UNITED NATIONS INTERFACE TO THE ICAO CARBON EMISSIONS CALCULATOR

USER GUIDE

VERSION 6.1

INTERNATIONAL CIVIL AVIATION ORGANIZATION

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1. INTRODUCTION

Welcome to the United Nations Interface to the ICAO Carbon Emissions Calculator (UN ICEC). This impartial, peer-reviewed ICAO Calculator estimates carbon dioxide (CO_2) emissions from air travel. This interface allows UN agencies to estimate the CO_2 emissions attributed to their organization's air travel through a simple interface that only requires inputs on the origin and destination airports and the cabin class. The UN ICEC methodology applies the best publicly available industry data to account for various parameters, such as aircraft type, route-specific information, passenger load factor, and cargo carried.

The following sections describe how to use the UN interface for the ICEC (in Microsoft Excel and API – Application Programming[1] Interface versions) to support the preparation of inventories under the Climate Neutral UN initiative. A public interface to the UN ICEC, along with detailed information on the methodology used, is available on the ICEC website.[2]

2. SYSTEM REQUIREMENTS

The UN ICEC requires at least Microsoft Windows XP with Service Pack 2 and Microsoft Excel 2003. Devices (desktops, laptops, or tablets) that do not meet these requirements cannot run the interface.

3. DATA REQUIREMENTS

To generate an inventory of air travel CO_2 emissions, the following information is required:

i. The complete routing for each trip, using the 3-letter IATA airport codes[3] (for example, a trip from Geneva to Nairobi that connects in Amsterdam would be specified as GVA/AMS/NBO).

ii. The class of service used: Economy, Premium Economy, Business class, and First class.

This information is typically available directly from your Enterprise Resource Planning (ERP) system, such as ATLAS, IMIS, etc. or from your travel agency.

✓ The UN ICEC does not support train station codes or city codes.

[1] Please contact the ICAO Office of the Environment and Cleaner Energy/ICEC team if your UN organization wants to use the ICEC API.

[2] ICAO Carbon Emissions Calculator website: https://www.icao.int/environmental-protection/environmental-tools/icec

[3] IATA Airport codes: https://www.iata.org/en/publications/directories/code-search/

4. INSTALLATION

The zipped file you received from the Sustainable UN (SUN) Team includes the two files needed to run the Calculator.

i. Extract the files
- Right-click on the .zip file
- Select "Extract All…"
- Choose the folder on your computer and click Extract.

ii. Open the calculator
- Open the extracted folder
- Double-click in the Microsoft Excel file (.xlsm) to launch the calculator

Keep the files together
- ✓ The Microsoft Excel (.xlsm) file and the Access database (.db) file must stay in the same folder for the Calculator to work correctly.

Important – save and run the file locally:
- ✓ Make sure the folder is on your **local computer** (for example: C:\Downloads\ICAO_Calculator)
- ✓ **Do not run or save the files directly from OneDrive, SharePoint, Teams, or other cloud drives.**
- ✓ Running the Calculator from cloud locations may cause errors or prevent it from working.

5. GETTING STARTED

Double-click the Microsoft Excel file **UN_ICAO_Calculator_v6.1.xlsm** to start working. Once the spreadsheet has been opened, depending on the security settings you have specified in Microsoft Excel, you will be prompted to *"Enable Content"* (see Figure 1) to run the UN ICEC.

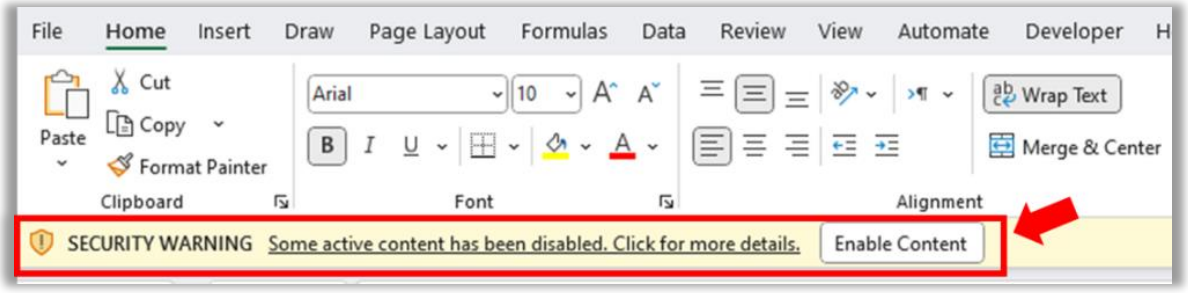

Figure 1. Microsoft Excel Security warning to "Enable Content".

If you are not given the option to Enable Macros or do not see any additional tabs after accepting the license agreement (see below), follow these instructions:

Instructions for Office 2010 and later (including Microsoft 365)

- ✓ When opening the document, you may see a security warning in the left-hand corner of the screen (just below the toolbar), stating: “Some active content has been disabled”.
- ✓ Click the “Enable Content” button.

For more information, please use the Microsoft instructions:
https://support.microsoft.com/en-US/Office/vba/a-potentially-dangerous-macro-has-been-blocked

5.1. What is new in Version 6.1

The release notes (see Figure 2) provide an overview of the key enhancements and updates introduced in each version of the UN ICEC, compared with the previous version. These updates typically include methodological improvements, updated datasets, and new functionalities aimed at increasing the accuracy, consistency, and usability of emissions calculations. Version 6.1 also introduces a new function for “two cabin class adjustments” and expands cabin class inputs to cover all airline fare basis letter codes.

