ITU World Radiocommunication Seminar

Equivalent power-flux density limits examination

2-6 December 2024, Geneva, Switzerland

Equivalent power-flux density limits examination

Part III – Preparing Input Data

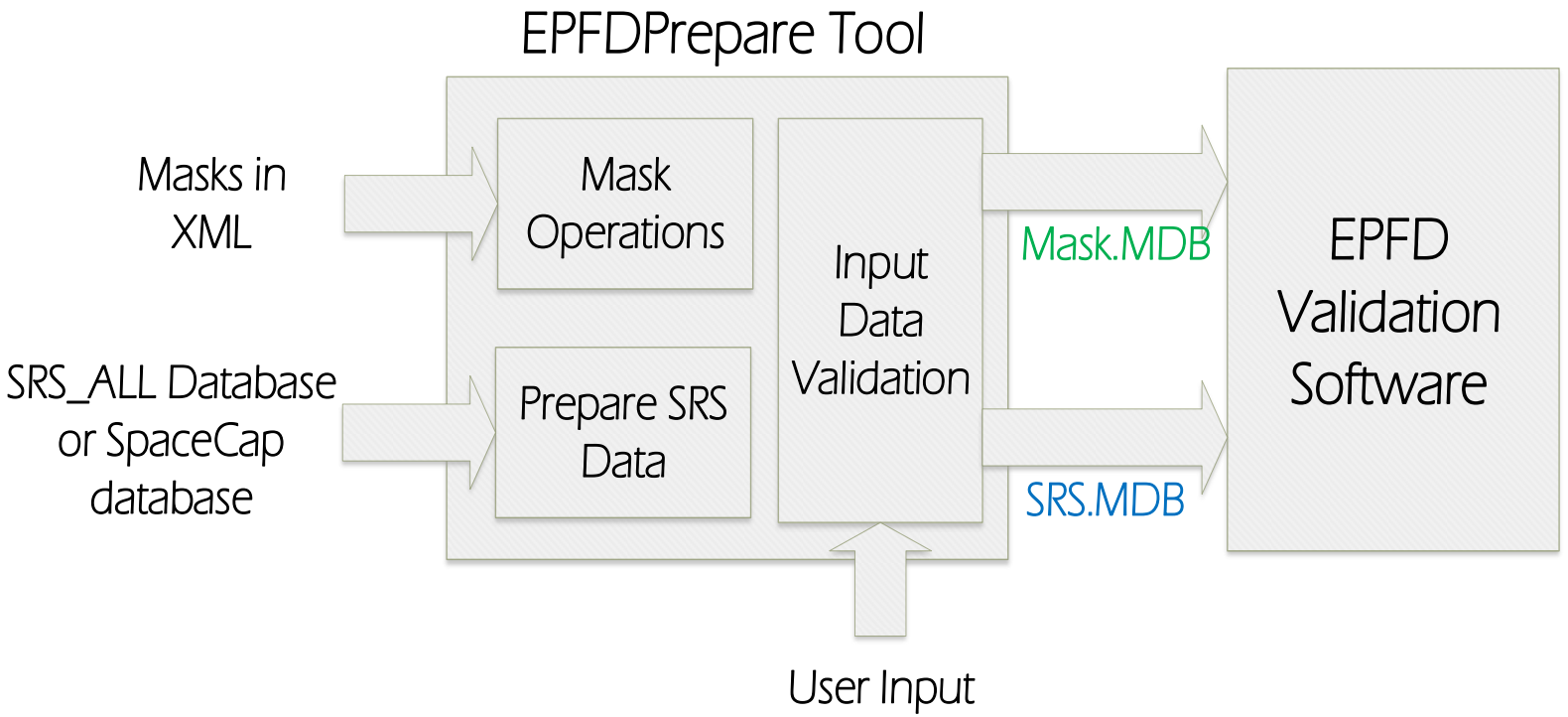
Compiling data set

Masks in XML format are stored in MDB file

All other parameters are contained in SRS Database.

To facilitate calculation, it is advisable to extract a notice to a separate database only including 1 frequency assignment per each frequency band subject to Article **22**, **9.7A**, **9.7B** examination.

All data is compiled using **EPFDPrepare** Tool



1. Download exercise file:

   Data EPFD files (zip)

2. Unzip it somewhere on your local drive
3. Repeat the steps below

or

Follow demonstration in video ***EPFD Demo***

Starting GIBC

Input databases:

-Mask database

-SRS-data

Options:

- Notice ID for examination
- Analysis RR.22 Hard Limits or No. 9.7B)
- Use Dual Timestep option to improve simulation performance (see Section 4.7, Part D, ITU-R Recommendation S.1503-2).
- Full WCG Down Check. The Worst-case geometry on downlink (WCG Down) calculation can take a significant amount of time to complete. To increase calculation performance, by default, the latitude step size of 1 degree will be used, if it less than PFD mask step size.
- Select Limits option to preselect Article 22 limits, which are to be examined.
- Timestep Normal or TS1. Use TS1 to reduce simulation time steps.
- Select software to run (Agenium or Transfinite)

Status window

Results review:

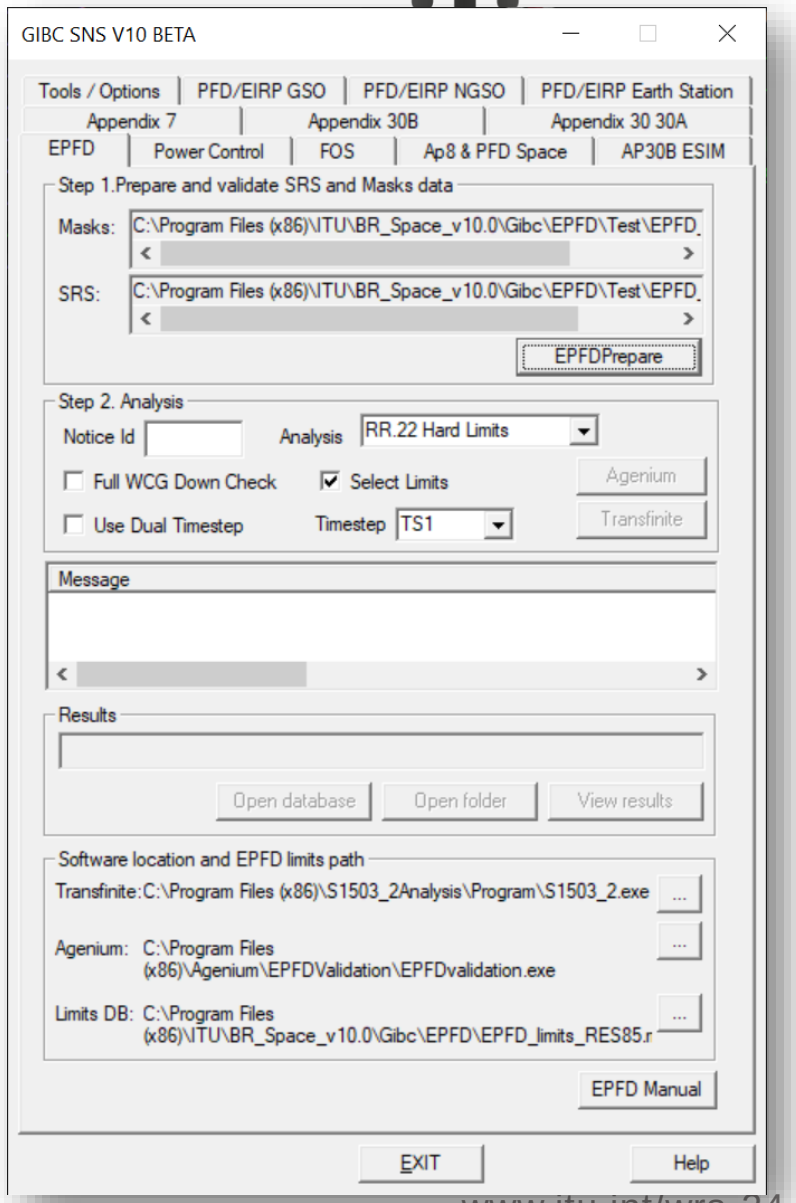
-Open database with the results

-Open folder with the results

-View Results using 'EPFD ResultsView'

Set default locations for the EPFD Validation Software:

- No need to change by default



Preparing data

Select input databases (for already compiled data):

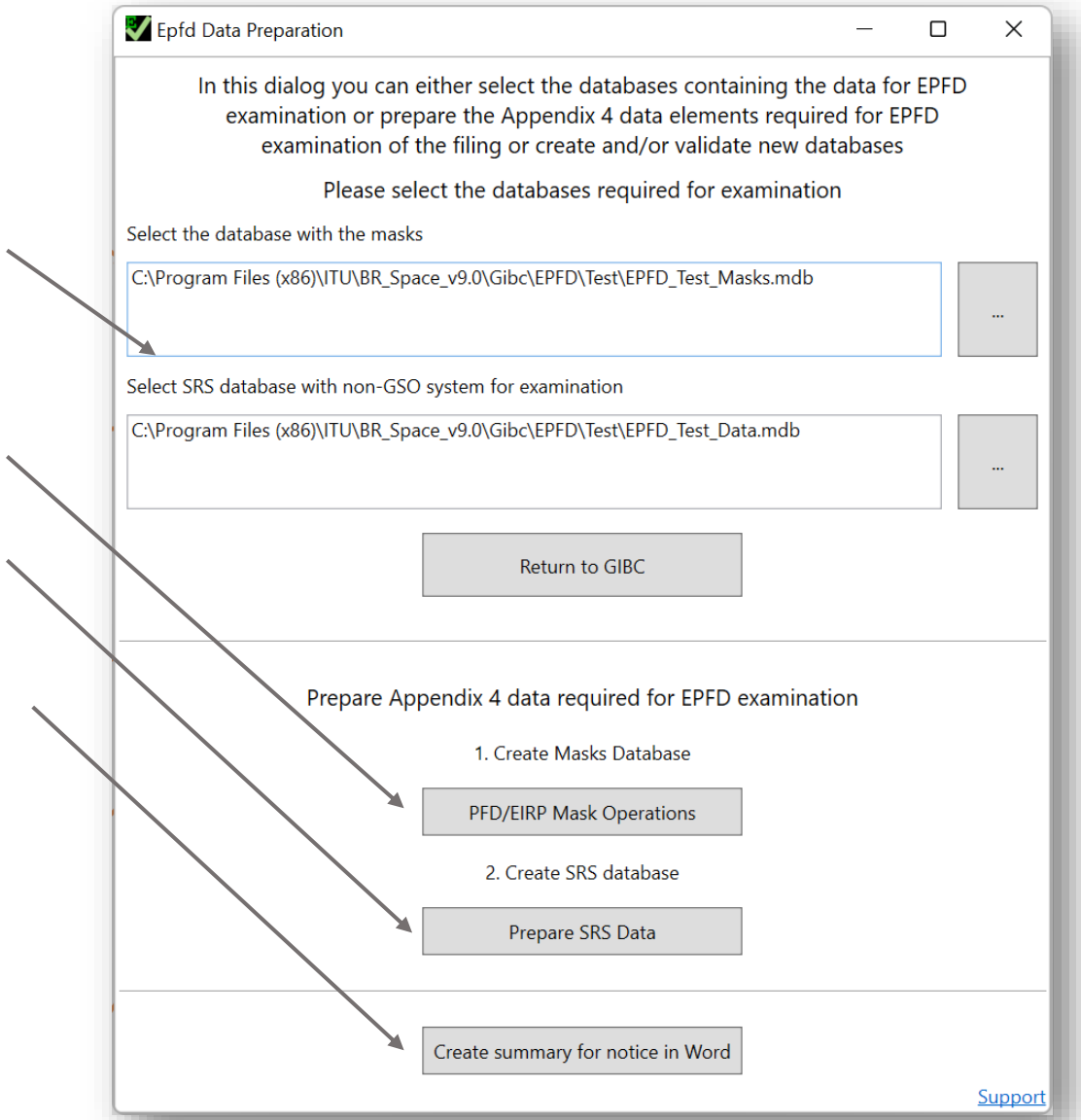
- Masks database
- SRS-data
- Select databases and press '**Return to GIBC**'

Prepare Mask Database

Prepare SRS-Data

Create summary for notice in Word

- Create report for data subject to Article 22



- Prepare the mask database
- Prepare SRS-type database:
  - Import the notice from an existing database
  - Link frequency assignments in imported notices to the masks in Mask database
- Validate input in the databases

- **Input files:**
  - SRS-data source:
    - `1-SpaceCap-NSKY.mdb`
  - XML Mask files:
    - `EIRP_ES_Mask_NSKY_id 3.xml`
    - `EIRP_SS_Mask_NSKY_id 4.xml`
    - `PFD_Mask_NSKY_id_1.xml`
    - `PFD_Mask_NSKY_id_2.xml`
- **Compiled files:**
  - Mask database:
    - `NSKY Masks.MDB`
  - SRS-type database:
    - `NSKY SRS.MDB`
  - Alternative SRS-type database to decrease calculation time:
    - `NSKY SRS-repeat track.MDB`
- **Result:**
    - `EPFDResults_123520456.mdb`

Preparing Mask database

Mask database operations:

- Create New mask database
- Open existing mask database
- Save modified mask database

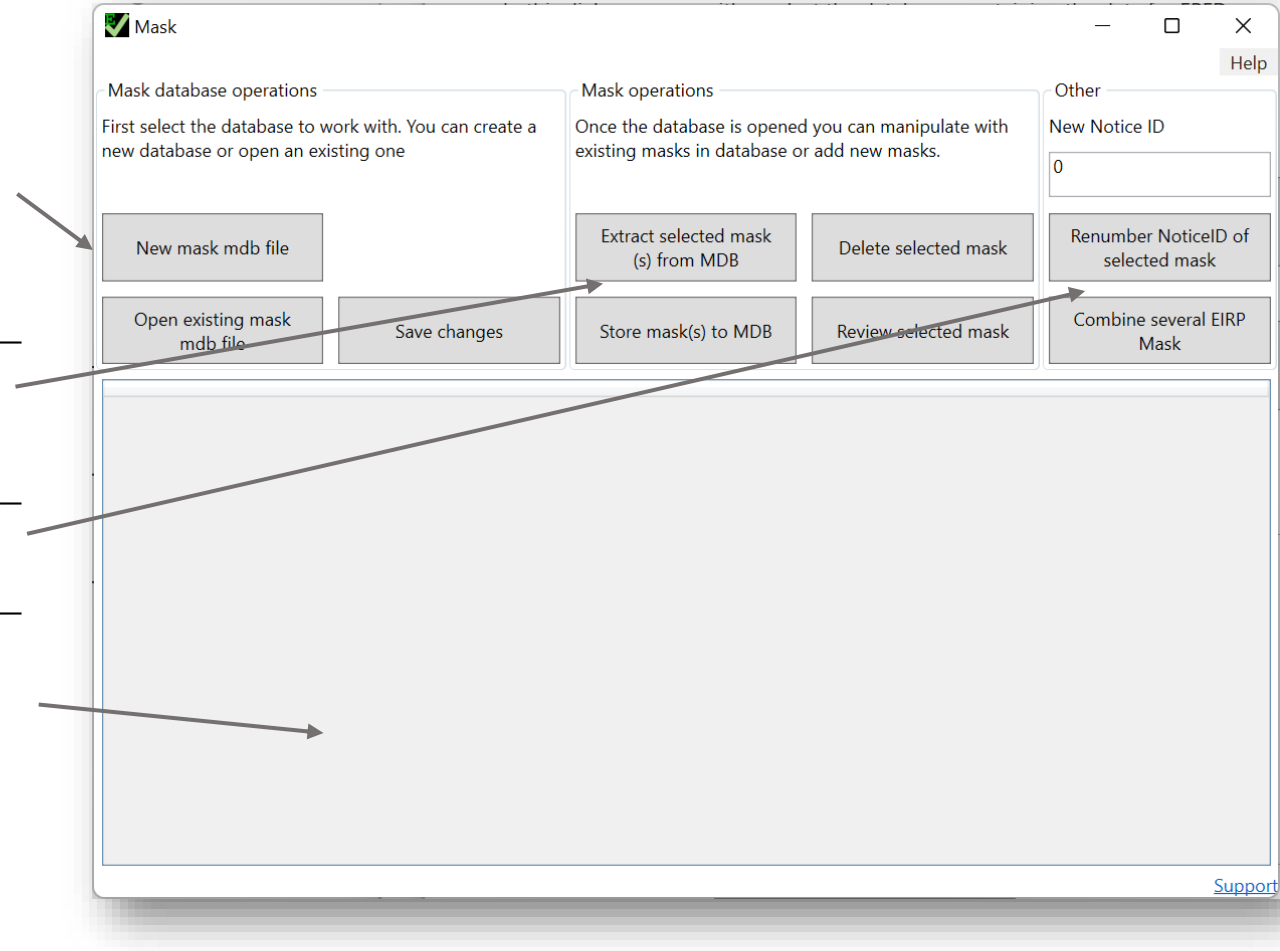
Prepare Mask Database:

