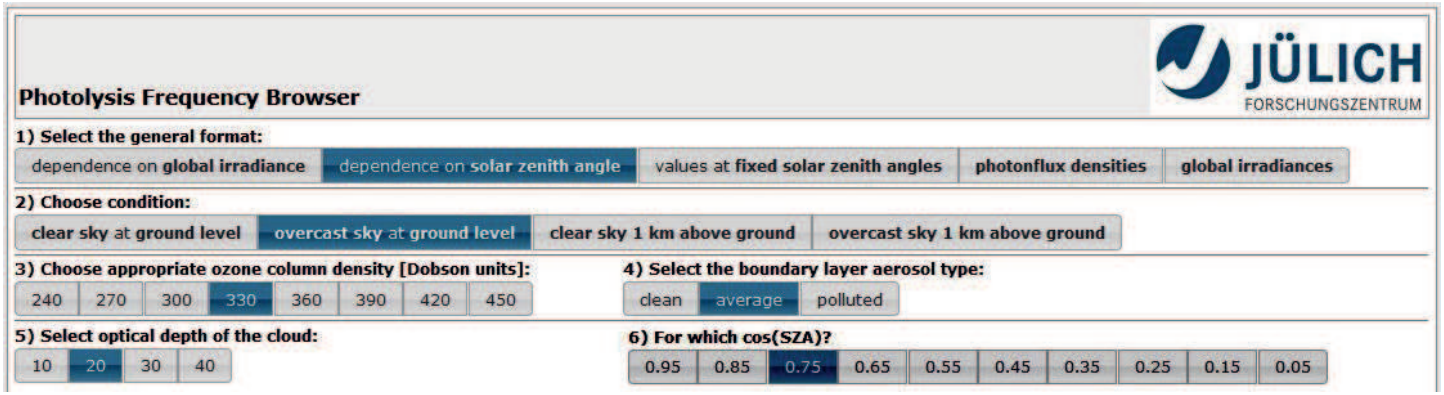
The Jülich Photolysis Frequency Browser

Version 2016 zu VDI-Richtlinie 3783 Blatt 18 *1.5.2016*

Manual

E.-P. Röth, B. Bohn, P. Koepke, B. Mayer, S. Lührs, M. Decker, H. London

After opening the link to the Jülich Photolysis Frequency Browser a short introduction appears, stating what is to be expected. This page also contains buttons for the contact to the scientist in charge of the catalog. and the others show the imprint.
To reach the catalog of the photolysis frequencies press one of the buttons [continue to data]. Due to the fact that the Technical Guideline VDI-3783 part 18 refers to this browser, [version 2016] represents the reference state of the guideline. The button [current version] represents the actual datasets which may be corrected and/or extended.



After pressing one of the two buttons for the respective version, the next page allows the choice of the requested simulation conditions:

Bar 1 : Select the general format

There are three possibilities for the depiction of the photolysis frequencies. To reach the calculated values for 10 fixed solar zenith angles (cos(SZA)= from 0.95 to 0.05, step width 0.10), press the button [values at fixed solar zenith angles].
The button [dependence on solar zenith angle] brings you to the parameters of the solar-zenith-angle-dependent functions of the photolysis frequencies. Both of these formats require the correct meteorological conditions (see below).
If the meteorological conditions are not known, there is the possibility of coupling the photolysis frequencies to the measured or estimated global irradiance. This button [dependence on global irradiance] opens a list of photolysis frequency functions, depending on the global irradiance and, if necessary, on the ozone column density.

The other two buttons [photoflux densities] and [global irradiances] open tables of the input data used for the determination of the photolysis frequencies and their functions. Besides the photolysis frequencies, the original actinic photon flux densities are made available. These data were calculated with the program libRadtran (Mayer and Kylling, 2005) by P. Köpke and B. Mayer of the LMU. After pressing the respective button, the

appropriate simulation conditions must be selected, e.g. the solar zenith angle (SZA). The respective buttons of Bar 6 indicate the cosine of the SZA, the related angles are assigned to their cosine in the following table:

cos(SZA)	0.95	0.85	0.75	0.65	0.55	0.45	0.35	0.25	0.15	0.05
SZA/dgr	18.2	31.8	41.45	49.5	56.6	63.3	69.5	75.5	81.4	87.1

Accordingly, for the global irradiances, the conditions have to be selected, too (see below).