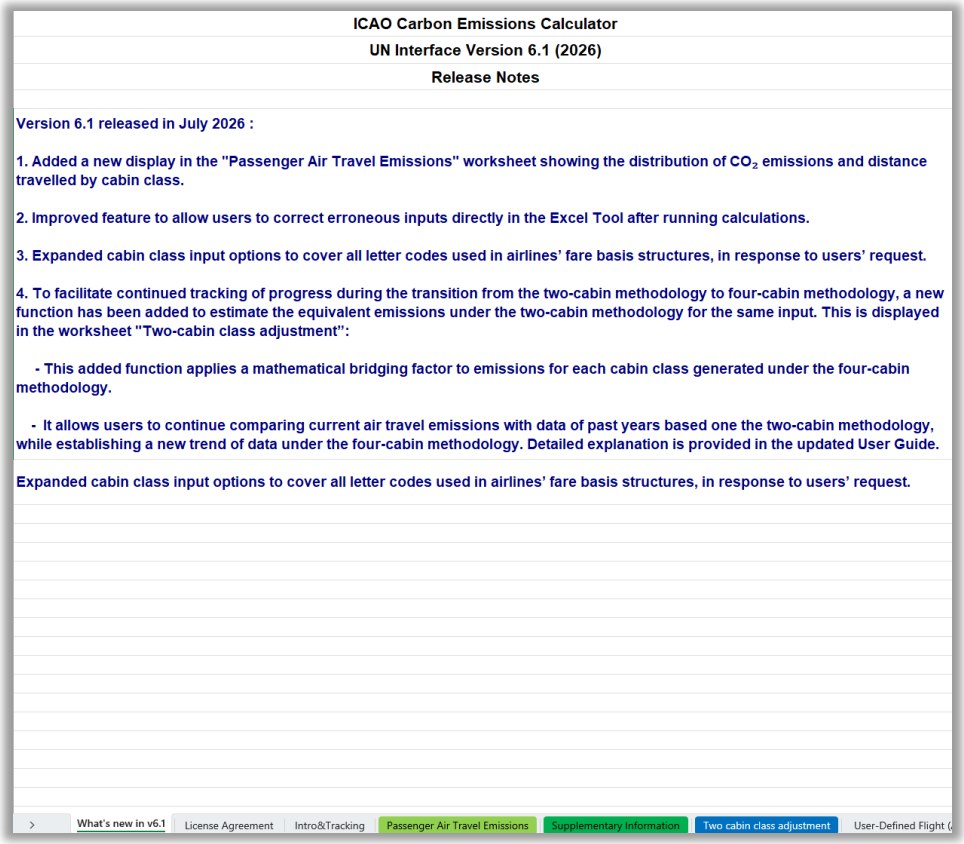

Figure 2. Release notes UN ICEC V6.1.

5.2. License agreement

After opening the UN ICEC in Microsoft Excel, please read the license agreement (see Figure 3) and check the box indicating that you accept the terms of the agreement. This interface is for the exclusive use by UN bodies in support of UN climate neutrality under the Greening the Blue initiative[4].

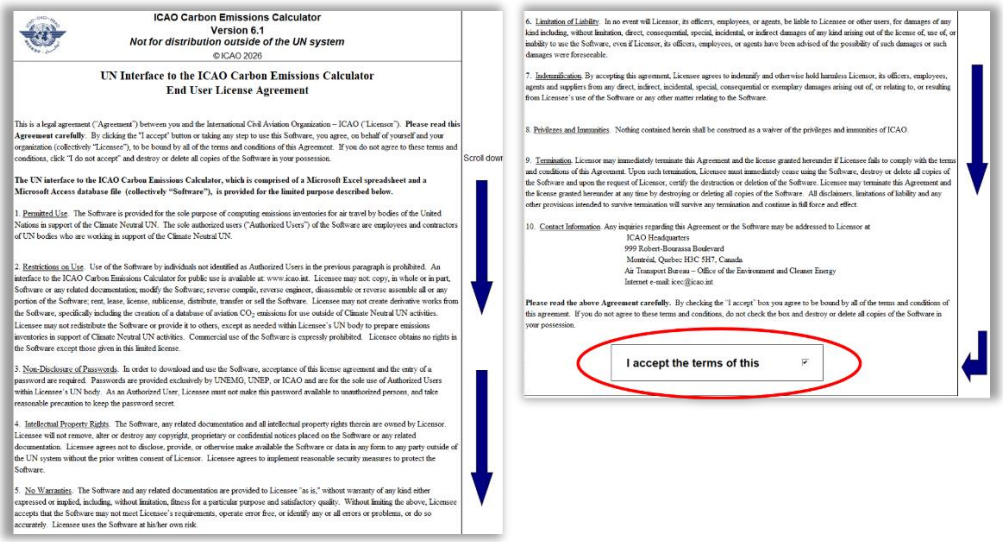

Figure 3. UN ICEC End User License Agreement.

6. INTRODUCTION AND TRACKING

After accepting the terms of the license agreement, a new tab will open in the spreadsheet called “Intro&Tracking” (see Figure 4).

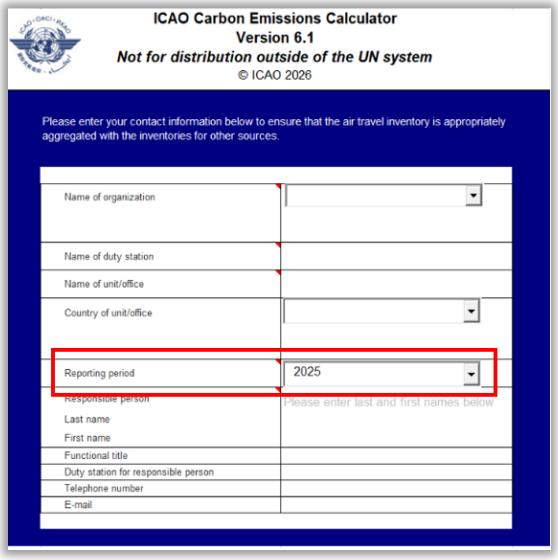

Figure 4. Contact information and reporting period in the Intro&Tracking Tab.

[4] *Greening the Blue website: https://greeningtheblue.org/*

- ✓ You must select the correct reporting period on this tab, as that will determine which emissions are generated.
- ✓ UN ICEC version 6.1 is meant for the 2025 inventory and should not be used to recalculate prior inventories.

This tab also allows you to enter contact information for the inventory that you are preparing. After entering the required information on the "Intro&Tracking" tab:

i. Select "File".

ii. Select "Save As…" to save your information using your preferred convention, for example:

- ➢ *AIR-[Agency Name]-[Loc]-[ReportingYear].xls,* for example, AIR-UNDP-NY-2025.xls

7. CALCULATING THE INVENTORY

This section describes the steps required to calculate a greenhouse gas emissions inventory using the UN ICEC. Users should first enter the required activity data, review the inputs for completeness and accuracy, and then generate the inventory. Following these steps will help ensure that the calculated results are accurate and that any input errors are identified and corrected before processing.

7.1. Data Entry

To generate an inventory of air travel CO_2 emissions, the following information is required:

i. The complete routing for each trip, using the 3-letter IATA airport codes[5] (for example, a trip from Geneva to Nairobi that connects in Amsterdam would be specified as GVA/AMS/NBO). The calculator does not support train station codes or city codes. For reference, official airport codes are listed in ICAO Doc 7910 (Location Indicators by State).[6]

ii. The class of service used: Economy, Premium Economy, Business class, and First class.