- Extracting/adding/deleting XML files in mask databases

Other functions

List of masks contained mask database

- Create report for data subject to Article 22



Preparing Mask database

-Start by creating new mask database:

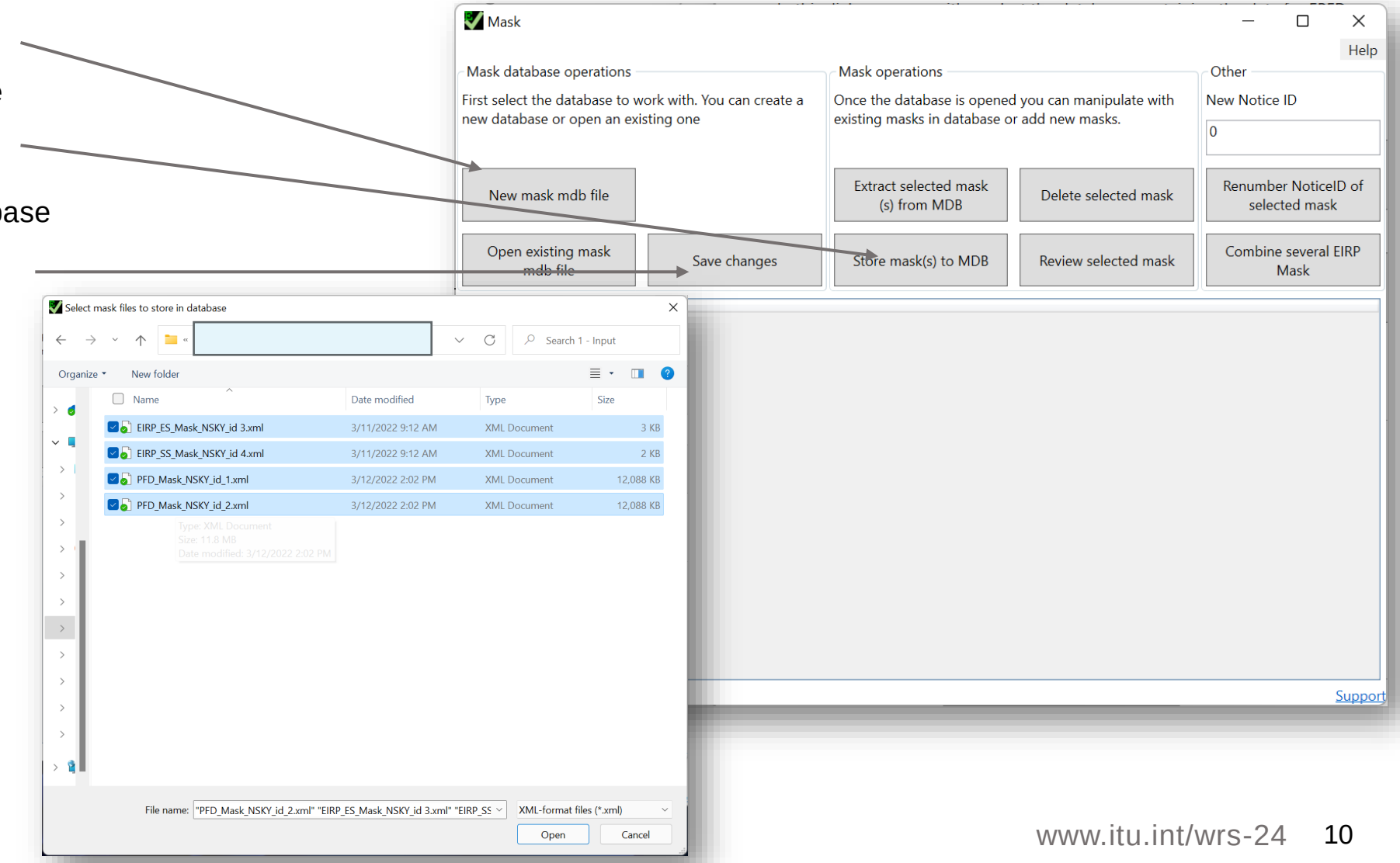
  -***New mask mdb file***

-Add XML files into mask database

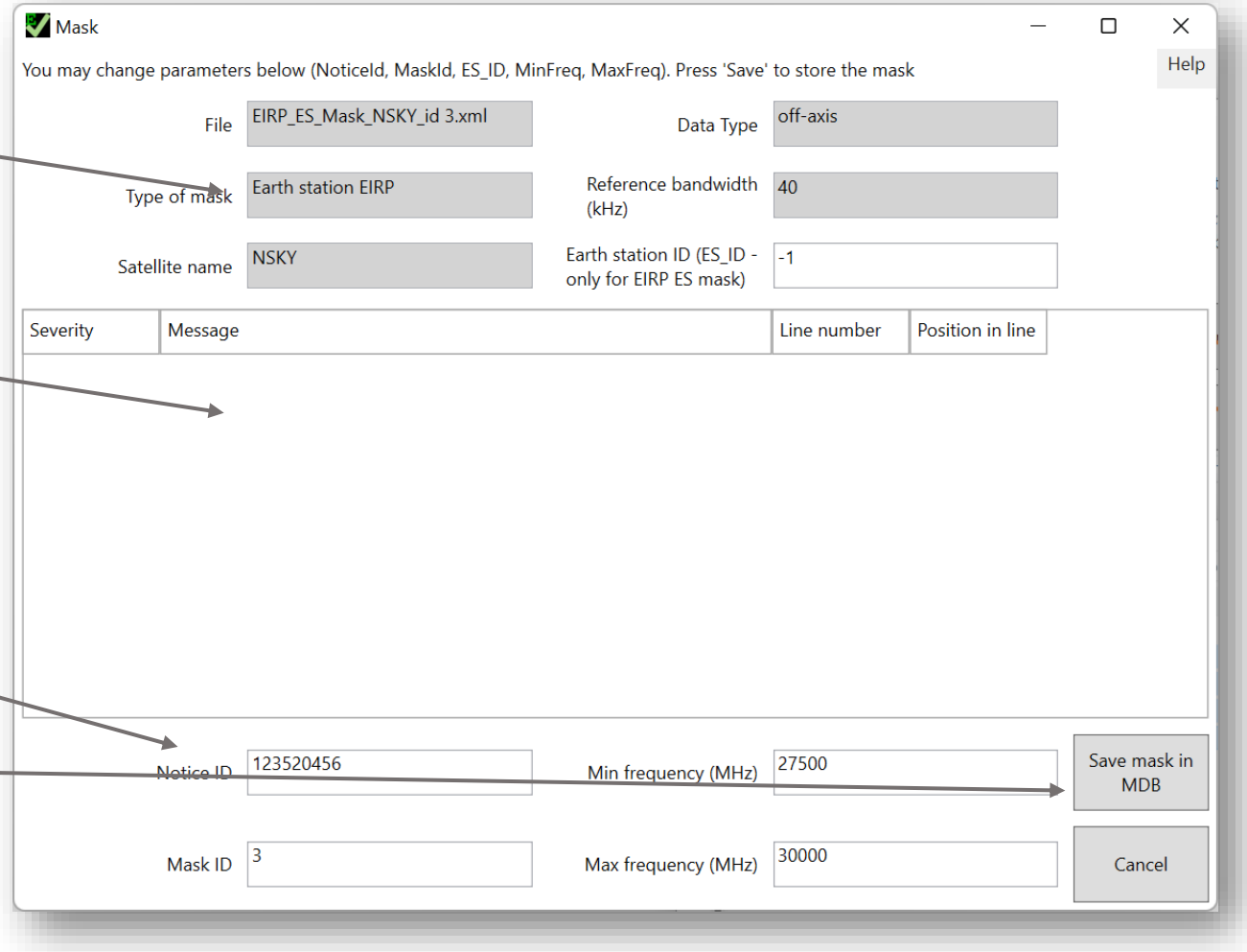
  -***Store masks(s) to MDB***

-Once done, save new mask database

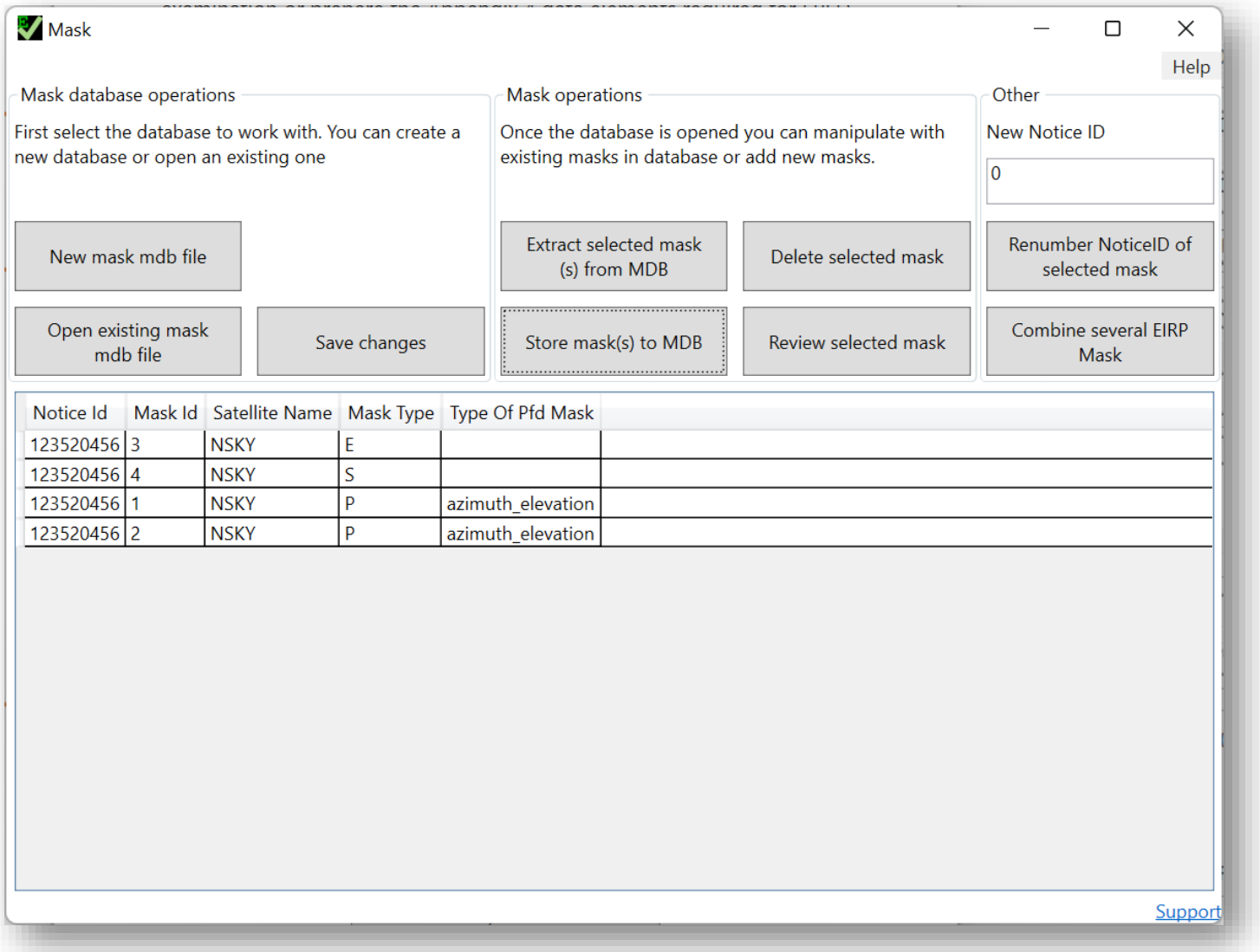
  -***Save changes***



- Read-only data
- List of errors/warnings in XML
- Some meta data can be changed here
- Save the mask in the database