Bar 2 : Choose conditions

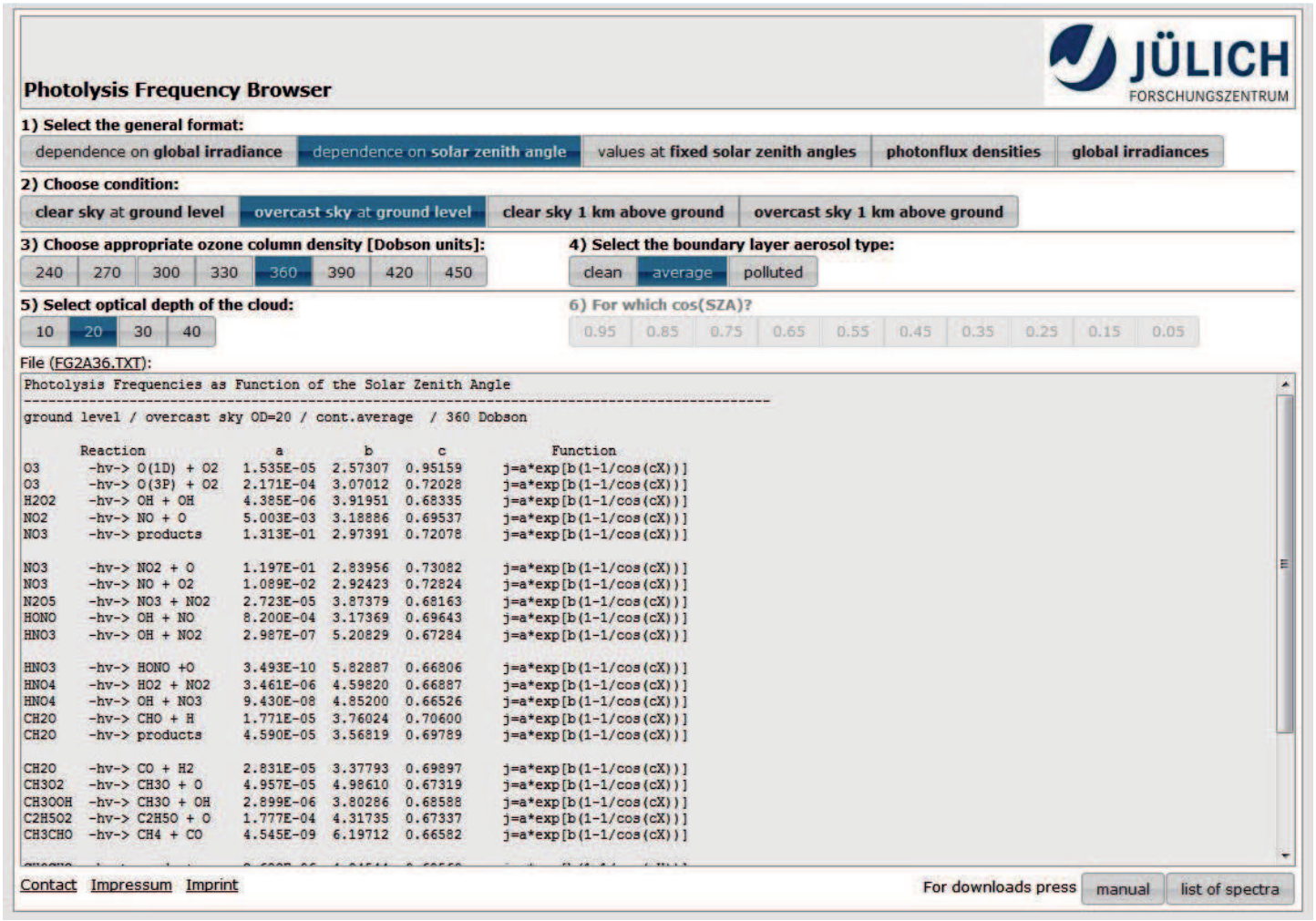
The spectral actinic photon flux densities were calculated for two general conditions: [clear sky] and [overcast sky]. For both conditions, the photolysis frequencies are displayed for two altitudes: [ground level] (200 m above sea level) and [1 km above ground]. These conditions can be chosen by the relevant button.