This information is typically available directly from your Enterprise Resource Planning (ERP) system, such as ATLAS, IMIS, etc. or from your travel agency.

- ✓ To facilitate data entry into the UN ICEC, it is generally possible to copy and paste an entire set of travel records from the ERP directly into the spreadsheet.

[5] *IATA airport codes: https://www.iata.org/en/publications/directories/code-search/*
[6] *ICAO Document 7910 (Location indicators): https://store.icao.int/en/catalogsearch/result/?q=7910*

- ✓ Split the routing to two legs, such as “GVA/AMS” and “AMS/NBO” to prevent input errors and to obtain the most accurate results.

7.2. Generate an inventory

i. Open the Tab titled “Passenger Air Travel Emissions” (see Figure 5).

ii. Starting from row 18, enter your route pairs (see **[1]** area in Figure 5) and cabin class (see **[2]** area in Figure 5), using the following cabin class codes:

- Economy: Y, B, M, H, K, L, Q, V, T, U, X, N, S, G, O, R
- Premium Economy: W, E
- Business Class: C, J, D, I, Z
- First Class: F, A, P

Specify the separator used to separate airport codes (for example, “/” or “-”).

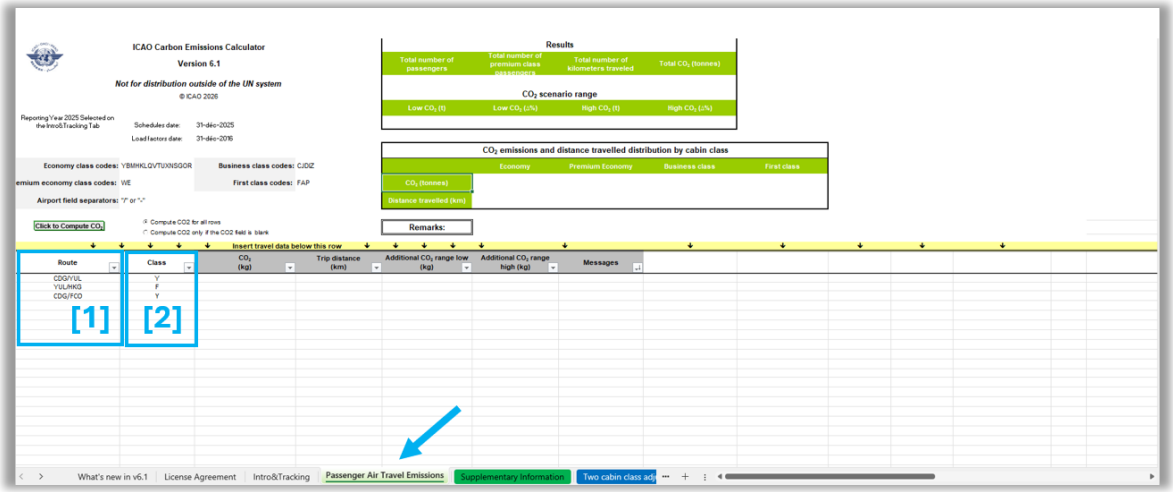

Figure 5. Passenger Air Travel Emissions Tab.

- ✓ Using the wrong separator (e.g., “//” or “/-”) may result in unrecognized route pairs and incorrect carbon emissions calculations. For example, if the flight “YUL-GVA//ZRH-NBO” is entered, the leg “GVA//ZRH” will not be considered. If there is a full stop “.” in the inputs, all legs after are not considered. i.e. if flight YUL-GVA.ZRH-NBO is entered, only the leg YUL-GVA is considered.

- ✓ Other data entry errors (e.g., empty rows, use of railway codes, unidentified airport codes etc) may affect calculations in the UN ICEC. Please review your data carefully before computing CO_2 emissions to avoid the need for reprocessing.

iii. Save your file.

iv. Click the "Click to Compute CO_2" button to calculate carbon emissions based on selected route pairs and cabin classes.

8. UNDERSTANDING THE RESULTS

Once the calculation is complete, the results are displayed in the summary tables and charts. These outputs provide an overview of the calculated CO_2 emissions, including emissions by cabin class, distance travelled, and total emissions for the selected reporting period. Users should review the results to ensure they are reasonable and consistent with the travel data entered. Figure 6 highlights the main results sections and explains the information presented in each area.

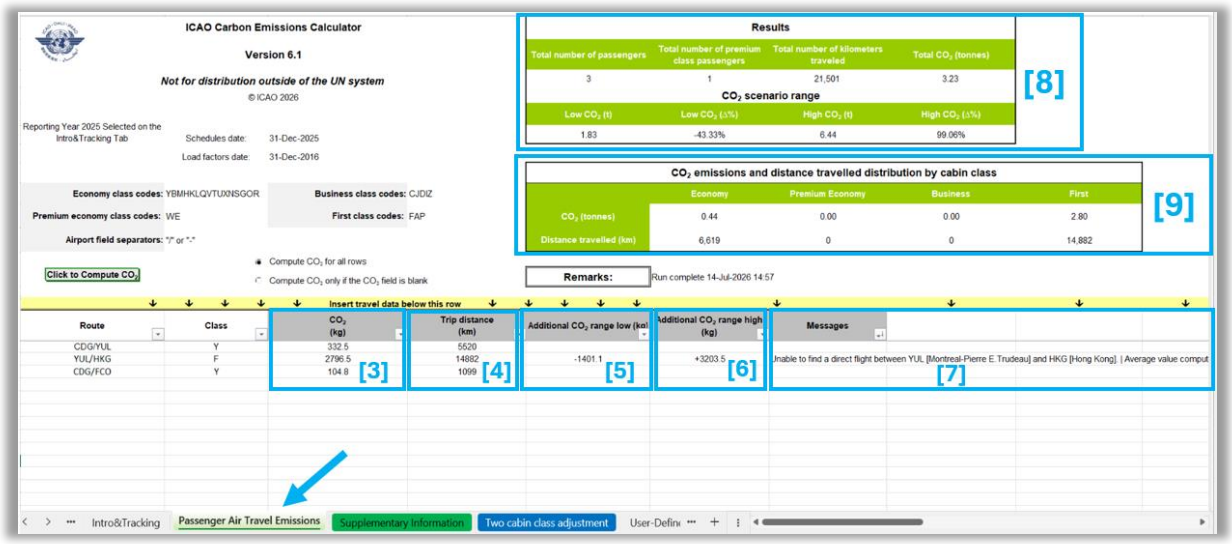

Figure 6. Summary of results in the Passenger Air Travel Emissions.