List of all masks added

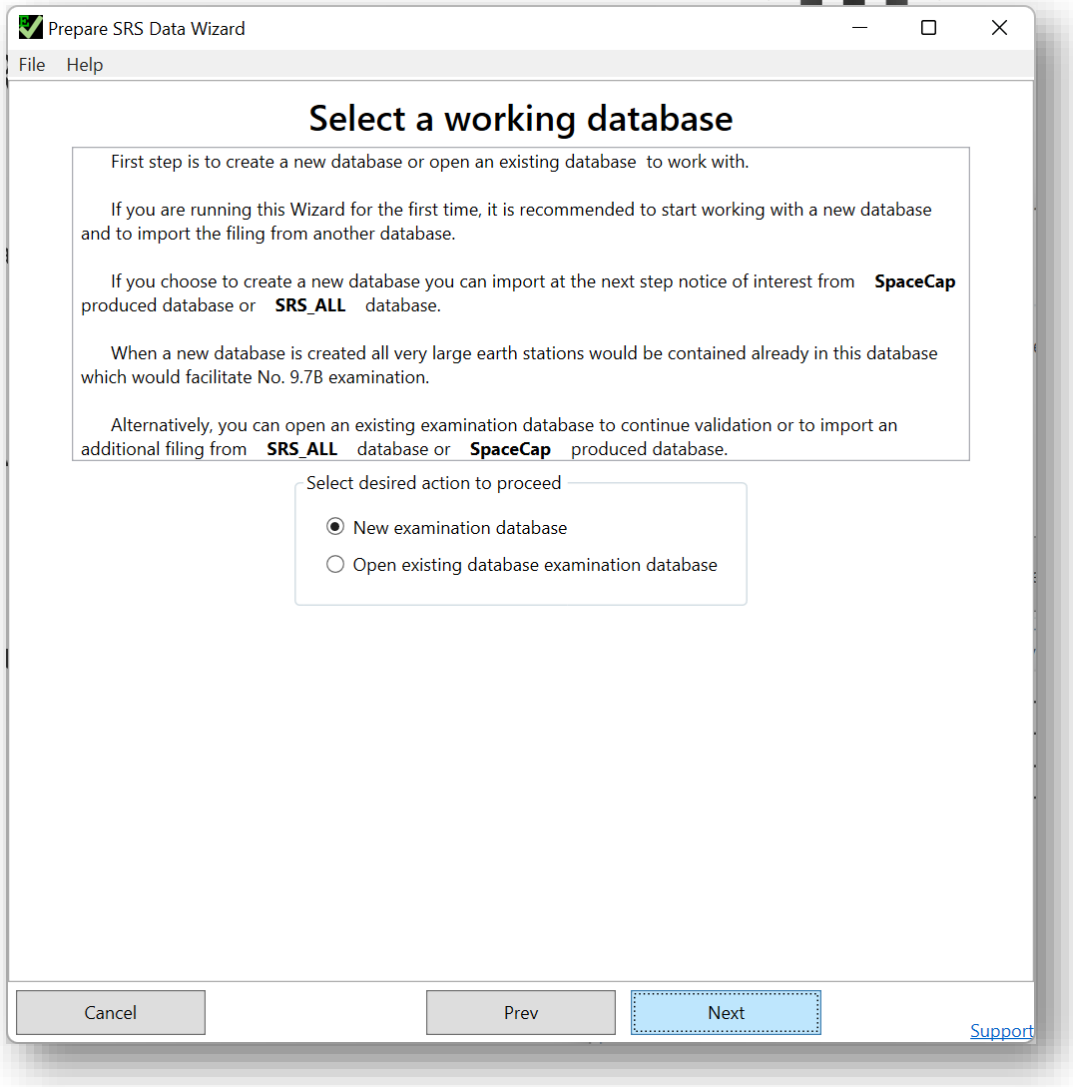


Preparing SRS database

- Create new examination database

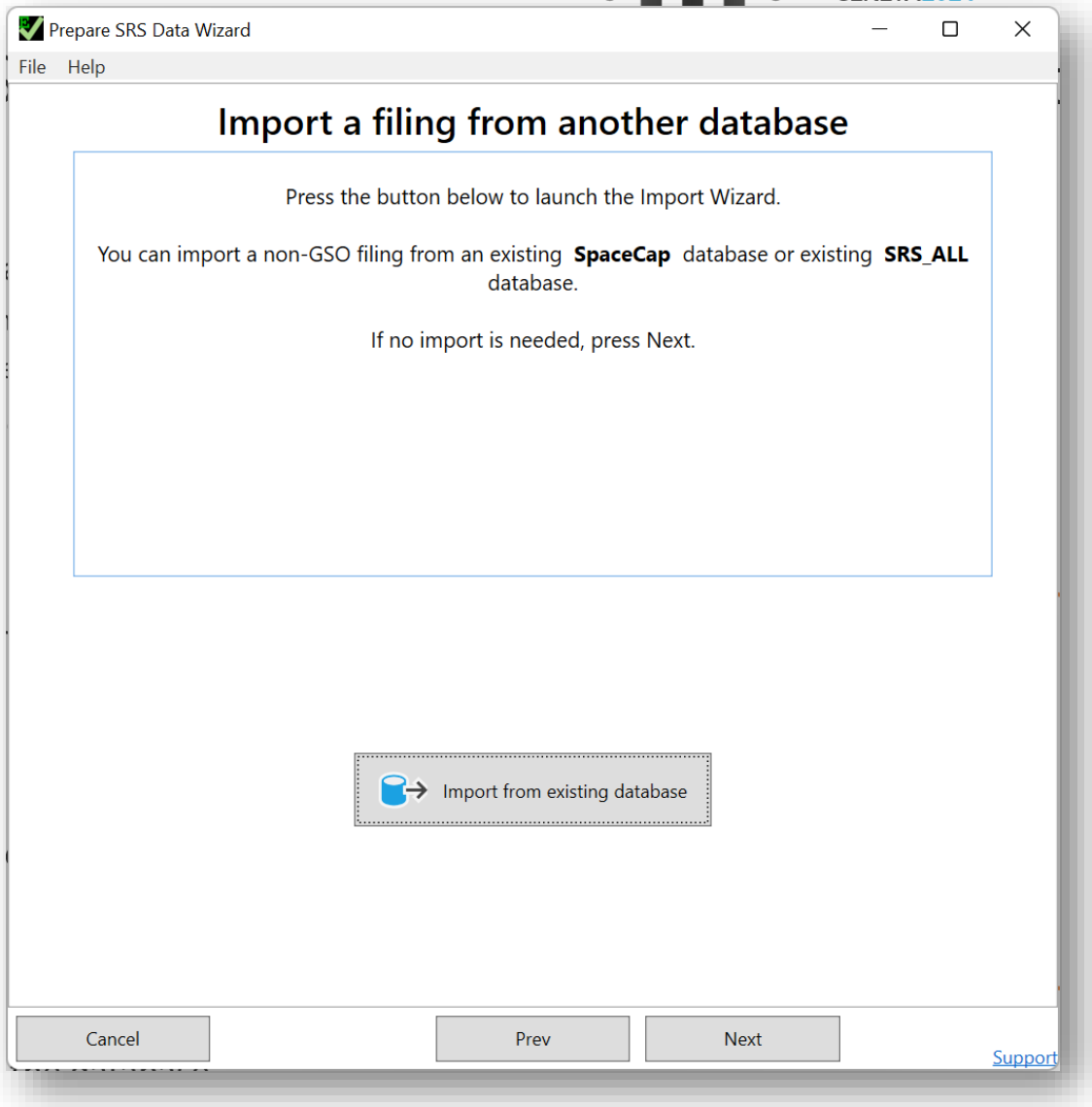
  Or
- Open existing database to validate/modify the data

- Start with creating a new database

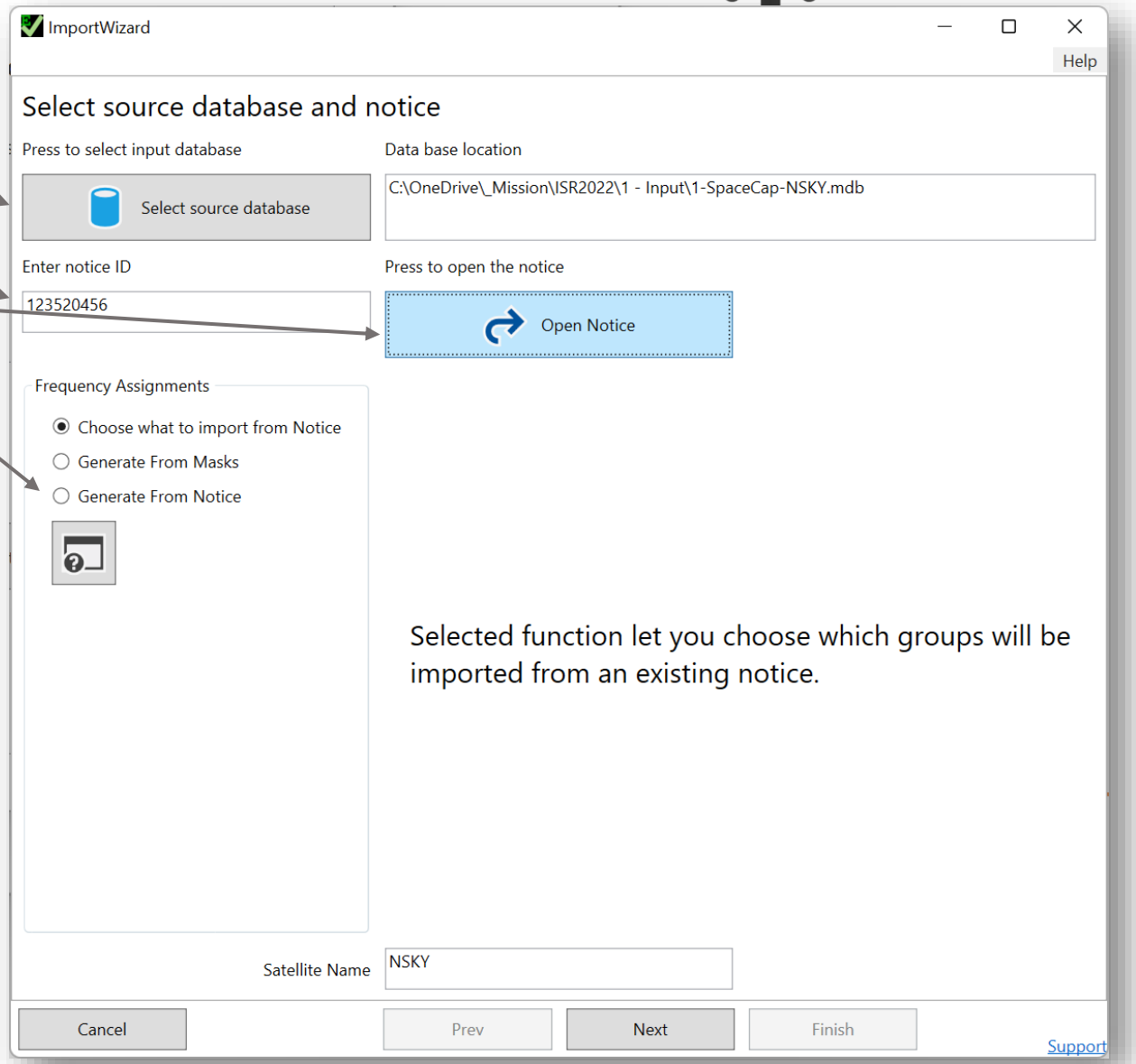


Preparing SRS database – Import filing from existing database

- The purpose is to create examination SRS-type database which would contain minimum required data for EPFD validation
- Basic principles:
  - Will contain only groups subject to Article 22 limits
  - Only 1 group per frequency range subject to Article 22 limit
  - Fill-out any missing data
- For source database the following can be used:
  - BR IFIC SRS.mdb
  - Database prepared in SpaceCap
- We will use ‘1-SpaceCap-NSKY.mdb’ as a source database
- Click ‘Import from existing database’ to start import wizard



- Select source database to import from
- Enter notice ID in source database
- Open the source notice
- Select the way how examination groups will be created



First option is a default method of selecting frequency assignments groups which can be imported from source databased. Under this option, program looks for frequency assignments groups which are subject to Article 22 or No. 9.7B coordination provision and lets user to select which are the groups need to be imported from.

!!! With new SNS v10 – under this option you can select Scenario already captured in the database in v10 SNS.

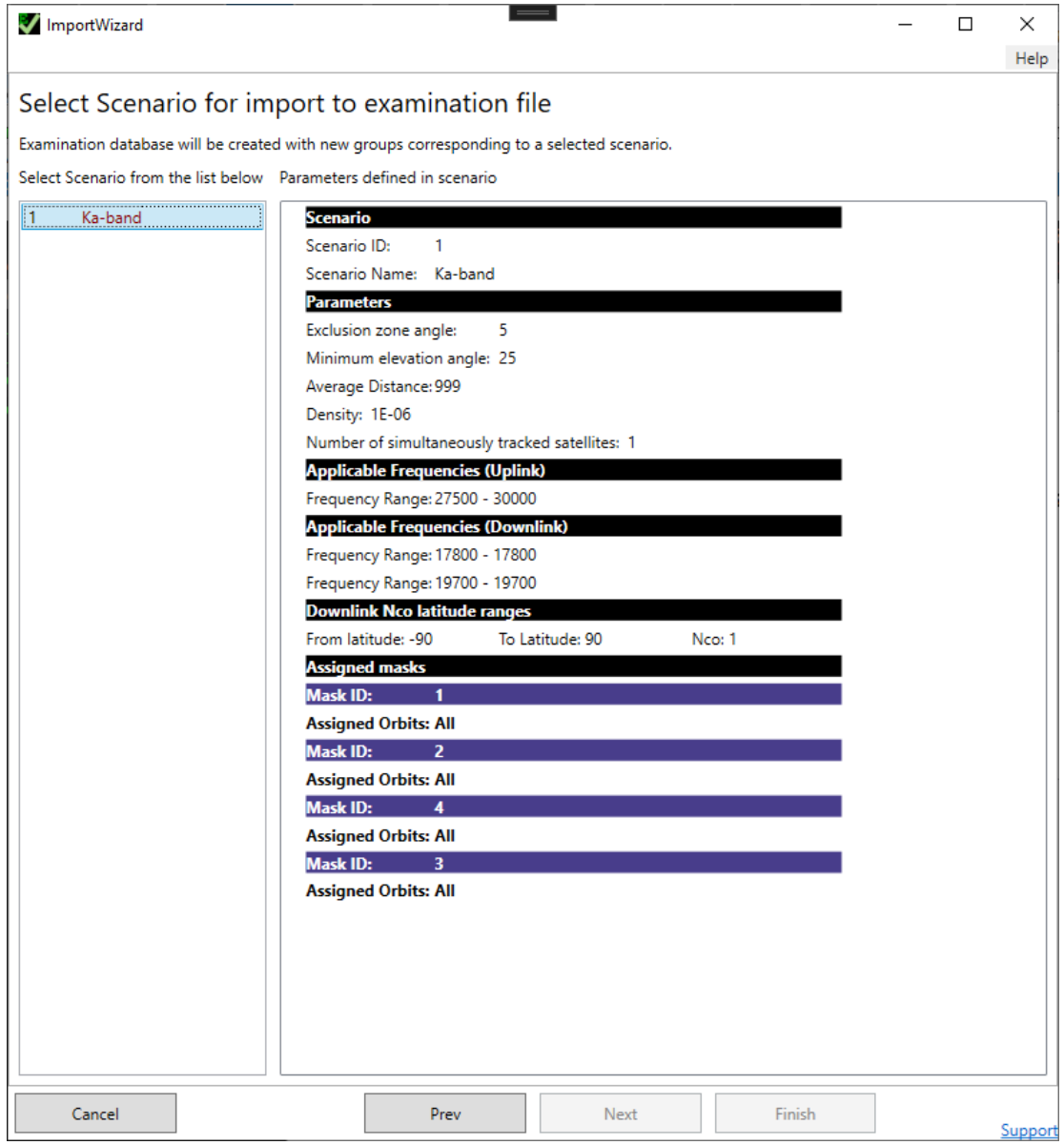
Second option is using information provided in the masks regarding minimum and maximum frequency of the frequency range to which particular PFD/EIRP mask is applicable. Provided that only single PFD or EIRP mask is applicable to specific frequency range only one new group will be generated.

Third option uses information on Article 22 EPFD limit applicable frequency band and frequency assignments used in the notice. But unlike first option, this option generates completely new groups, while avoiding having multiple groups operating in overlapping frequency band.

