Importing a Total Electron Content (TEC) Data File:

Nominally the Ionosphere delay is computed – on a per satellite basis – using the ICD-GPS-200 L_1 model modified to support L_2 by frequency scaling. There are two modifications to this model:

(a) Lear high altitude model

The Lear model should be used to compensate for high altitude motion such as that achieved by lift-off and / or re-entry vehicles, and exo-atmospheric operation. This model uses the Total Electron Content (TEC) values defined by the ICD-GPS α parameters and the periodicity defined by the β parameters. The model re-computes the line-of-sight angles and obliquity factor to correctly compensate for high altitude operation.

(b) Import Total Electron Content (TEC) file.

The user can replace the GPS α parameters defined in ICD-GPS-200 used to compute the (vertical) Total Electron Content (TEC) with pre-computed values binned by vehicle altitude. If used, the import file replaces the computation of TEC by ICD-GPS but retains the periodicity (derived from the sun-earth-user angle) defined by the β parameters.

The import capability can be combined with the Lear model to provide an altitude compensated ionosphere delay consistent with an earth shell model at high altitude.

To import a TEC file select the pull down menu item *IMPORT | Vehicle TEC Control File* from the main menu function of the **Build Scenario** Application. The program will prompt you for the file to import. Your file can have any name, as the application will copy it into the scenario folder with the correct name. *(For reference, your file will be copied from your destination to the scenario folder with the name IonoData.scn)*
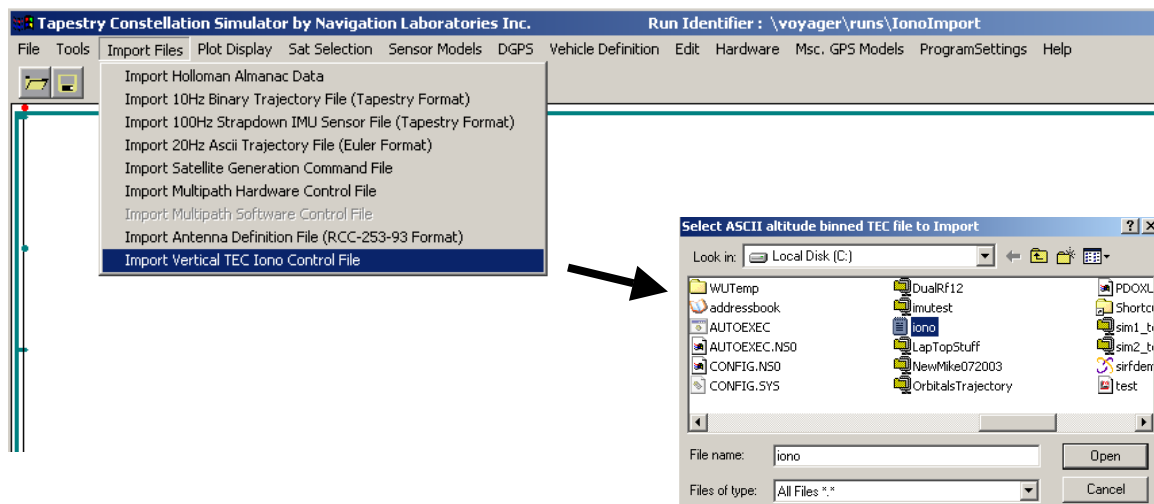
In addition to importing the file, you must configure the simulator to use it. To do this, elect the satellite data base manager as shown:
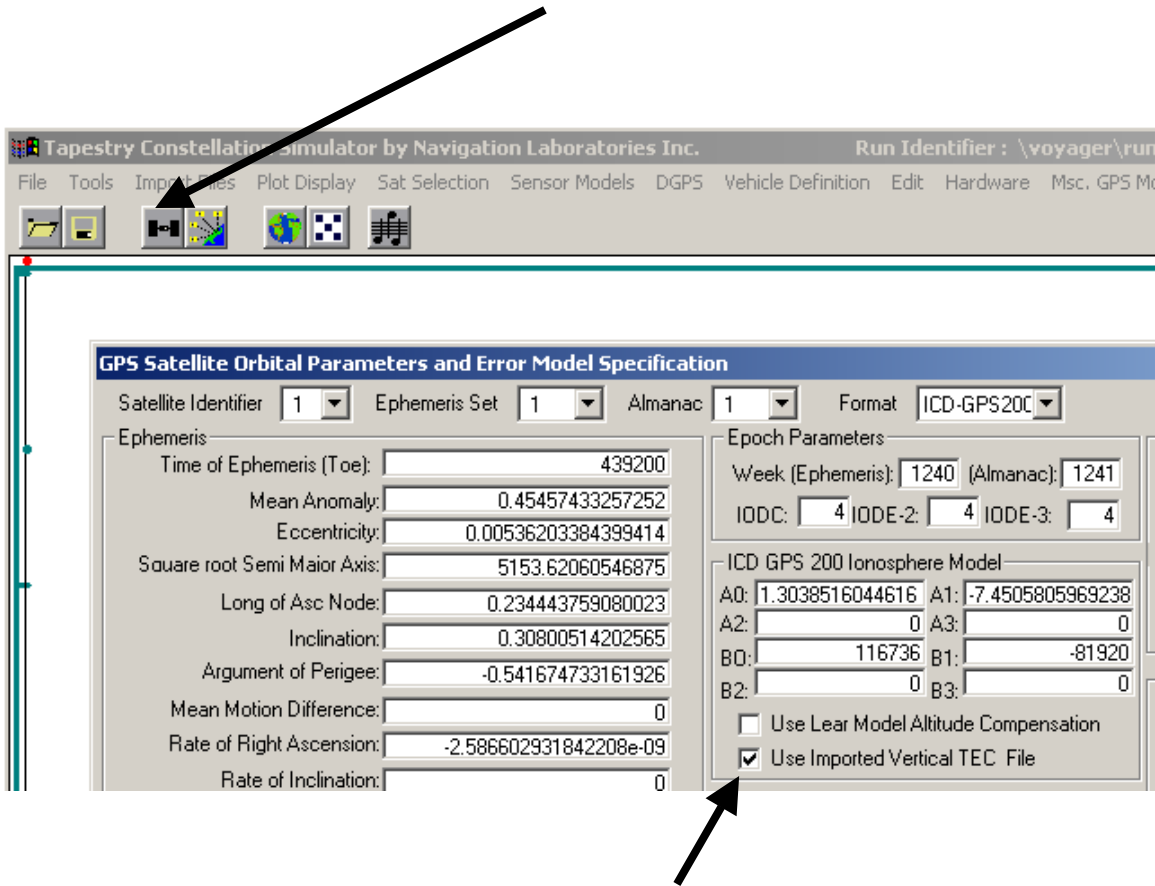
In the Ionosphere Data portion of the display, check the "Use Imported TEC File check box. For high altitude operation you may also want to use the Lear model. If so check that box as well. If you want to disable the import file, un-check this box and the standard ICD-GPS-200 model will be used.