Bar 3 : Choose appropriate ozone column density, Bar 4 : Select the boundary layer aerosol type, and Bar 5 : Select optical depth of the cloud

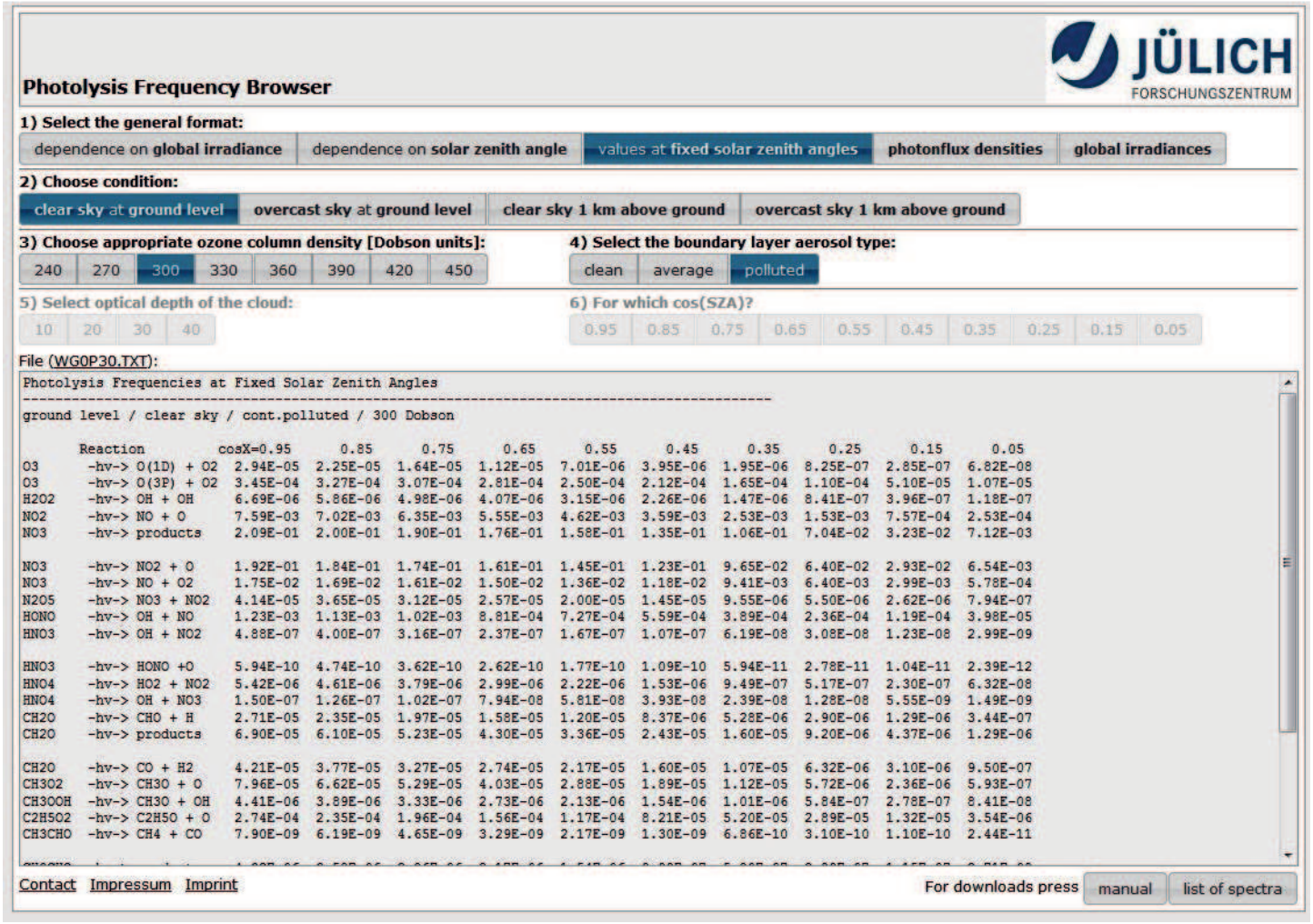
There are three essential meteorological data to be specified:

1) The ozone column density, which is important for the decay of the sun's irradiation towards shorter wavelengths : The range of the ozone column density considered reaches from 240 Dobson Units to 450 Dobson Units with a step width of 30 Dobson Units. An annual mean value for Central Europe is 330 Dobson Units.
2) The aerosol type which governs the scattered light in the planetary boundary layer :
   The menu items for the aerosol type are [continental clean], [continental average], and [continental polluted].
3) And the optical depth of the cloud (COD) in case of an overcast sky : There are four COD to choose from: 10, 20, 30, and 40 with a mean value of 20.

In the following examples are given for the different possibilities to depict the photolysis frequencies. If the relevant buttons are activated, the name of the respective file appears on the display, together with the requested values and a legend. But the tables only appear if all necessary buttons are activated. With a click on the file's name, the file itself is displayed and can be printed or stored for further use.



If the general formats [dependence on solar zenith angle] or [values at fixed solar zenith angles] are chosen, a selection of the solar zenith angle is not required. The display then shows the photolysis reactions and the parameters of the related frequency function, resp. a table with all 10 SZA values for every listed photolysis reaction. If the overcast sky version is selected, the button for the optical depth of the cloud must be pressed.