8.1. CO_2 emissions (kg)

The CO_2 (kg) value (see [3] in Figure 6) shows the estimated carbon dioxide emissions generated by each route, expressed in kilograms. This value represents the calculated emissions associated with the passenger's air travel based on the flight information entered in the calculator.

8.2. Trip distance (km)

The Trip distance (km) value (see [4] area in Figure 6) indicates the total flight distance used for the calculation, expressed in kilometres. This distance corresponds to the great-circle distance between the selected airports and may include adjustments applied by the calculator methodology.

- ✓ Some great-circle distances may appear longer than expected when one or more connections are involved. If unsure, please review the inputs and accompanying messages.

8.3. Additional CO_2 range (low) (kg)

The Additional CO_2 Range (low) (kg) value (see [5] area in Figure 6) represents the lower bound of the emissions scenario range. This result shows how much the reported CO_2 value could vary around the baseline estimate under realistic schedule-based alternatives: the low value is a possible downward adjustment.

- ✓ This is a scenario range, not a statistical confidence interval.

8.4. Additional CO_2 range (high) (kg)

The Additional CO_2 Range (high) (kg) value (see [6] area in Figure 6) represents the upper bound of the emissions scenario range. This result shows how much the reported CO_2 value could vary around the baseline estimate under realistic schedule-based alternatives: the high value is a possible upward adjustment.

- ✓ This is a scenario range, not a statistical confidence interval.

- ✓ If connecting airport information was not provided in the calculator, the emissions from possible connecting airports will be computed. This will result in a range of uncertainty in the inventory being displayed in the form of the lower and upper bounds of possible connections. For the purpose of generating inventories, the UN ICEC assumes the median CO_2 value in these cases and presents the uncertainty relative to this value. The user must then decide if the level of uncertainty in the inventory is acceptable.

8.5. Messages

The Messages section (see [7] area in Figure 6) displays additional information related to the calculation. This may include warnings, notes, or explanations regarding the selected flight, airport availability, or other factors that may influence the results. Table 1 presents a list of messages and a complete explanation.

Table 1: Description of warning messages inside the UN ICEC.

Warning message (examples)	Explanation
Average value computed due to a missing connecting airport between: ADD and CPH. There are 28 possible connecting airports for this route. 1-stop estimate symmetrized using reverse direction CPH/ADD. Reverse direction has 34 possible connecting airports. Median connections averaged for estimate: ARN and MXP.	This concerns missing information about connecting airports for routings without direct flights. An average value was computed because no direct data was available for either ADD–CPH or CPH–ADD. A 1-stop estimate was therefore built independently for both directions (28 possible connections for ADD–CPH and 34 for CPH–ADD), and the final CO_2 and/distance value is the average of those two directional estimates, meaning "symmetrized using the reverse direction" does not imply that only reverse data existed. Please specify the exact connecting airport, if applicable, to generate a more accurate result.
Unable to find a direct flight or a 1-stop connection between CKY and DKR.	This message occurs when there is no direct or 1-stop connection for routing, i.e., the routing involves 2 or more connecting airports. Please specify the connecting airports to generate a result.
Route amended to include KSA/PNI/TKK due to missing connecting airport PNI.	This message arises when there is no direct connection for the route, but a 1-stop connection is available. The Calculator will automatically amend the route to include the possible connecting airport. Please specify the exact connecting airport if applicable to generate a more accurate result.
Direct value not available for COO/DSS. Emissions computed using reverse direction DSS/COO.	In this case, the routing is available only one-way in the flight database. This can occur when a direct or one-stop flight exists in one direction, but the return trip requires multiple connections. The Calculator will generate a result based on the available flight information (i.e. the reverse direction). Please specify the exact connecting airport if applicable to generate a more accurate result.
Requested cabin class not available - emissions computed using Economy class *Requested cabin class not available - emissions computed using Premium Economy class*	Premium cabin classes (premium economy, business class, and first class) may not be available on some routes; in that case, the next available cabin class is selected. This can result from differences in aircraft configurations or airline business models. For example, some fares marketed as premium economy or business class may use enhanced economy seating rather than a distinct premium cabin. Please check the inputs for possible errors to ensure the best results.
Unknown airport: XXX	This message occurs when the input airport code is incorrect or no longer available. This could happen when railway codes or outdated airport codes are provided.

Warning message (examples)	Explanation
Airport of origin = airport of destination (XXX/YYY). Distance forced and CO_2 forced to 0	Routes with identical origin and destination airport codes will return zero. Please check the inputs for possible errors or missing connections.

8.6. Summary of results

The Summary of results section (see **[8]** area in Figure 6) provides a consolidated overview of the calculation outputs, including the total air travel CO_2 emissions and the total distance travelled. This summary is displayed at the top of the page to allow users to quickly view the overall result of the calculation. The final results include: total number of passengers, passengers who used premium classes (premium economy, business, and first class), and the total of CO_2 emissions (in tonnes). It also displays the CO_2 emissions scenario range, which describes the low and upper bounds of emissions.

A new feature in V6.1 is the cabin class emissions distribution table (see **[9]** area in Figure 6), which automatically shows the share (in volume) of total CO_2 Emissions and total distance travelled associated with each cabin class. This provides users with an additional way to visualize the distribution of emissions across cabin classes.

- ✓ If one or more input rows contain errors, summary results are not displayed because totals would otherwise be incomplete or misleading.
- ✓ In case the workbook is locked after the first run, users could copy the travel data and the results already generated into a fresh blank V6.1 workbook, correct the flagged input rows, and then rerun the calculation.
- ✓ After correcting the flagged rows, users may select “Compute CO_2 only if the CO_2 field is blank” to calculate only the missing values and avoid recalculating rows that already contain valid results.

8.7. Identifying and correcting input errors

If an input error is detected, the affected row will be highlighted in light yellow, and an error message will be displayed. Common issues include invalid codes, missing values or incomplete entries.

To quickly locate rows containing errors, use the filter button in the “Messages” column header and review the error messages displayed in the highlighted cells **[1]**. You can then select Filter by Cell Color **[2]** to display only the rows highlighted in light yellow, making it easier to identify invalid entries (refer to

Figure 7**)**. Errorneous inputs can be corrected directly within the excel tool and users can select "Compute CO_2 only if the CO_2 field is blank" to calculate only the missing values.