Imported TEC File Format:

The file format is ASCII and consists of successive lines containing the reference altitude and associated Total Electron Content (TEC) value. An example is:

```
0.0 1.2345e-8
10000.0  1.01256e-8
20000.0  0.98456e-8
```

etc. The first value is the altitude in meters and the second value is the associated Vertical Total Electron Content (TEC), which is dimensionless.

Processing and Limitations:

You may enter up to 100 values into the file. For altitude between those entered linear interpolation is used. If the altitude exceeds the last value entered into the file, then the last value is used without interpolation.

The following code snippet illustrates how the TEC values are used to modify the ICD-GPS-200 computation.

```
a = tx_iono[i].alpha0 + tx_iono[i].alpha1*theta_m +
    tx_iono[i].alpha2*theta_m*theta_m +
    tx_iono[i].alpha3*theta_m*theta_m*theta_m;

// If the user wants to use thier own TEC value do so.
if(UseImportedTec && !ImportFileError) {
    // interpolate the TEC value based upon the correct altitude binning value
    a = GetImportedTec(altitude,a);
}

b = tx_iono[i].beta0 + tx_iono[i].beta1*theta_m +
    tx_iono[i].beta2*theta_m*theta_m +
    tx_iono[i].beta3*theta_m*theta_m*theta_m;
```

As can be seen. The imported value replaces the GPS-200 model but NOT the periodicity associated with the earth-sun-user angle.