9239 4444  
Email: [Marcus.Thatcher@csiro.au](mailto:Marcus.Thatcher@csiro.au)

## 5. CCAM SUPPLEMENTARY INFORMATION

The CCAM GUI has been designed so that it can be used with minimal technical knowledge of CCAM and Numerical Weather Forecasting. Nevertheless, the CCAM system can be used more effectively if the user understands how CCAM generates its forecast.

In this section we provide a limited discussion on some technical aspects of CCAM. In particular, the section describes:

- The Conformal-Cubic grid (Section 5.1);
- Initial weather conditions (Section 5.2);
- Orography and land-use datasets (Section 5.3);
- Forecast accuracy (Section 5.4).

### 5.1 The Conformal-Cubic Grid

One of the characteristic features of the CCAM model is its use of a Conformal-Cubic (CC) grid. The CC grid is important, since it determines the resolution of the forecast and influences the accuracy. The CC grid is based on projecting the surface of a cube onto a sphere (i.e. the globe). This projection is illustrated in Figure 5.1.

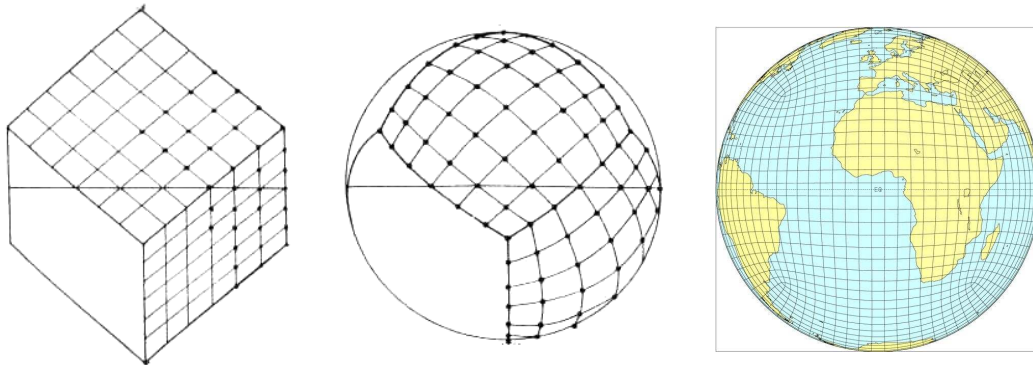


FIGURE 5.1: The CC grid is based on the projection of a cube onto a sphere.

Hence, the CC grid consists of six panels or 'faces' with the centre of the forecast located on the front face. An alternative view of the CC grid in terms of latitude and longitude coordinates is shown in Figure 5.2.

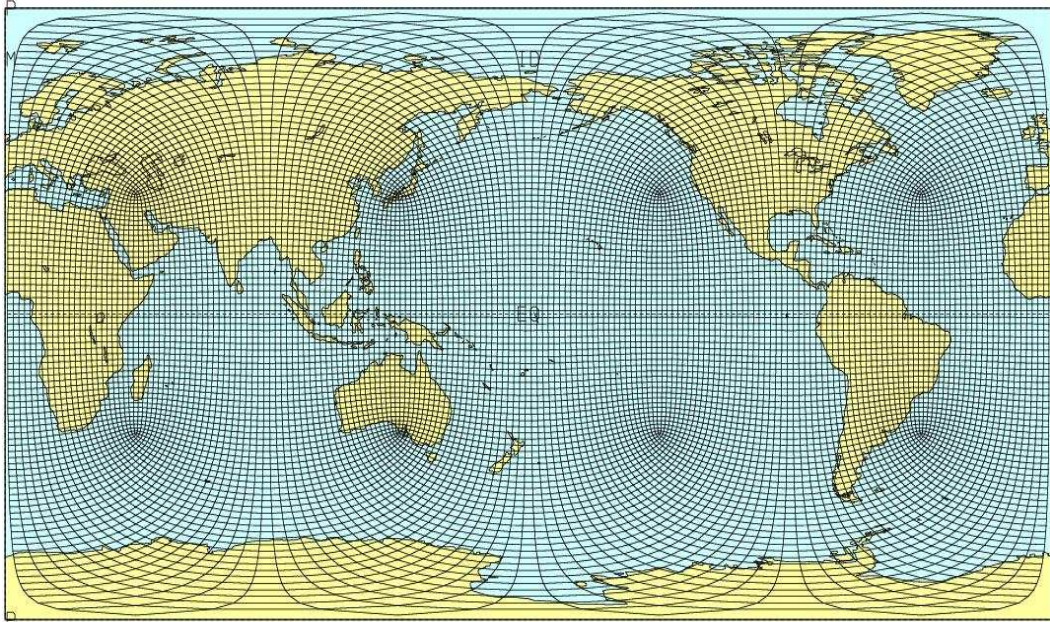


FIGURE 5.2: The CC grid shown in terms of latitude and longitude coordinates.