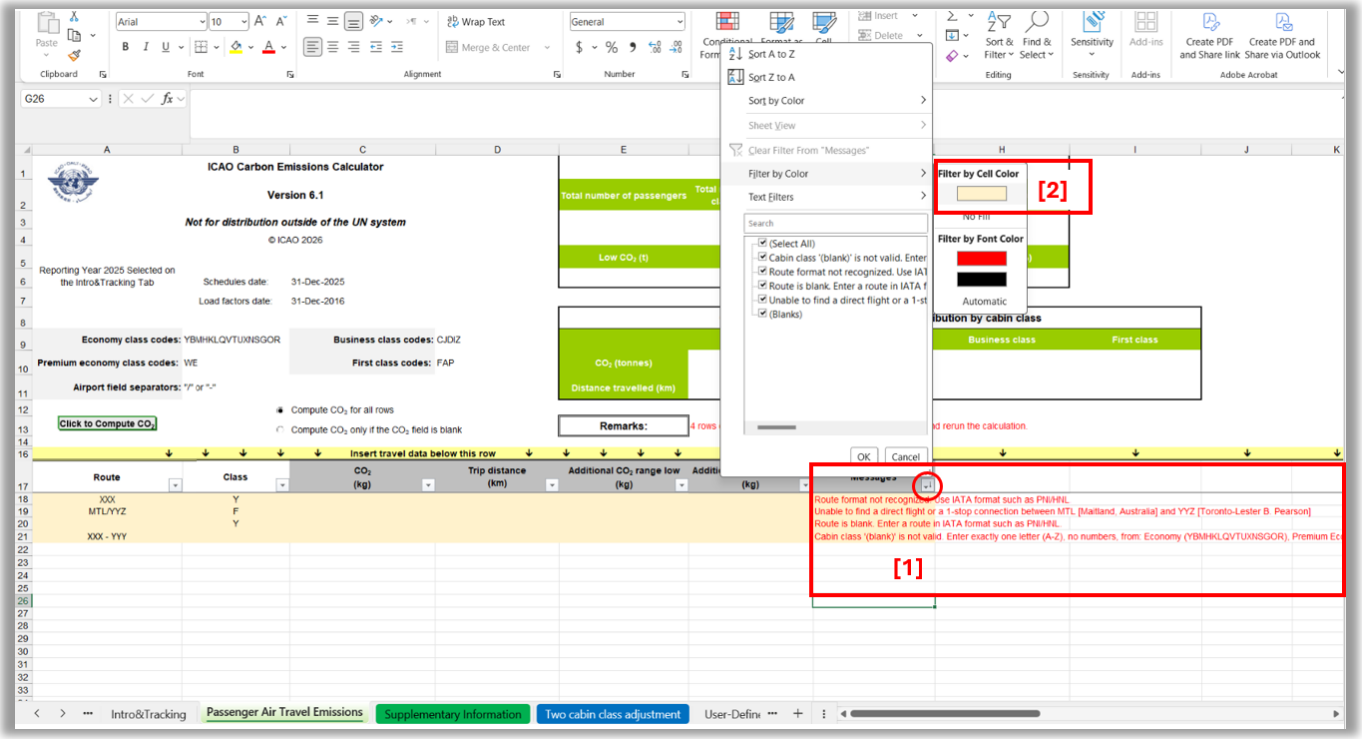

Figure 7. Identifying input errors

✓ Results will not be generated until all highlighted errors have been resolved.

9. SUPPLEMENTARY INFORMATION TAB

In addition to calculating air travel CO_2 emissions by passengers, this UN ICEC provides supplementary data (see Figure 8) relevant for users interested in understanding how these emissions are related to the ICAO Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA)[7].

CORSIA was adopted by the ICAO Assembly in 2016 as the only global market-based measure applying to CO_2 emissions from international aviation. Robust and transparent data collection, as well as comprehensive monitoring and verification processes, are in place under CORSIA, which covers all CO_2 emissions from international aviation. Given the global role of CORSIA and the limited information available on other market-based measures, only information related to CORSIA is provided in the ICAO Calculator.

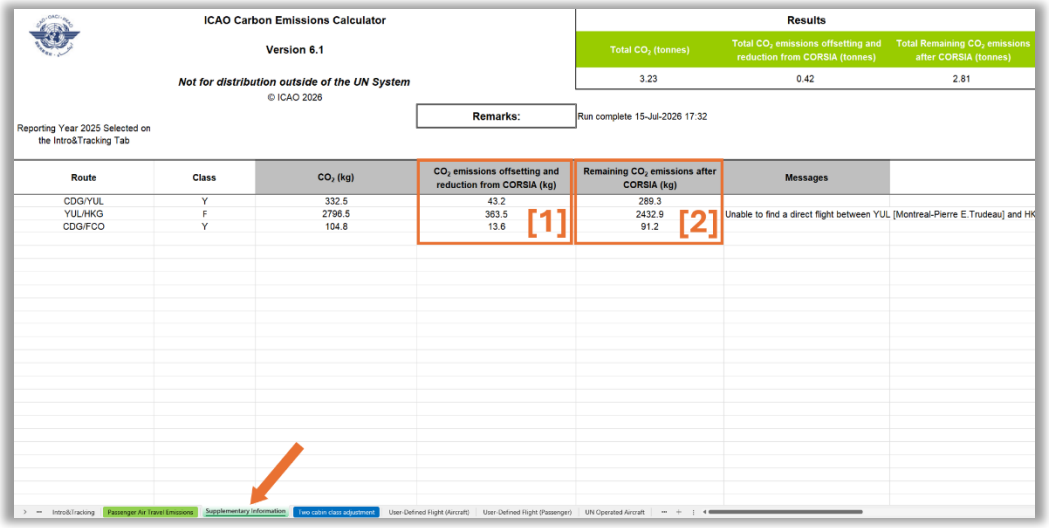

Figure 8. Supplementary Information Tab.

The “Supplementary Information” worksheet is included for reference only, as the calculator's primary purpose is to estimate air travel CO_2 emissions.

The UN ICEC is not intended to inform offsetting policies; any decision to offset air travel CO_2 emissions based on the Supplementary Information is solely at the user's discretion.