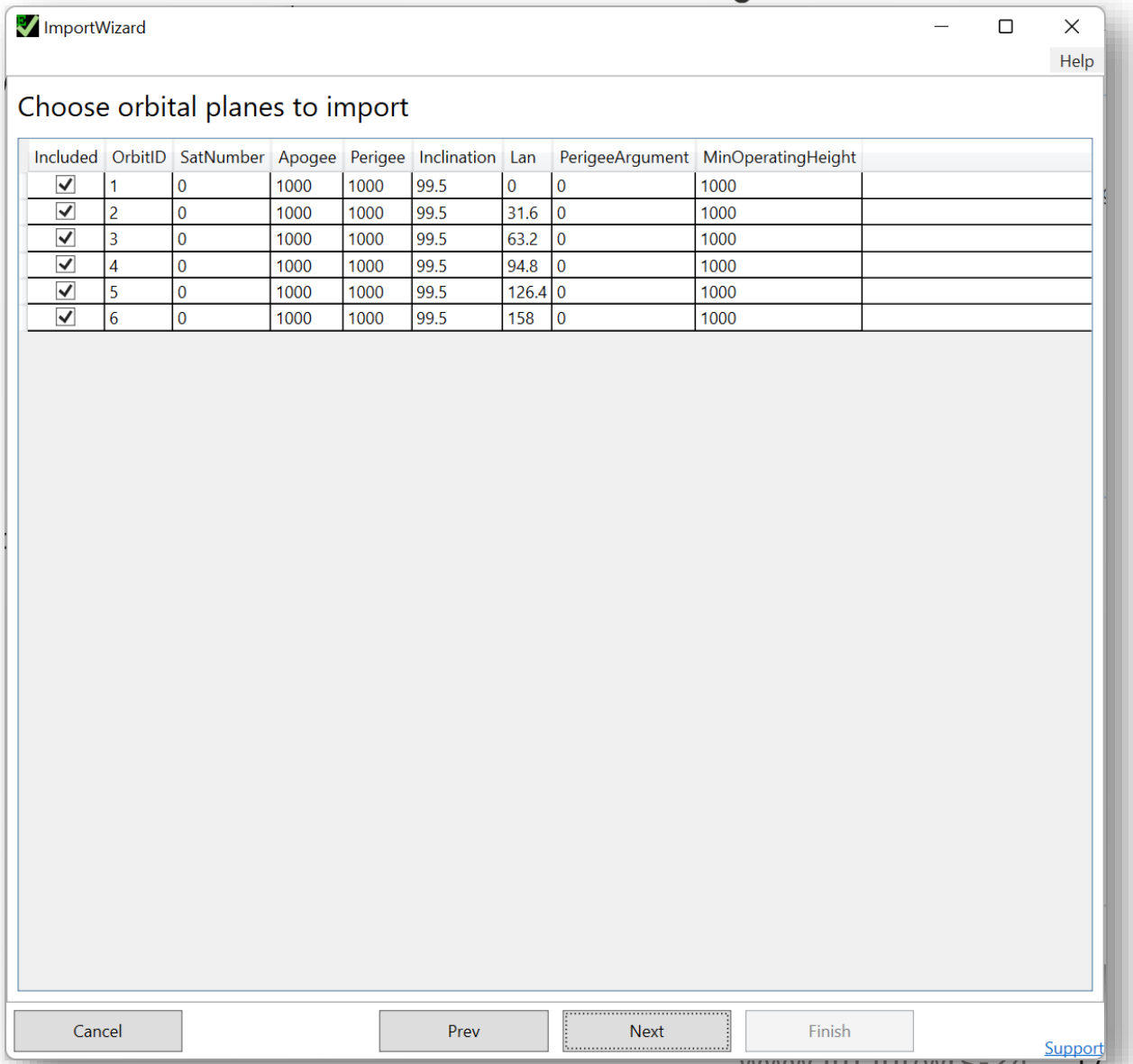
- Since we have already our mask database prepared and it is covering all the frequency bands subject to Article 22 limits, we will use second option

Preparing SRS database – Import filing from existing database

- New from 2025
- Reads scenarios defined in the source database
- Creates examination database which can be read by EPFD validation software using the parameters from the scenario
- Not yet available in BR Software released for Workshop

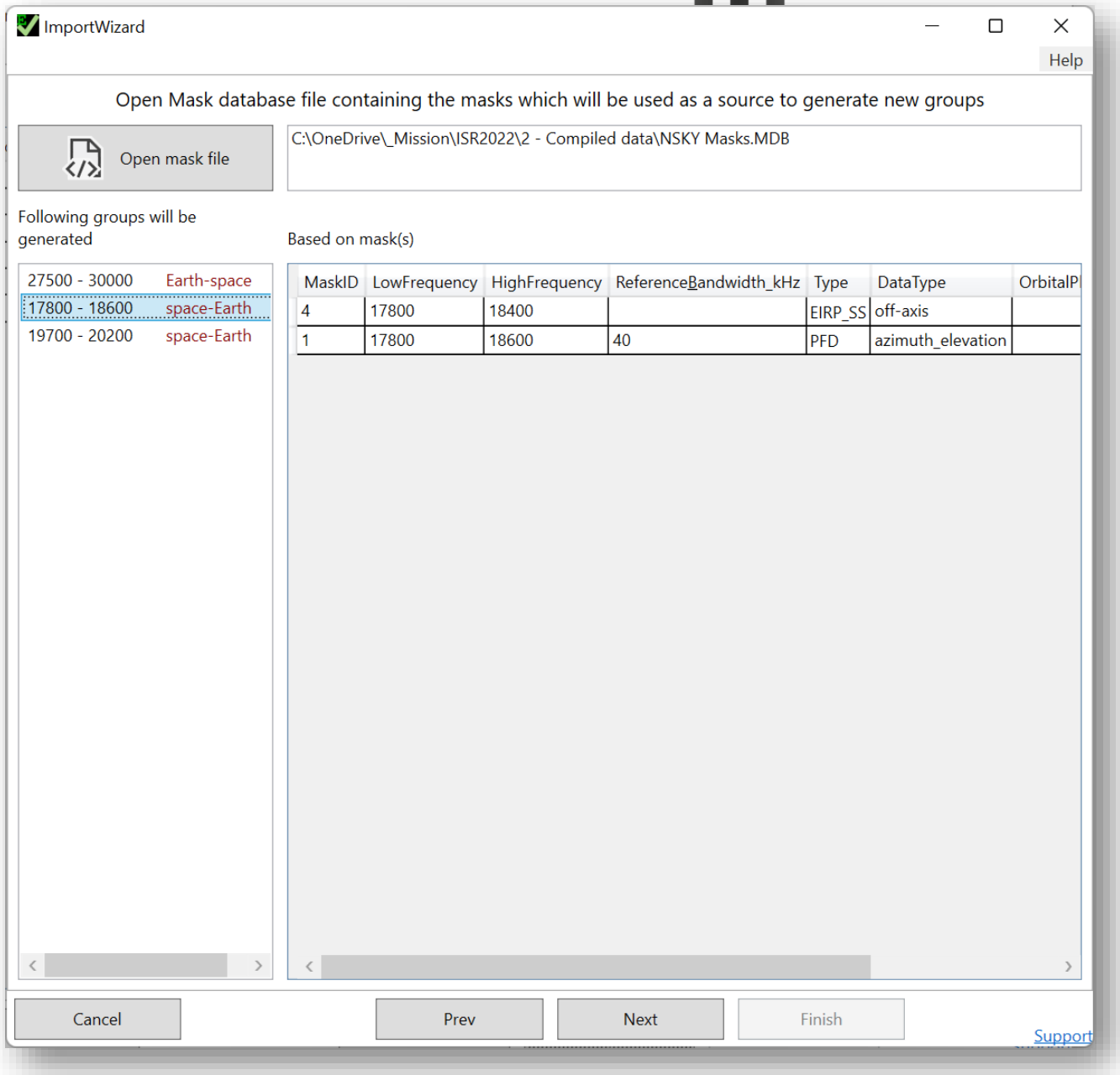


- At the next step we need to select orbital planes to import
- If there are several orbital configurations having different sets of orbital planes, we need to select only orbital planes of 1 configuration only which we are going to examine
- For each orbital configuration a separate SRS-type database needs to be created

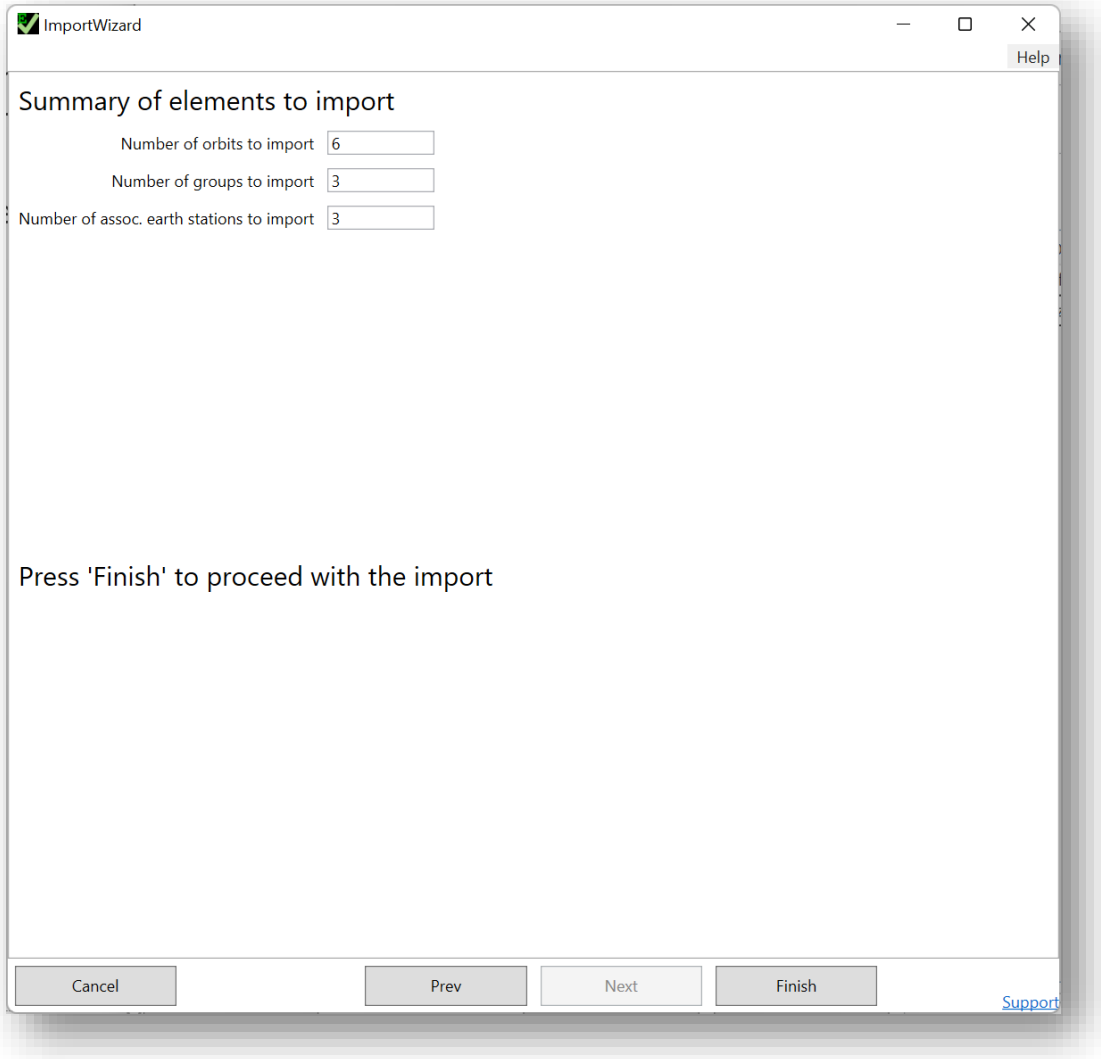


Preparing SRS database – Import filing from existing database

- At the next step, since we selected an option to generate groups from mask database, we need to open the mask database we are going to use
- The program will identify required groups of frequency assignments to be generated next

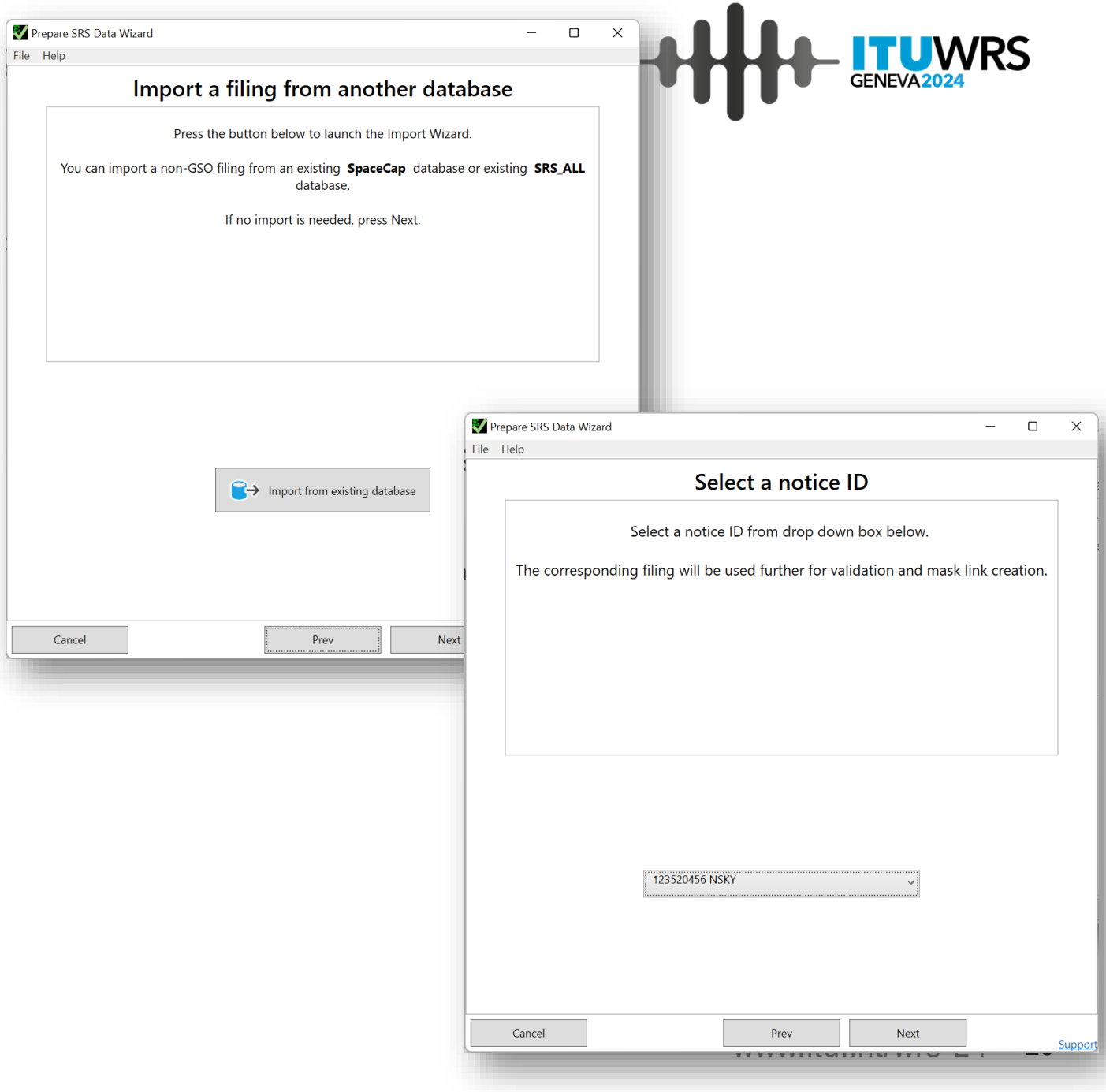


- At the next step, the summary is given for required import action
- Press ‘Finish’ to proceed with the import