Photolysis Frequency Browser

JÜLICH FORSCHUNGSZENTRUM

1) Select the general format:

dependence on **global irradiance** | dependence on **solar zenith angle** | values at **fixed solar zenith angles** | **photonflux densities** | **global irradiances**

2) Choose condition:

clear sky at ground level | **overcast sky at ground level** | **clear sky 1 km above ground** | **overcast sky 1 km above ground**

3) Choose appropriate ozone column density [Dobson units]:

240 | 270 | 300 | 330 | 360 | 390 | 420 | 450

4) Select the boundary layer aerosol type:

clean | average | polluted

5) Select optical depth of the cloud:

10 | 20 | 30 | 40

6) For which cos(SZA)?

0.95 | 0.85 | 0.75 | 0.65 | 0.55 | 0.45 | 0.35 | 0.25 | 0.15 | 0.05

File (WG0P30.TXT):

Photolysis Frequencies at Fixed Solar Zenith Angles

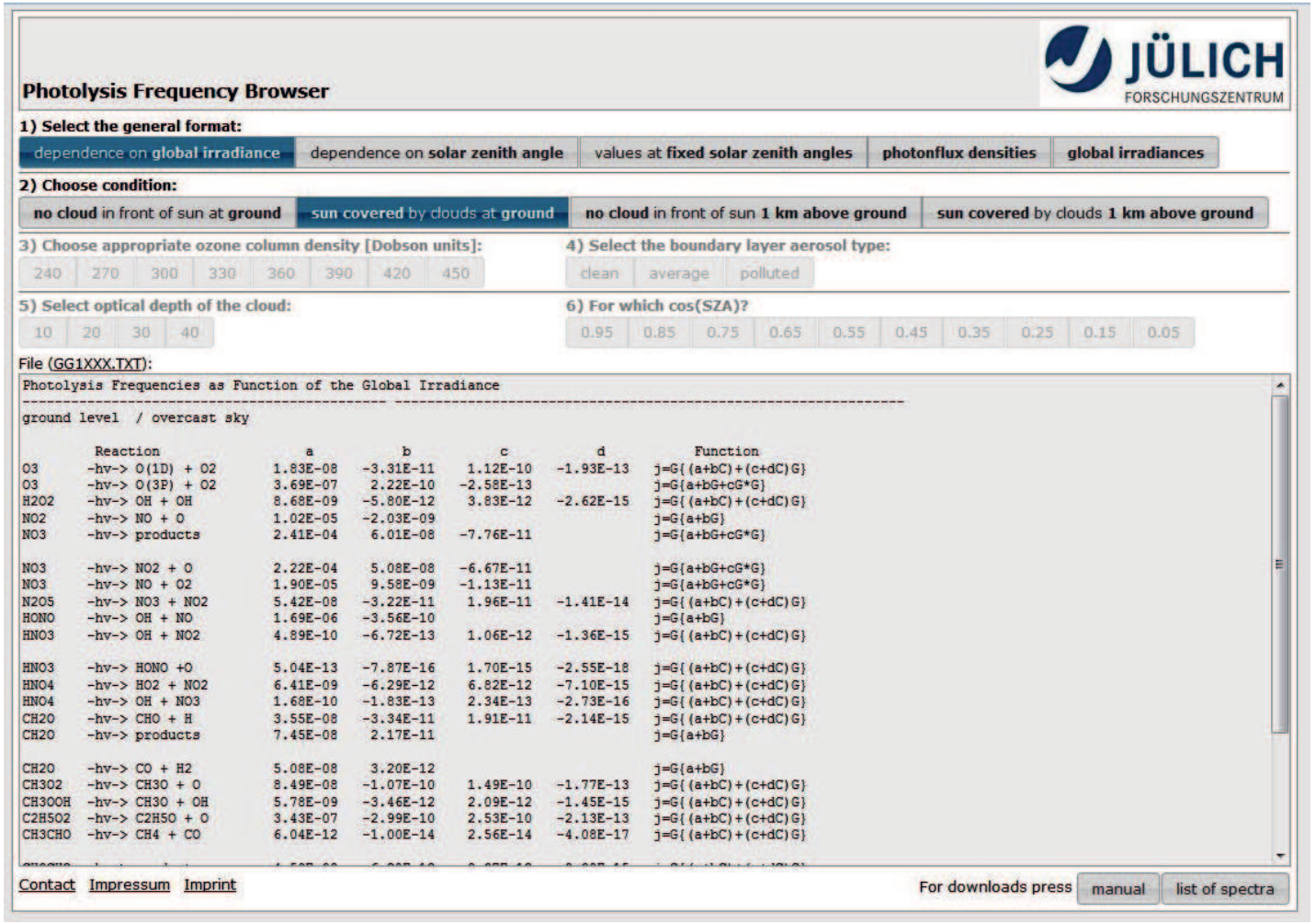
ground level / clear sky / cont.polluted / 300 Dobson