After the Passenger Air Travel Emissions spreadsheet is computed, this Supplementary Information on CORSIA will be automatically generated in a separate spreadsheet. The CO_2 emissions offsetting from

[7] *ICAO Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) website: https://www.icao.int/CORSIA*

CORSIA (kg) (see **[1]** area in Figure 8) indicates the estimated CO_2 emissions associated with CORSIA, expressed in kilograms. Remaining CO_2 emissions after CORSIA (kg) (see **[2]** area in Figure 8) indicates the portion of CO_2 emissions that remains after CORSIA offsetting has been applied, expressed in kilograms.

10. TWO-CABIN CLASS ADJUSTMENT

A new "Two Cabin Class Adjustment" worksheet has been added to the UN ICEC Excel output. The results in this worksheet will be generated automatically, with no further inputs required. This temporary feature has been introduced for the transition period between the old and new methodologies (starting in 2025). It supports continued progress tracking and allows for comparability with baseline(s) established under the previous methodology, until new baseline(s) or trends are defined.

The "Two Cabin Class Adjustment" worksheet (see Figure 9) presents the air travel emissions results from the four-cabin-class methodology, and an estimated representation of the results as they would appear under the previous two-cabin-class methodology. This estimation applies "Bridging Factors" to adjust results from the new methodology, enabling users to approximate how their inventory would have performed under the previous methodology. The bridging factors applied in V6.1 are derived from the full flight operations database and based on a three-year average comparison.

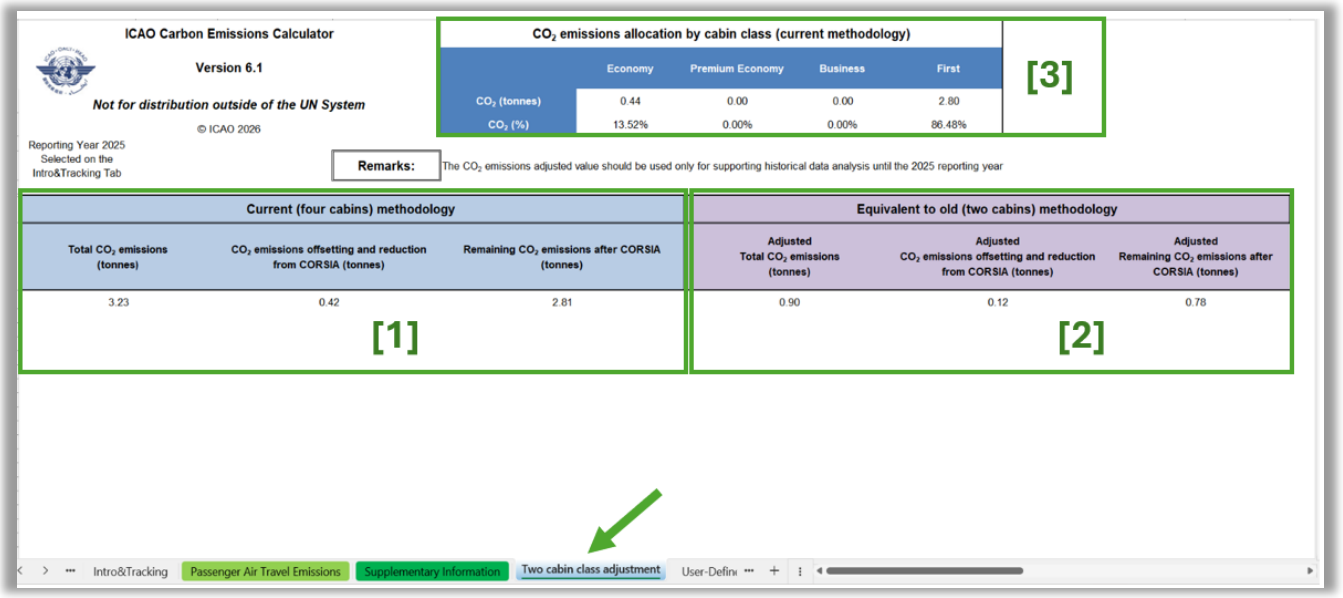

Figure 9. Two Cabin Class Adjustment tab

The total CO_2 emissions and CORSIA results calculated using the new (four-cabin class) methodology are displayed in the **[1]** area of Figure 9. The adjusted total CO_2 emissions and CORSIA results, related to the previous methodology (two-cabin class) are presented in the **[2]** area. Potential errors affecting the application of bridging factors are explained in the remarks section. The **[3]** area presents the value and percentage allocations of CO_2 emissions by cabin class that allow users to compare the emissions distribution under the current methodology with the distribution from the previous methodology.

Bridging Factors used in V6.1:

- Economy: +6.06%
- Premium Economy: +11.70%
- Business class: +100.27%
- First class: +471.38%

The bridging factors reflect the percentage difference between the new and previous methodologies for each cabin class.

- ✓ No results will be generated under the new "Two Cabin Class Adjustment" sheet if the "Passenger Air Travel Emissions" worksheet contains errors (e.g., invalid railway codes). Users are advised to review and correct all inputs before running the UN ICEC to avoid processing failures and the need to rerun the calculation,

11. USER-DEFINED FLIGHTS

Recognizing that for some UN offices, a significant portion of mission travel is through chartered flights, two tabs are available to compute CO_2 emissions from "user-defined" flights based on the following parameters:

- Aircraft Type
- Airport pair or flight distance length in kilometres
- Load factor/percentage of passenger seats occupied (if emissions at the passenger level are required)