Preparing SRS database

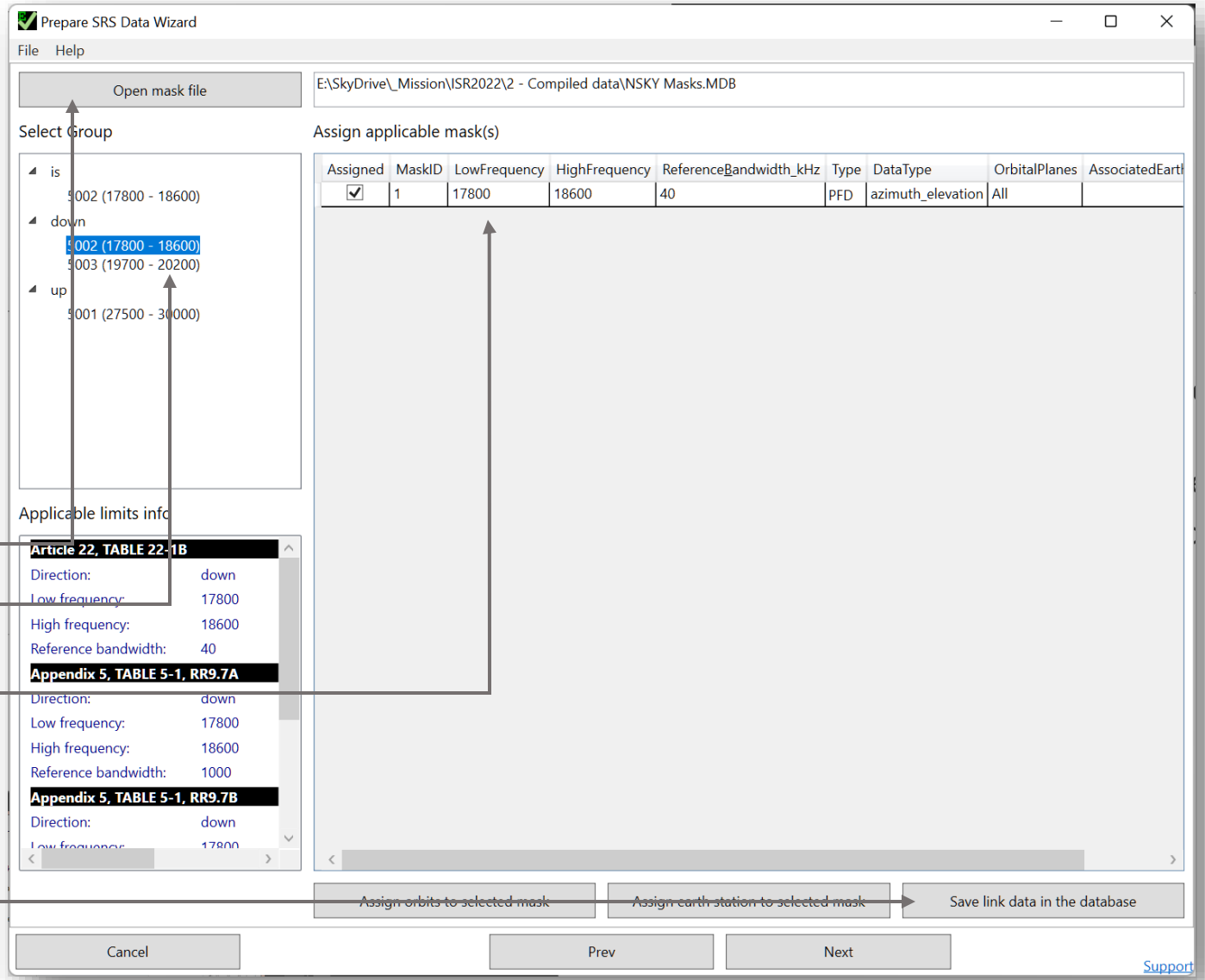
- Once import is done we can advance to the next step (press ‘Next’)
- On the next step, select the notice from drop-down list and press ‘Next’



Preparing SRS database – linking masks to the frequency assignments group

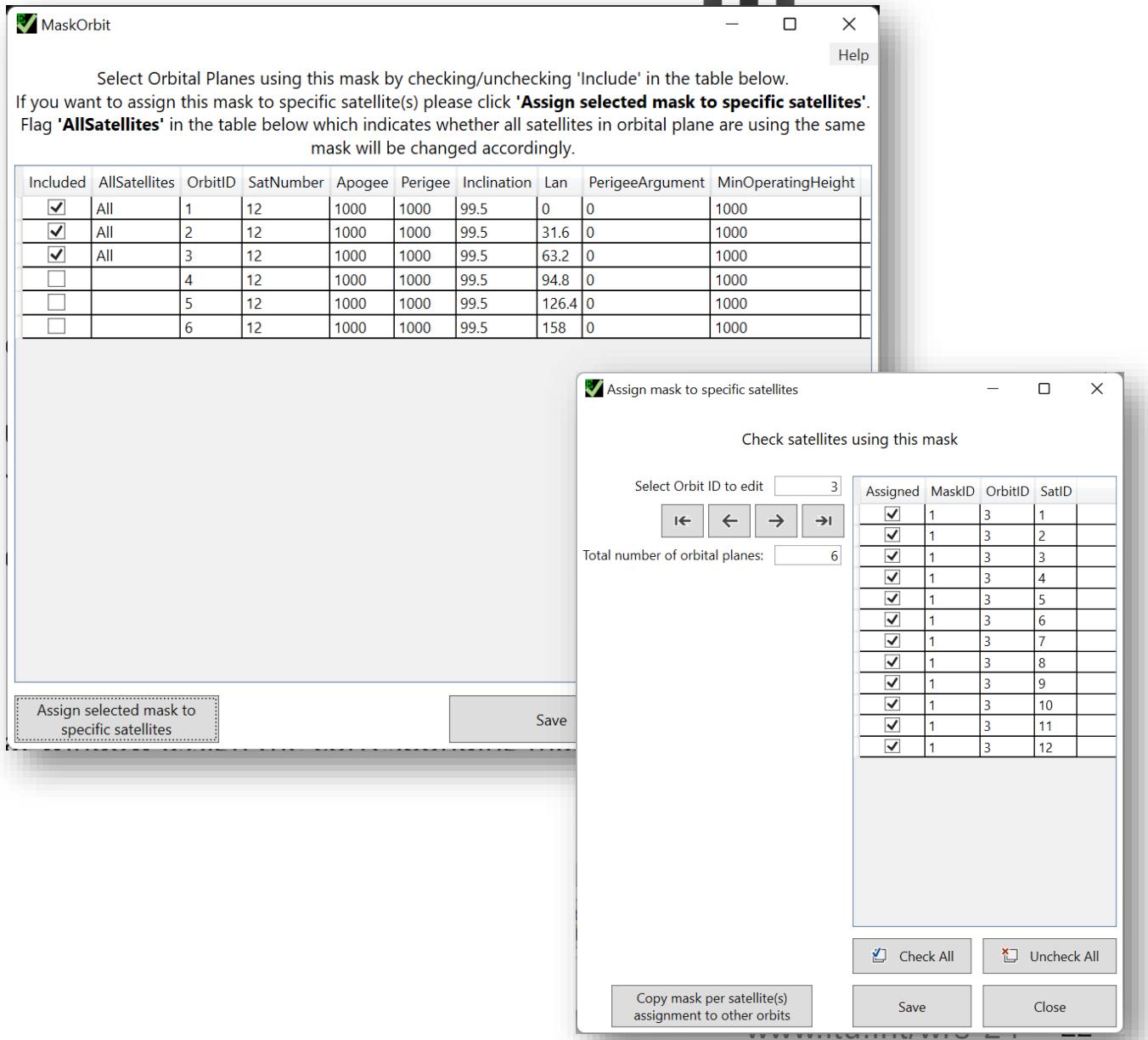
- EPFD validation software requires that each mask is to be assigned to specific frequency assignment group
- General rule – 1 type of mask assigned to 1 group.
- Exceptions:
  - Several mask(s) can be used if assigned to different orbital planes
  - Some groups may require two different types of mask. For example, group in 17.8-18.6 GHz is subject to different EPFD limits (*EPFDdown* and *EPFDis*). Therefore, space station EIRP mask and space station PFD mask need to be assigned to the group

- Select mask database
- Highlight the group you wish to establish link to
- Assign the mask to selected group
- Save link data information



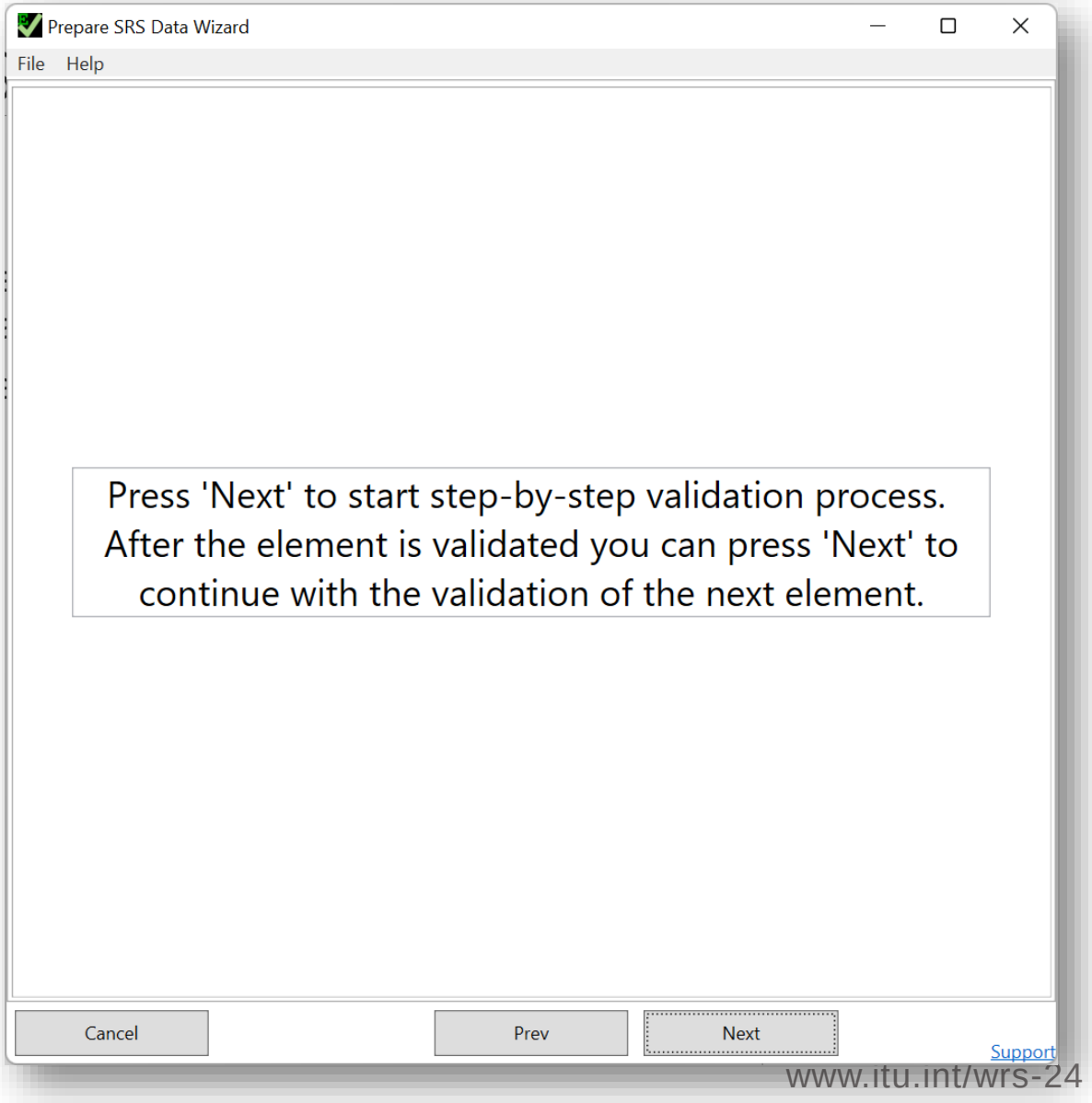
Preparing SRS database – linking masks to the frequency assignments group

- Example of selective assignment of the mask to specific orbits
- Please note that each orbit needs to have a mask assigned
- Need to repeat the process for each mask
- You may also assign the mask to specific satellite in the orbit



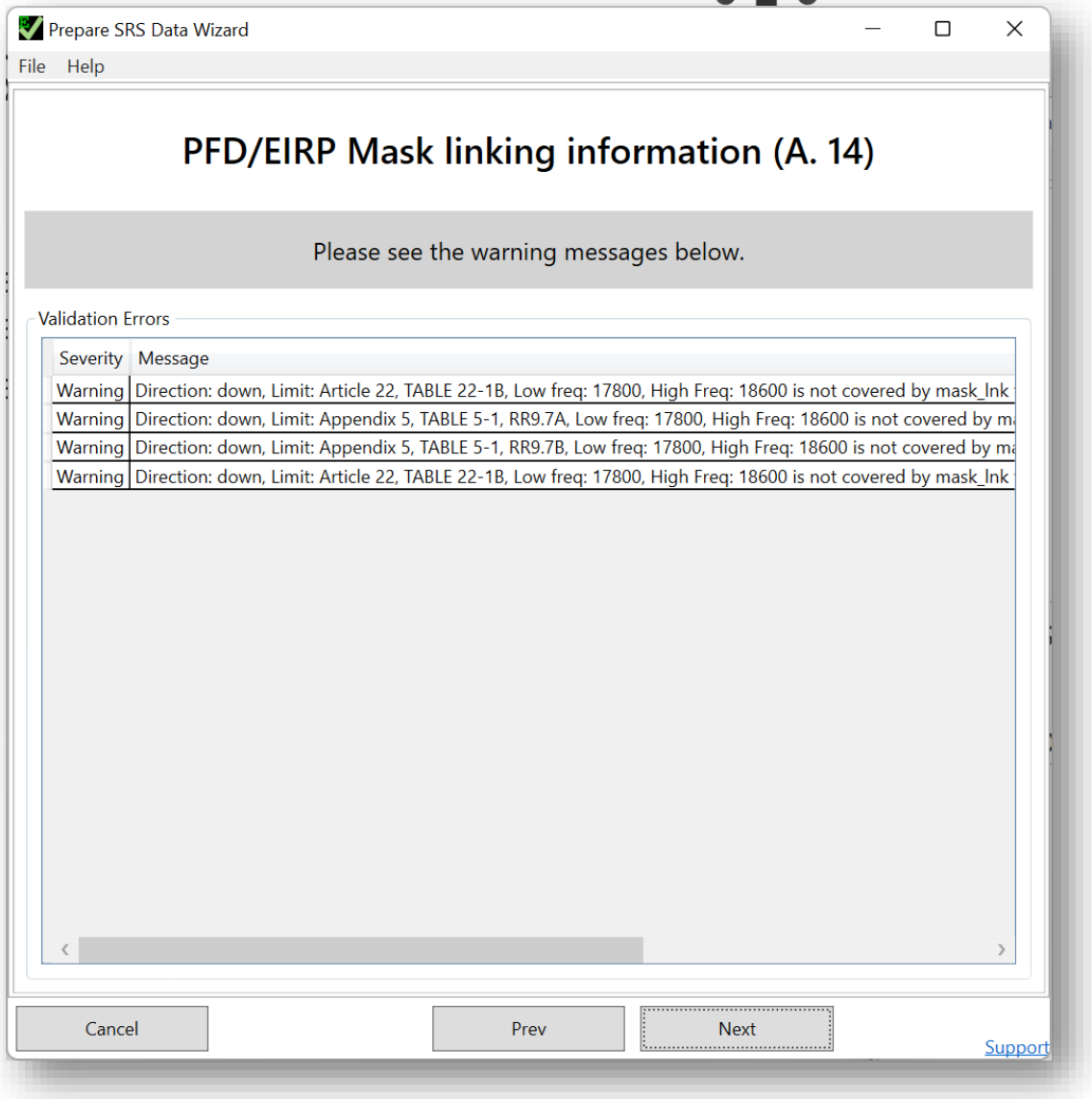
Preparing SRS database – validation

- Next step is the validation of the prepared data for its completeness and correctness
- Again, it is a step-by-step wizard