Furthermore the CC grid can also be translated and stretched to concentrate on a particular area by using the Schmidt transformation (see Figure 5.3).

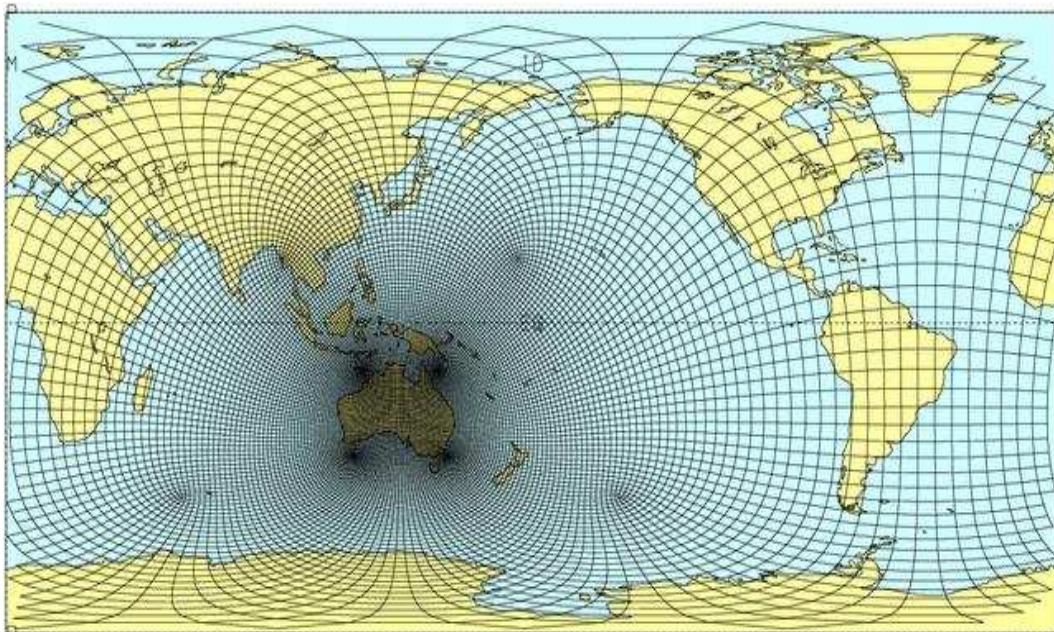


FIGURE 5.3: An example of a stretched CCAM grid. In this case, the grid will produce a forecast at 60km resolution over Australia. Note that as a consequence of the higher resolution over Australia, there is an area of lower resolution on the opposite side of the world (over the Atlantic Ocean in this case).

The Schmidt transformation is used since it preserves the orthogonality of the CC grid. By using the stretched grid, CCAM can produce high resolution forecasts over a limited area, but without any lateral boundaries. As a consequence CCAM only requires initial conditions (i.e., an analysis) and does not require any boundary conditions. Please note that the default output area for CCAM forecasts corresponds to the ‘front’ or high resolution panel of the CC grid.

For most practical applications, CCAM employs a C48 grid with 48x48x6 grid points in the horizontal and 18 sigma levels in the vertical. The sigma levels used by CCAM and the associated height in meters are shown in Table 5.1. It is also possible to use a 27 level version of CCAM with a C48 grid, with the vertical levels described in Table 5.2

Sigma level	Approximate height
1.000	0 m
0.996	40 m
0.978	190 m
0.946	470 m
0.900	880 m
0.843	1,400 m
0.776	2,100 m
0.702	2,900 m
0.623	3,800 m
0.542	4,900 m
0.459	6,200 m
0.377	7,600 m
0.298	9,200 m
0.224	11,000 m
0.157	13,000 m
0.100	16,000 m
0.054	20,000 m
0.022	26,000 m
0.005	35,000 m

TABLE 5.1: List of sigma levels used by 18 level CCAM to model the atmosphere and their approximate height in meters.