11.1. User-Defined Flights (Aircraft) Tab

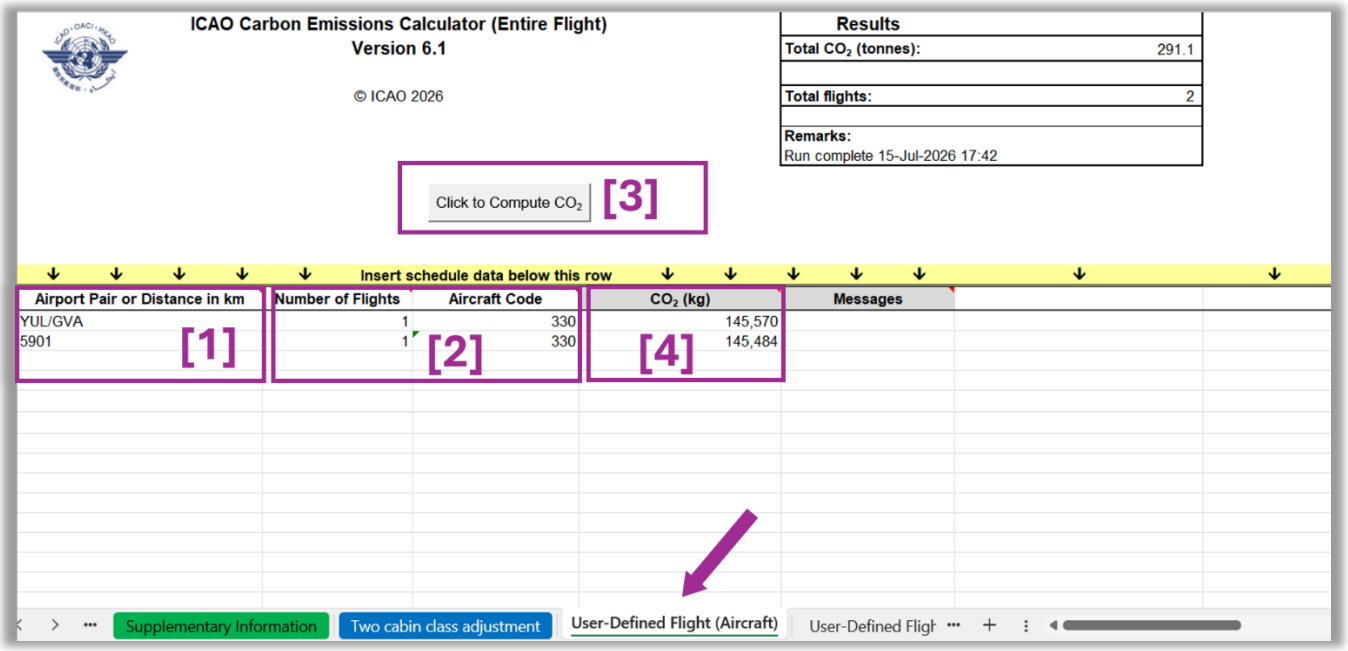

Figure 10: User Defined Flight (Aircraft) Tab.

The User Defined Flight (Aircraft) tab can be used to calculate CO_2 emissions for the whole aircraft. In the User Defined Flight (Aircraft) tab (see Figure 10), follow the steps below:

i. Enter either a valid airport pair (for example, YUL/GVA) or the trip distance in kilometres (for example, 5901 km) starting in cell A15 (see [1] area in Figure 10).

ii. Enter the number of flights and aircraft codes in cells B15 and C15, respectively (see area [2] in Figure 10).

iii. If needed, consult the tab titled “Available Aircraft Types”, which provides the list of available aircraft codes.

iv. Click the “Click to Compute CO_2” button to calculate the CO_2 emissions for the entire flight (see area [3] in Figure 10).

v. The CO_2 emissions results are then displayed in column D (see area [4] in Figure 10).

vi. The Summary of the Results, in terms of generated inventories, is displayed at the top of the page (see area [5] in Figure 10).

11.2. User-Defined Flights (Passenger) Tab

The “User Defined Flights (Passenger)” tab (see Figure 11) works similarly to the “User Defined Flight (Aircraft)” tab described above (see Figure 10), with one key difference: the user can enter the percentage of seats occupied (load factor) in column C (see [1] area in Figure 11). The CO_2 emissions

results, calculated for one passenger on the flight, are displayed in the results column (see [2] area in Figure 11). The Summary of the Results in terms of inventories generated is displayed at the top of the Page (see [3] area in Figure 11).

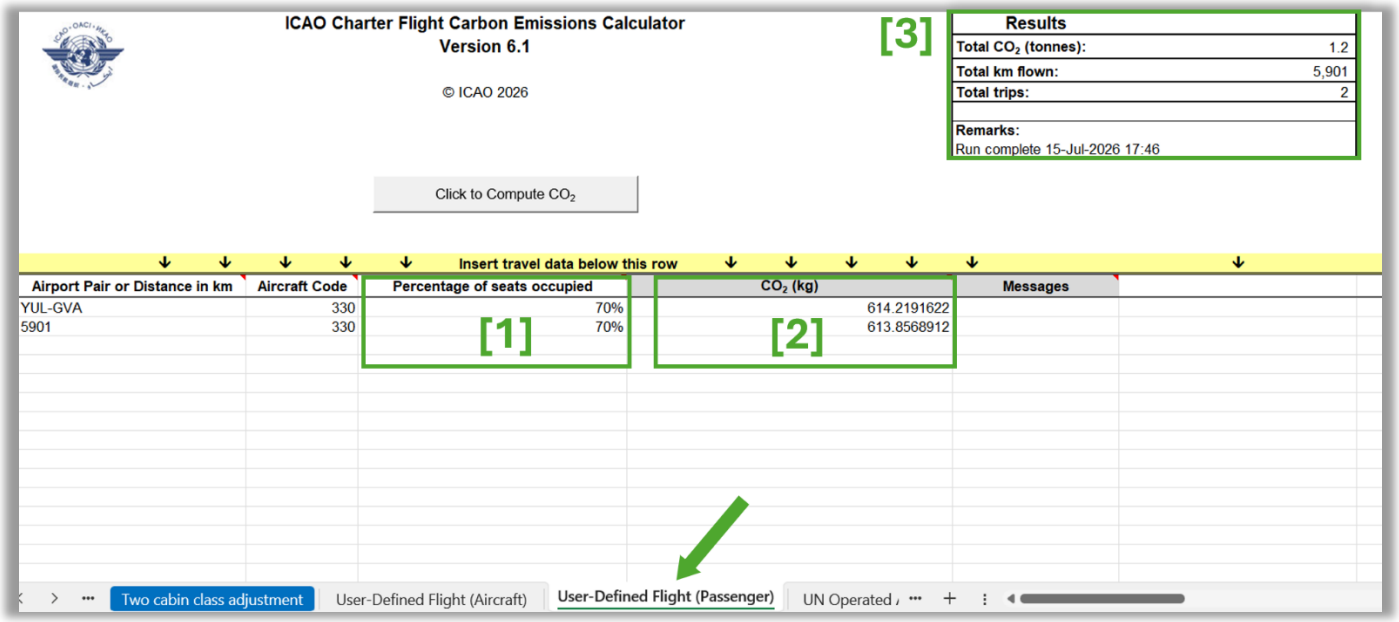

Figure 11. User Defined Flight (Passenger) Tab.