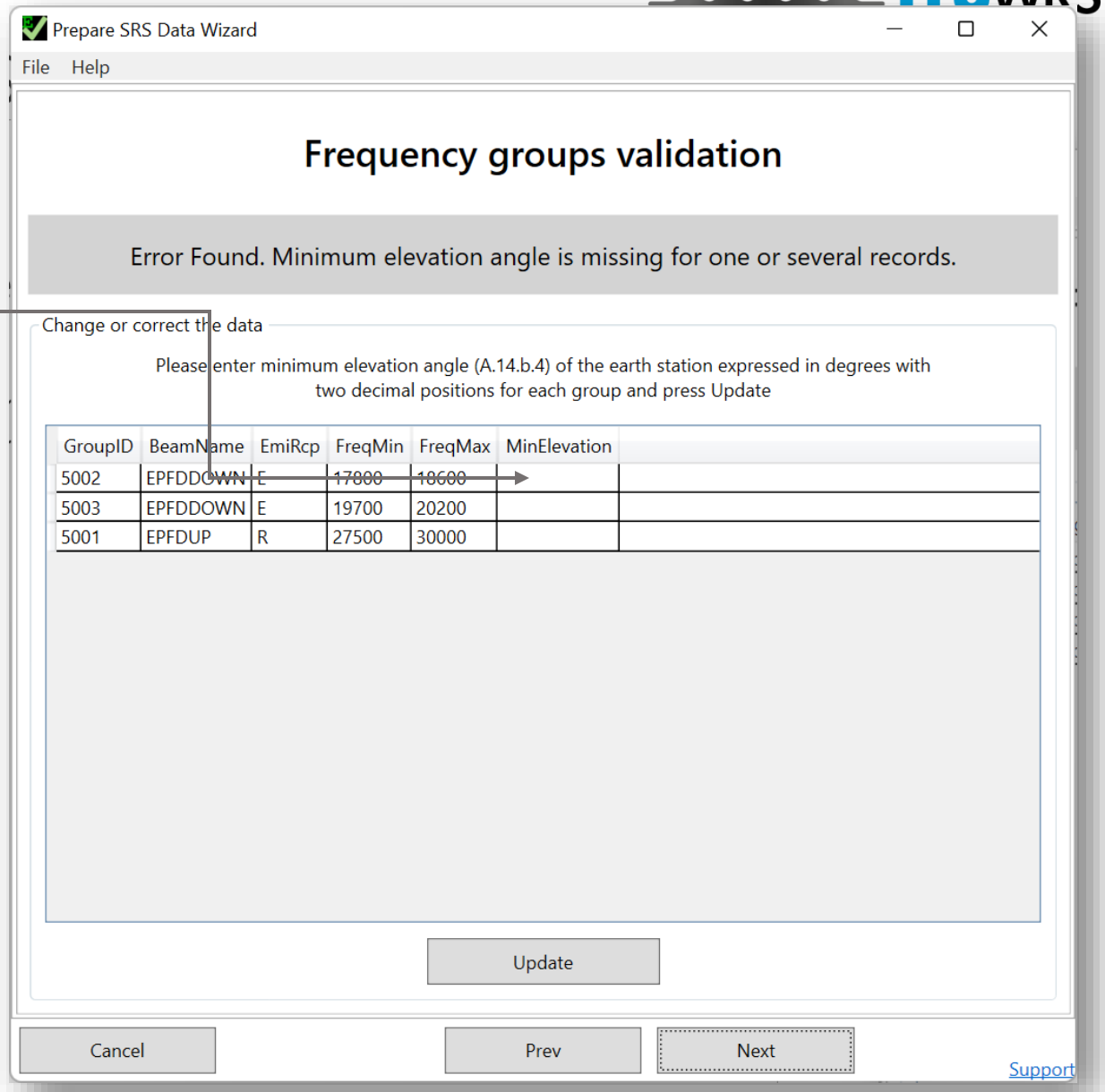


Preparing SRS database – validation

- First step is the verification of linking information
- Some warning messages are shown here as an example:
  - These warning messages indicate that some orbits do not have any mask assigned

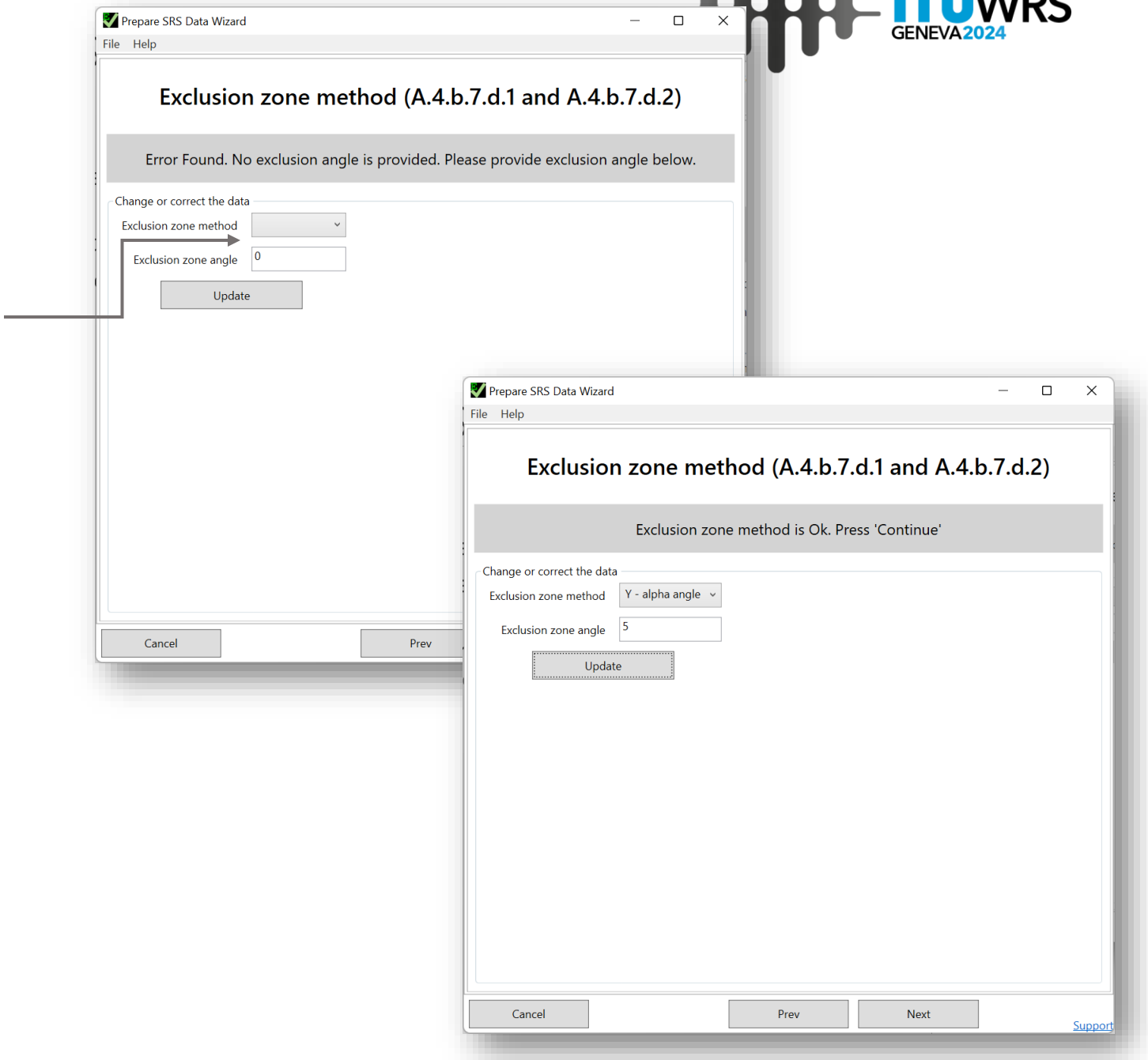


- Next step is the verification of group (grp) table containing information on the minimum elevation angle
- Here we have the minimum elevation angle missing
- Enter 25 degrees for each group and press ‘Update’



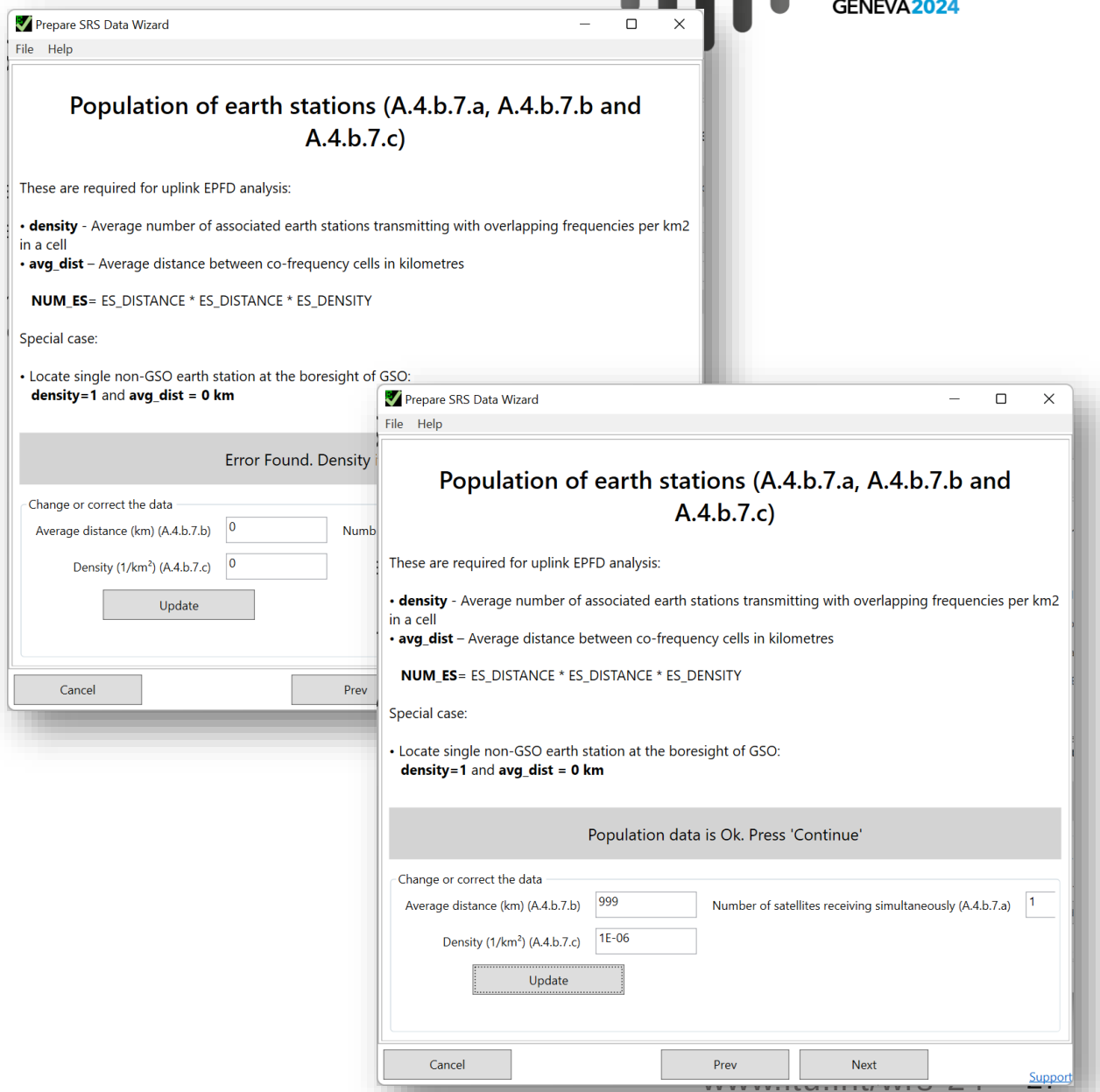
Preparing SRS database – validation

- Next step is the verification of exclusion zone method
- Here we have exclusion zone method and associated angle missing
- Enter ‘Exclusion zone method’=Y and ‘Exclusion zone angle’=5 degrees and press ‘Update’



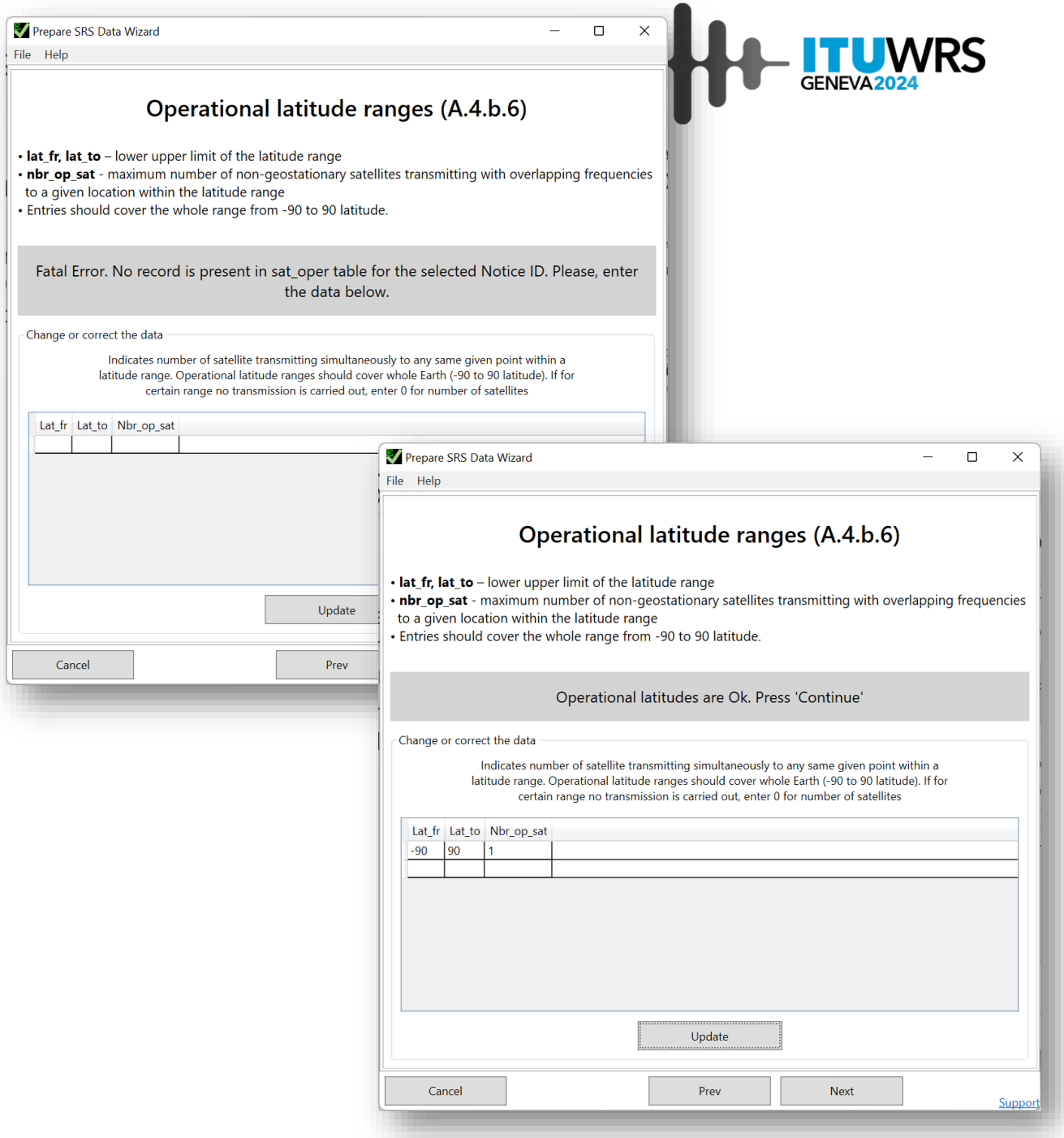
Preparing SRS database – validation

- Next step is the verification of distribution of earth stations on the uplink
- Required information is missing. Enter ‘Average distance’=999, ‘Density’=0.000001 and ‘Number of satellites receiving simultaneously’=1 and press ‘Update’