Sigma level	Approximate height	Sigma level	Approximate height
1.000	0 m	0.778	2,100 m
0.998	20 m	0.733	2,600 m
0.973	65 m	0.680	3,200 m
0.987	120 m	0.618	4,000 m
0.979	180 m	0.544	5,000 m
0.971	260 m	0.460	6,300 m
0.961	350 m	0.380	7,700 m
0.949	460 m	0.303	9,300 m
0.935	580 m	0.230	11,000 m
0.918	740 m	0.164	13,000 m
0.899	920 m	0.107	16,000 m
0.876	1,100 m	0.060	19,000 m
0.848	1,200 m	0.025	25,000 m
0.816	1,700 m	0.005	35,000 m

TABLE 5.2: List of sigma levels used by 27 level CCAM to model the atmosphere and their approximate height in meters.

## 5.2 Initial weather conditions

CCAM requires knowledge of the current weather conditions to initialise its weather forecast. Typically, the observed weather conditions can be obtained in the form of an ‘analysis’. In this case, available observational data (e.g. from different satellites, ground stations, etc) is combined together to form a self-consistent picture of the weather at that time. However, given memory and computational constraints, it is not possible for the analysis to correspond to the exact observations everywhere.



Nevertheless, the analysis provides the best self-consistent description of the observed weather and its synoptic pattern.

As discussed in Section 5.1, CCAM is a global atmospheric model, describing the weather for the entire globe (at varying resolutions). As a consequence, to initialise the CCAM forecast necessitates a global analysis (i.e. knowledge of the global synoptic weather pattern). Valid analysis files include

- the GASP model from the Australian Bureau of Meteorology,
- the GFS 1 deg analysis from NCEP
- the GFS 0.5 deg analysis from NCEP.

These analysis files are usually available for 00Z, 06Z, 12Z and 18Z each day. Since it takes time to process the observational data, the analyses are typically created 3 to 4 hours after the time they describe. When a forecast is started, the latest analysis observational data is mapped onto the CC grid as part of the pre-processing before running CCAM.

### 5.3 Orography and land-use datasets

CCAM weather forecasts are influenced by local orography and land-use (e.g. vegetation). Consequently, the accuracy of the weather forecast can be affected by the quality of these datasets.

By default, CCAM employs three orography datasets. The coverage and resolution of these datasets is described in Table 5.2.

Name	Resolution	Coverage
Topo2	10 km	Global
DEM	1 km	Global
TER	250 m	Australia only

TABLE 5.2: Coverage and resolution of the orography datasets used by CCAM.

For the standard land-surface scheme, the land-use data is based on SiB and Gratez datasets as shown in Table 5.3.

Name	Resolution	Coverage
SiB land-use	1 deg	Global
Gratez land-use	6 km	Australia only
SiB albedo	1 deg	Global
Zobler soil	1 deg	Global

TABLE 5.3: Coverage and resolution of the SiB/Gratez datasets used by CCAM for the standard land-surface scheme.

When the CABLE land-surface scheme is selected, the land-use data is based on USGS and MODIS datasets as described in Table 5.4.

Name	Resolution	Coverage
USGS land-use (IGBP)	1 km	Global
HWSD soil	4 km	Global
Soil albedo (VIS/NIR)	4 km	Global
MODIS leaf area index	4 km	Global

TABLE 5.4: Coverage and resolution of the USGS/MODIS datasets used by CCAM for the CABLE land-surface scheme.

The datasets in Tables 5.2 to 5.4 are then used to create a map of orography and land-use in terms of the CCAM coordinate system or grid (see Section 5.2). Multiple datasets at different resolutions are required as a consequence of the changing resolution of the CCAM grid. In this way, low resolution

datasets are used for the low resolution areas of the CCAM grid and high resolution datasets for the high resolution areas of the grid. Note that the MODIS for the leaf area index and soil albedo are derived from datasets processed by Boston University. Also, the CABLE land-surface scheme has been implemented using a mosaic approach so that multiple land-use types are simulated at each grid point.

When the mixed layer ocean scheme is activated, bathymetry is estimated from the ETOPO1 dataset (approximately 2 km resolution).