12. UN OPERATED AIRCRAFT

The "UN Operated Aircraft" tab (see Figure 12) allows users to calculate CO_2 emissions from fuel consumption data for the UN-operated fleet. The following information can be entered:

- **Location (optional)** – Starting in cell A9, enter the location where the fuel was consumed. This entry is optional.
- **Fuel Type** – Starting in cell B9, enter the fuel type: Jet-A or AvGas.
- **Quantity** – Starting in cell C9, enter the amount of fuel, in either litres or kilograms.
- **Units** – Starting in cell D9, enter the units for the fuel quantity provided in the previous column: either litres (l) or kg.
- **Density (kg/l)** – Starting in cell E9, if the fuel quantity is specified in litres, enter the fuel density here. The average density under standard conditions is 0.8 kg/l for Jet-A and 0.721 for AvGas (required if fuel provided in litres).
- Click "Compute CO_2" button to calculate the CO_2 emissions for the entered parameters. The results are displayed under column F8 in kilograms (kg).

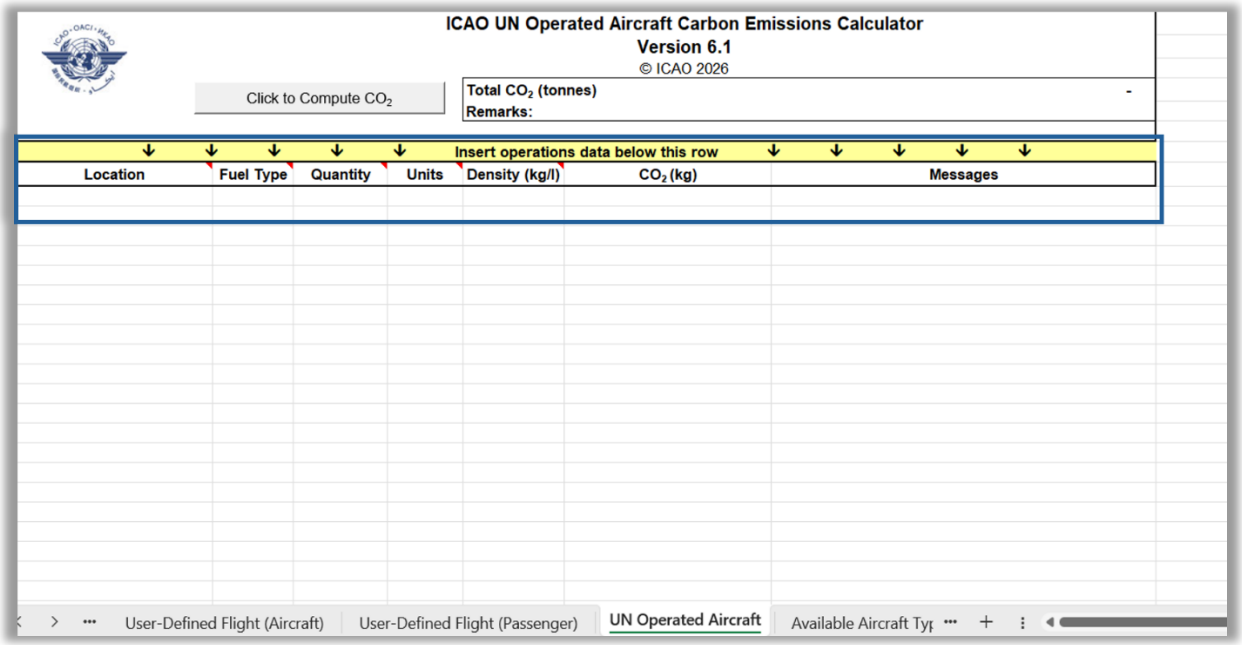

Figure 12. UN Operated Aircraft Tab.

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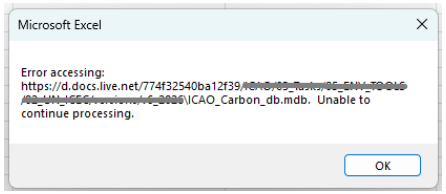
ANNEX A: Troubleshooting

Problem	Possible Solutions
	This error happens because the UN ICEC cannot access the database file if it is stored on OneDrive, SharePoint, Teams, or any other cloud drive. To fix it, close Microsoft Excel, then move the entire extracted folder (containing both the .xlsm and .db files) to a folder on your local computer. For example, *C:\Users\[YourName]\Documents\ICAO_Calculator*, and open the Microsoft Excel file from that location. Make sure both files stay in the same folder and do not run them directly from cloud locations; otherwise, the Calculator will not work.
Nothing happens when I click the "Click to Compute CO_2" button.	Macros may not have been enabled when the spreadsheet was opened. Save and close the spreadsheet, then reopen it and follow the troubleshooting tips on Page 3. The database file: *ICAO_Carbon_db.mdb* must be in the same directory/folder as the spreadsheet. If it is not, simply extract the .mdb file from the original zip archive into the directory/folder where the spreadsheet is saved. Row 17 must contain headers for the data fields below. Each column with data must have a header or the Calculator will not read the data properly. Please note that the data entry must start in row 18.
I receive the error message: "Unable to find a direct route between XXX and YYY."	The entered airport code may be incorrect (for example, outdated airport codes or railway codes). The field separator may not be correct. Please use only "/" **or** "-" for the field separator. The connecting airports may need to be specified for routings with multiple connections. Specify the airports used for connection and try again. The wrong airport within a city was selected (for example, a trip from New York to London where there are multiple airports on both ends. Specifying a route from Newark (EWR) to London Gatwick (LGW) will give an error, but JFK to LGW is a valid route).
The CO_2 computed for the same route is the identical for different cabin classes.	Premium cabin classes may not be available for some routings, resulting in the economy class value being generated. This can result from differences in aircraft configurations or airline business models. For example, some fares marketed as premium economy or business class may use enhanced economy seating rather than a distinct premium cabin.

Problem	Possible Solutions
	In some cases, the trip may have been too short in distance for significant differences between cabin classes. See the Calculator methodology for more information: Check that the cabin class designators were specified correctly, as listed in the Passenger Air Travel Emissions worksheet and paragraph 7.2 ii of this User Guide. Note: only the first character of the class of service data is read for each record (for example, two-letter class codes such as HX and HW would both be interpreted simply as 'H').
Summary results are not displayed	One or more input rows contain errors. Correct the flagged rows and rerun the calculation. To avoid recalculating all rows, select "Compute CO_2 only if the CO_2 field is blank" after correcting the inputs.

- END -