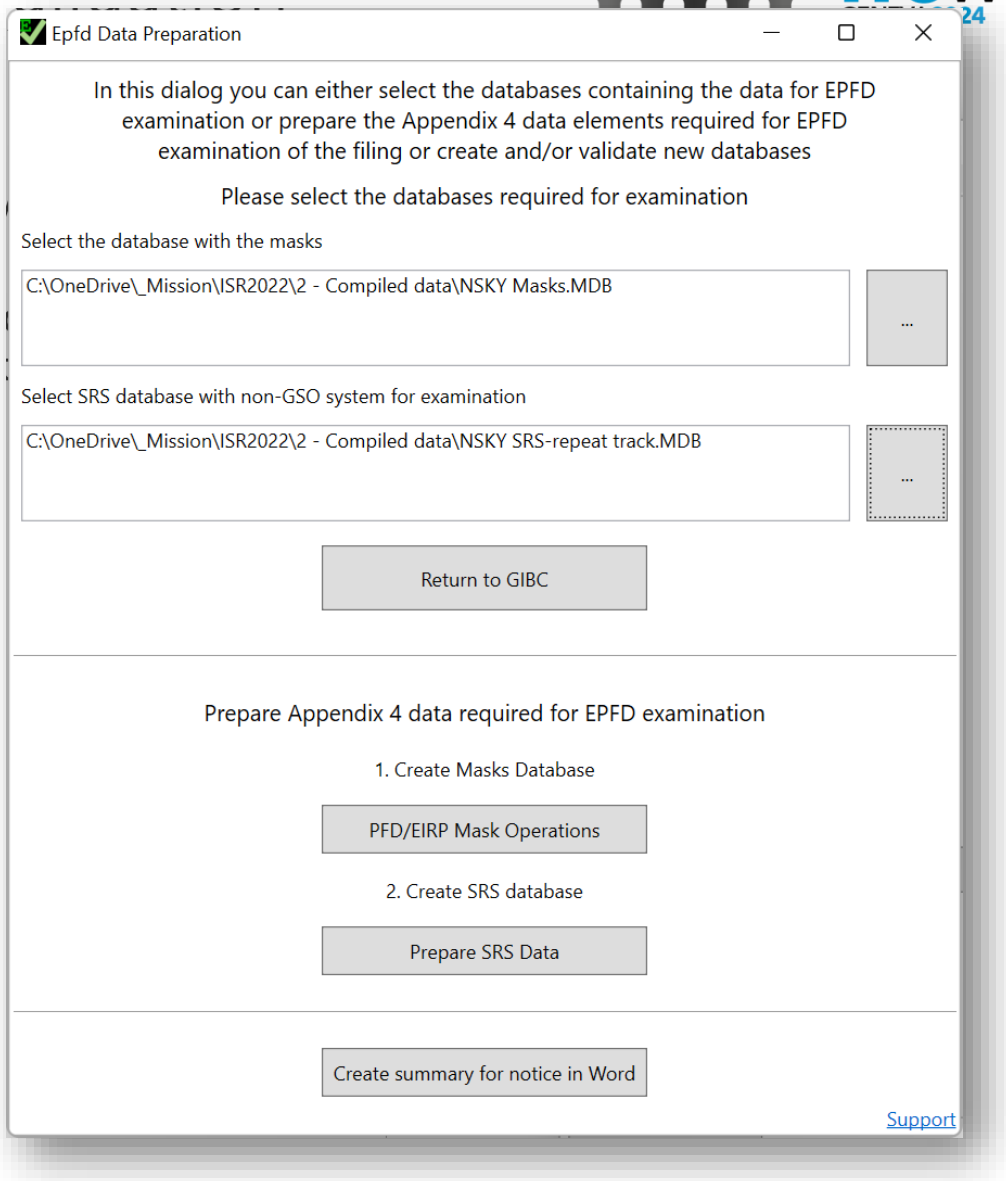


Preparing SRS database – validation

- Next step is the verification of ***Nco*** (number of satellites transmitting simultaneously to the same geographical area at any point within the given latitude range)
- Required information is missing. Enter the values: -90 to 90 with 1 satellite and press ‘Update’
- In some cases several ranges might be required. E.g. system is only serving specific latitude range. For example, -45 to 45. In this case the table should contain 3 rows:
  - -90 to -45 with Nco=0
  - -45 to 45 with **Nco=1**
  - 45 to 90 with Nco=0

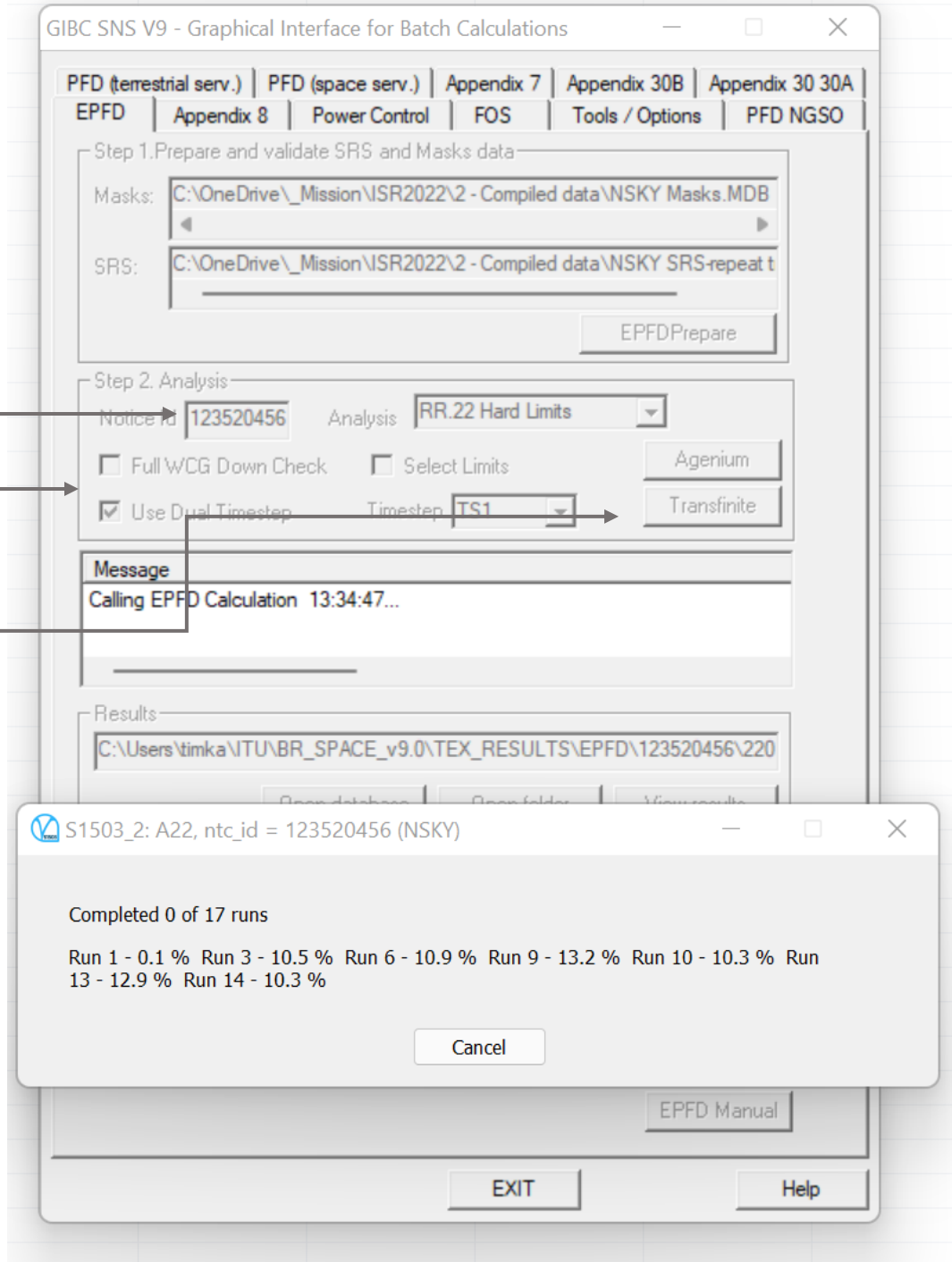


Now we can select our prepared databases and '**Return to GIBC**'



Preparing databases

- Once everything is ready:
  - Enter notice ID
  - Select recommended options
- Start running EPFD validation by choosing ‘Transfinite’

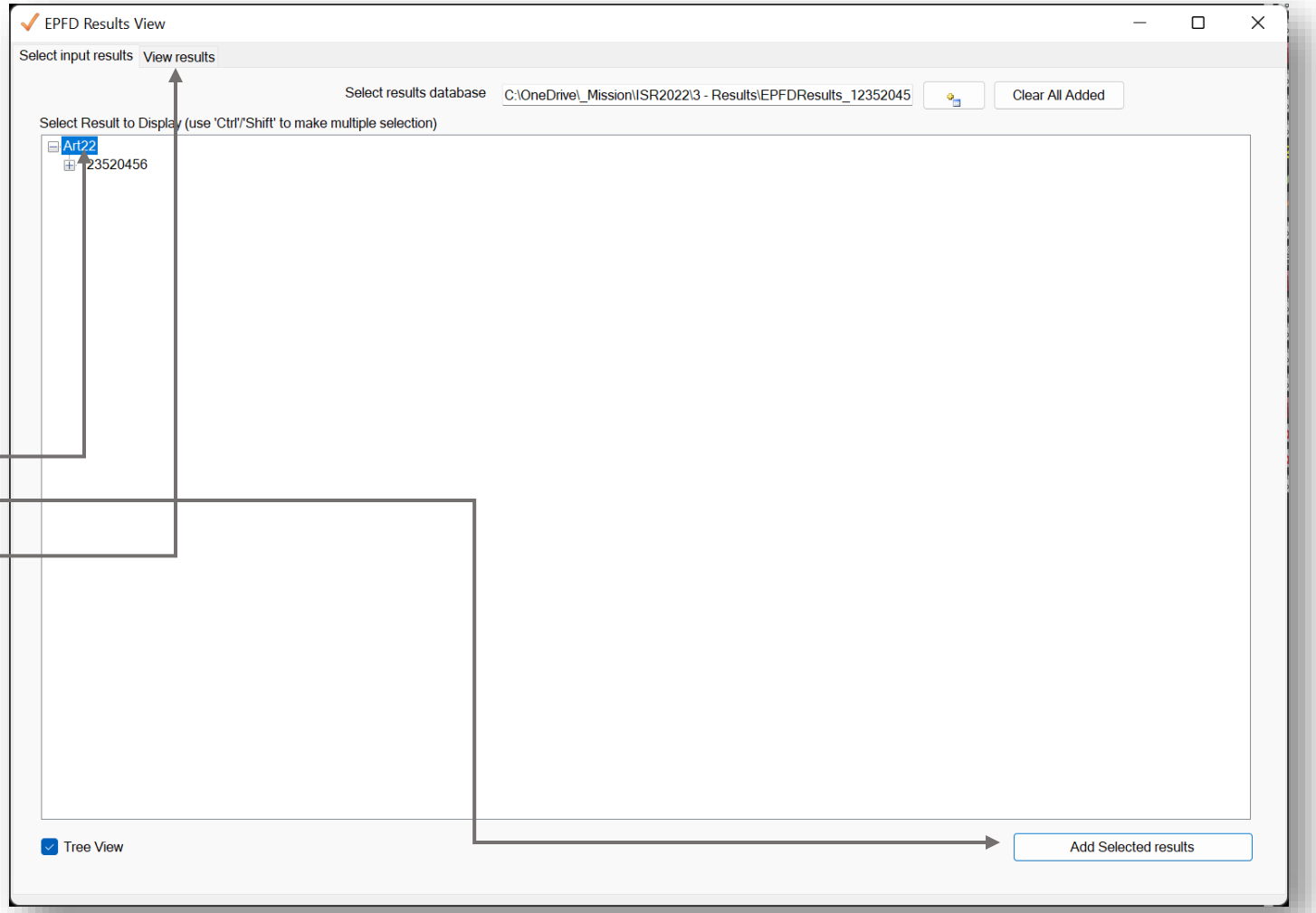


Viewing the results

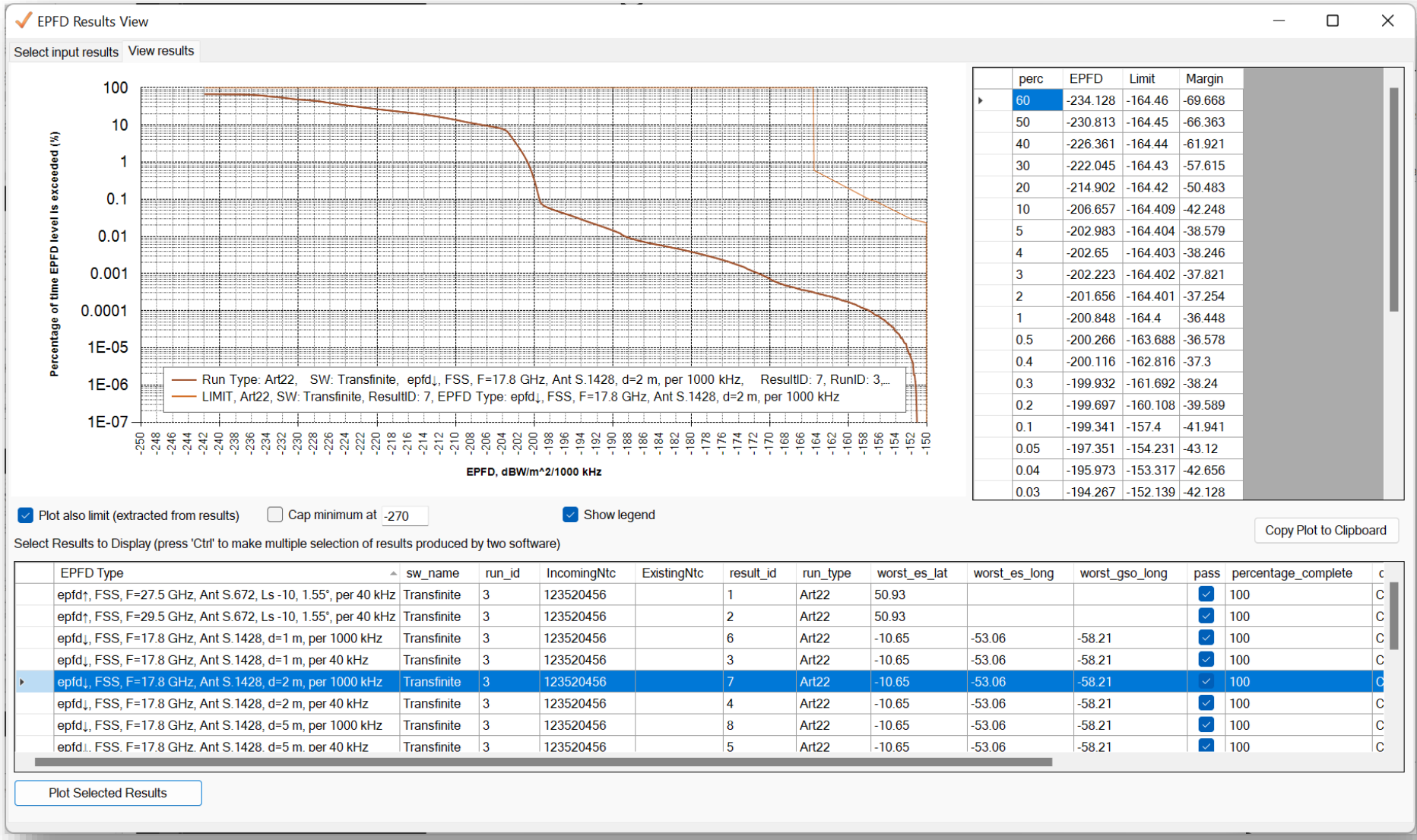
- Once calculation is finished click ‘View Results’
- EPFD Results View is started
- Note: You can also run EPFD Results View as standalone application by starting:

c:\Program Files (x86)\ITU\BR_Space_v10\Gibc\EPFD\EPFDResultsView.exe

- In the main window highlight the limit and click ‘Add Selected results’
- Then switch to ‘View results’ tab



- Checkbox under ‘pass’ in each limit indicates the pass/fail status
- Highlight the result/limit you wish to plot and press ‘Plot Selected results’



perc	EPFD	Limit	Margin
60	-234.128	-164.46	-69.668
50	-230.813	-164.45	-66.363
40	-226.361	-164.44	-61.921
30	-222.045	-164.43	-57.615
20	-214.902	-164.42	-50.483
10	-206.657	-164.409	-42.248
5	-202.983	-164.404	-38.579
4	-202.65	-164.403	-38.246
3	-202.223	-164.402	-37.821
2	-201.656	-164.401	-37.254
1	-200.848	-164.4	-36.448
0.5	-200.266	-163.688	-36.578
0.4	-200.116	-162.816	-37.3
0.3	-199.932	-161.692	-38.24
0.2	-199.697	-160.108	-39.589
0.1	-199.341	-157.4	-41.941
0.05	-197.351	-154.231	-43.12
0.04	-195.973	-153.317	-42.656
0.03	-194.267	-152.139	-42.128

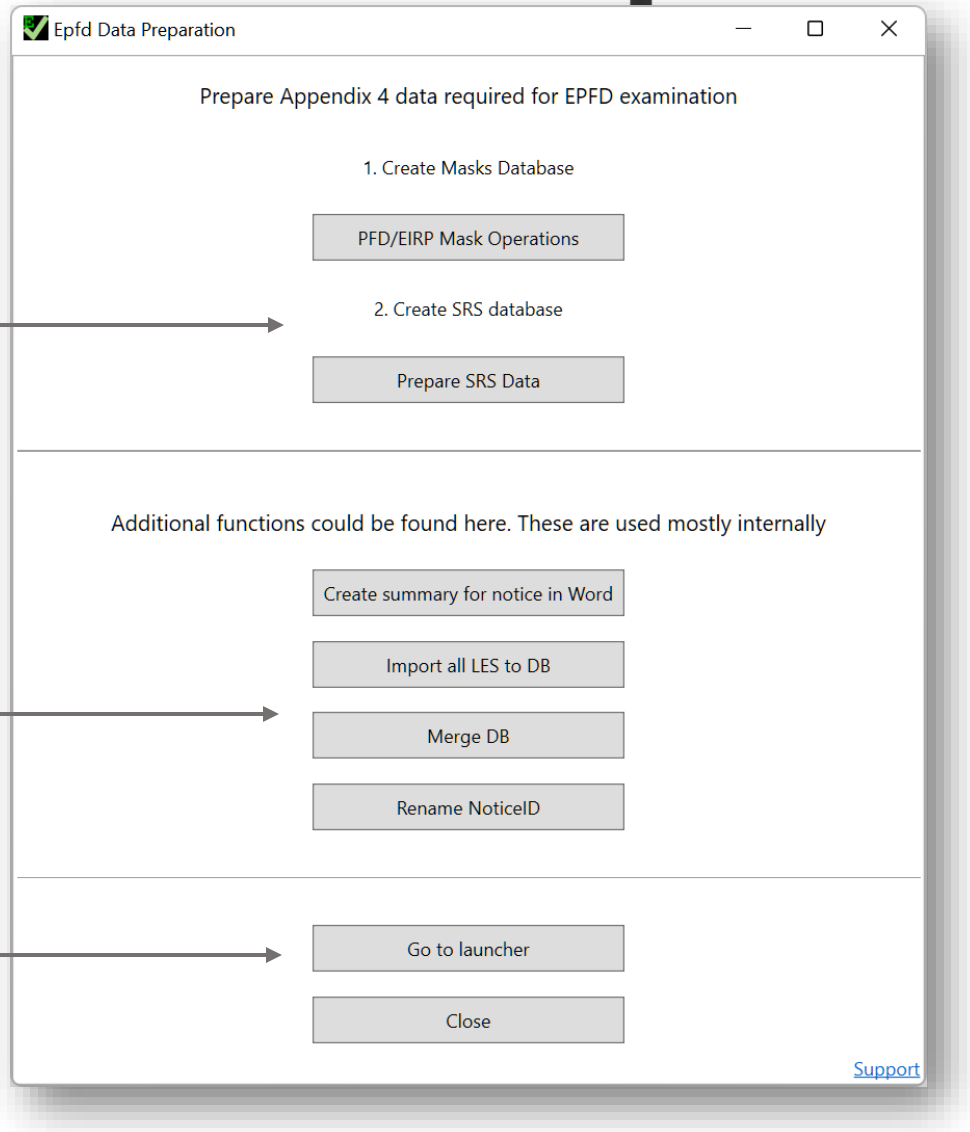
EPFD Type	sw_name	run_id	IncomingNtc	ExistingNtc	result_id	run_type	worst_es_lat	worst_es_long	worst_gso_long	pass	percentage_complete	c
epfd↑, FSS, F=27.5 GHz, Ant S.672, Ls -10, 1.55°, per 40 kHz	Transfinite	3	123520456		1	Art22	50.93			☑	100	C
epfd↑, FSS, F=29.5 GHz, Ant S.672, Ls -10, 1.55°, per 40 kHz	Transfinite	3	123520456		2	Art22	50.93			☑	100	C
epfd↓, FSS, F=17.8 GHz, Ant S.1428, d=1 m, per 1000 kHz	Transfinite	3	123520456		6	Art22	-10.65	-53.06	-58.21	☑	100	C
epfd↓, FSS, F=17.8 GHz, Ant S.1428, d=1 m, per 40 kHz	Transfinite	3	123520456		3	Art22	-10.65	-53.06	-58.21	☑	100	C
epfd↓, FSS, F=17.8 GHz, Ant S.1428, d=2 m, per 1000 kHz	Transfinite	3	123520456		7	Art22	-10.65	-53.06	-58.21	☑	100	C
epfd↓, FSS, F=17.8 GHz, Ant S.1428, d=2 m, per 40 kHz	Transfinite	3	123520456		4	Art22	-10.65	-53.06	-58.21	☑	100	C
epfd↓, FSS, F=17.8 GHz, Ant S.1428, d=5 m, per 1000 kHz	Transfinite	3	123520456		8	Art22	-10.65	-53.06	-58.21	☑	100	C
epfd↓, FSS, F=17.8 GHz, Ant S.1428, d=5 m, per 40 kHz	Transfinite	3	123520456		5	Art22	-10.65	-53.06	-58.21	☑	100	C

Running EPFD Prepare as stand-alone app

Launch it from:

c:\Program Files (x86)\ITU\BR_Space_v10\Gibc\EPFD\EPFDPrepare.exe

- Input databases preparation
- Some internal functions
- EPFD validation launcher



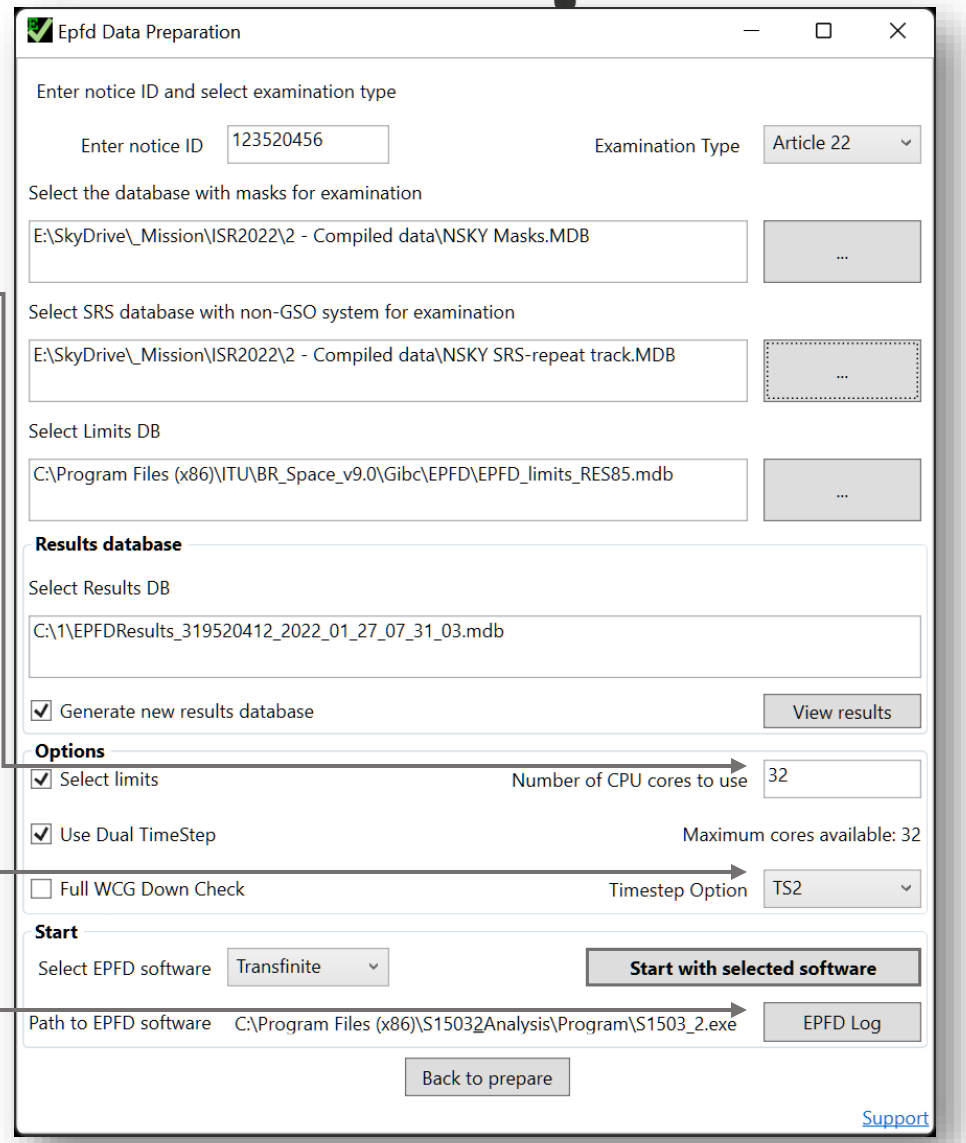
More options are available

- Can control number of CPU hardware threads to use:

  Note: higher number does not mean faster – may need to decrease this number significantly. It is recommended to keep it below the number of available CPU cores

- Timestep ‘TS2’ option is available for Transfinite
  - Decreases calculation time for large constellations
  - Is not officially described in Rec. ITU-R S. 1503
  - Therefore, can be used only for experimenting/tunning

- Access to log-file of EPFD validation software to troubleshoot



- Use ‘Dual Time Step’ or ‘TS1’ option
- If experimenting with a single mask, run with an option ‘Select limits’ to avoid running all the masks and limits
- If experimenting with a mask, try unofficial ‘TS2’ option only available in ***Transfinite***
- If experimenting with a mask you may increase performance by limiting number of timesteps required for calculation

⇒Set orbital planes to have repeating ground-track (see file **NSKY SRS-repeat track.MDB**)

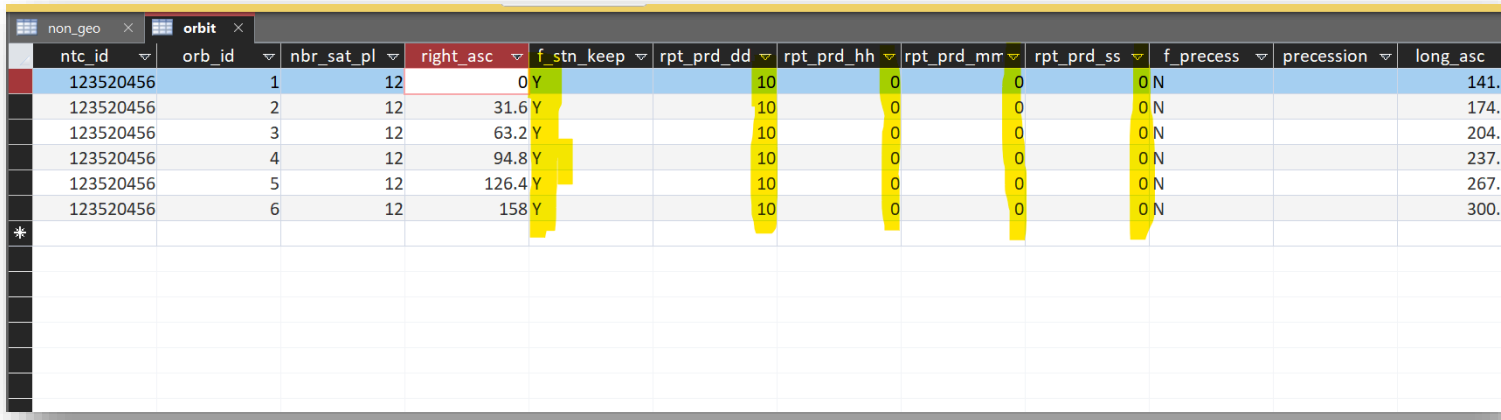
⇒Open SRS-exam database

⇒Open orbit table

⇒Modify values as shown:

⇒f_stn_keep=Y

⇒rpt_prd_dd=number of days (3-10)


non_geo | orbit

ntc_id	orb_id	nbr_sat_pl	right_asc	f_stn_keep	rpt_prd_dd	rpt_prd_hh	rpt_prd_mn	rpt_prd_ss	f_precess	precession	long_asc
123520456	1	12	0	Y	10	0	0	0	N		141.
123520456	2	12	31.6	Y	10	0	0	0	N		174.
123520456	3	12	63.2	Y	10	0	0	0	N		204.
123520456	4	12	94.8	Y	10	0	0	0	N		237.
123520456	5	12	126.4	Y	10	0	0	0	N		267.
123520456	6	12	158	Y	10	0	0	0	N		300.

⇒Don’t forget to change back these values before executing the final validation

- Before submitting the data, please make sure that you are certain in the results:
- You may submit the masks as separate files or inside MDB
- You may submit examination SRS-database which you used to validate EPFD on your side:
  - Please make sure that characteristics (especially orbital characteristics) are the same as in initial submission
  - Please make sure that it covers all the frequency ranges in initial submission which are subject to Article 22 EPFD limits
- If you choose not to submit examination SRS-database, please indicate in accompanying note all the information related:
  - Minimum elevation angles
  - Exclusion zone
  - Earth station distribution
  - ***Nco*** data
- In case of a doubt or technical issue, you may seek assistance of the Bureau
- Please note, once you submit the data and it is complete, the findings established by the Bureau using your data will be definitive

EPFD web-page

https://www.itu.int/epfdsupport

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