Reaction		cosX=0.95	0.85	0.75	0.65	0.55	0.45	0.35	0.25	0.15	0.05
O3	-hv-> O(1D) + O2	2.94E-05	2.25E-05	1.64E-05	1.12E-05	7.01E-06	3.95E-06	1.95E-06	8.25E-07	2.85E-07	6.82E-08
O3	-hv-> O(3P) + O2	3.45E-04	3.27E-04	3.07E-04	2.81E-04	2.50E-04	2.12E-04	1.65E-04	1.10E-04	5.10E-05	1.07E-05
H2O2	-hv-> OH + OH	6.69E-06	5.86E-06	4.98E-06	4.07E-06	3.15E-06	2.26E-06	1.47E-06	8.41E-07	3.96E-07	1.18E-07
NO2	-hv-> NO + O	7.59E-03	7.02E-03	6.35E-03	5.55E-03	4.62E-03	3.59E-03	2.53E-03	1.53E-03	7.57E-04	2.53E-04
NO3	-hv-> products	2.09E-01	2.00E-01	1.90E-01	1.76E-01	1.58E-01	1.35E-01	1.06E-01	7.04E-02	3.23E-02	7.12E-03
NO3	-hv-> NO2 + O	1.92E-01	1.84E-01	1.74E-01	1.61E-01	1.45E-01	1.23E-01	9.65E-02	6.40E-02	2.93E-02	6.54E-03
NO3	-hv-> NO + O2	1.75E-02	1.69E-02	1.61E-02	1.50E-02	1.36E-02	1.18E-02	9.41E-03	6.40E-03	2.99E-03	5.78E-04
N2O5	-hv-> NO3 + NO2	4.14E-05	3.65E-05	3.12E-05	2.57E-05	2.00E-05	1.45E-05	9.55E-06	5.50E-06	2.62E-06	7.94E-07
HONO	-hv-> OH + NO	1.23E-03	1.13E-03	1.02E-03	8.81E-04	7.27E-04	5.59E-04	3.89E-04	2.36E-04	1.19E-04	3.98E-05
HNO3	-hv-> OH + NO2	4.88E-07	4.00E-07	3.16E-07	2.37E-07	1.67E-07	1.07E-07	6.19E-08	3.08E-08	1.23E-08	2.99E-09
HNO3	-hv-> HONO +O	5.94E-10	4.74E-10	3.62E-10	2.62E-10	1.77E-10	1.09E-10	5.94E-11	2.78E-11	1.04E-11	2.39E-12
HNO4	-hv-> HO2 + NO2	5.42E-06	4.61E-06	3.79E-06	2.99E-06	2.22E-06	1.53E-06	9.49E-07	5.17E-07	2.30E-07	6.32E-08
HNO4	-hv-> OH + NO3	1.50E-07	1.26E-07	1.02E-07	7.94E-08	5.81E-08	3.93E-08	2.39E-08	1.28E-08	5.55E-09	1.49E-09
CH2O	-hv-> CHO + H	2.71E-05	2.35E-05	1.97E-05	1.58E-05	1.20E-05	8.37E-06	5.28E-06	2.90E-06	1.29E-06	3.44E-07
CH2O	-hv-> products	6.90E-05	6.10E-05	5.23E-05	4.30E-05	3.36E-05	2.43E-05	1.60E-05	9.20E-06	4.37E-06	1.29E-06
CH2O	-hv-> CO + H2	4.21E-05	3.77E-05	3.27E-05	2.74E-05	2.17E-05	1.60E-05	1.07E-05	6.32E-06	3.10E-06	9.50E-07
CH3O2	-hv-> CH3O + O	7.96E-05	6.62E-05	5.29E-05	4.03E-05	2.88E-05	1.89E-05	1.12E-05	5.72E-06	2.36E-06	5.93E-07
CH3OOH	-hv-> CH3O + OH	4.41E-06	3.89E-06	3.33E-06	2.73E-06	2.13E-06	1.54E-06	1.01E-06	5.84E-07	2.78E-07	8.41E-08
C2H5O2	-hv-> C2H5O + O	2.74E-04	2.35E-04	1.96E-04	1.56E-04	1.17E-04	8.21E-05	5.20E-05	2.89E-05	1.32E-05	3.54E-06
CH3CHO	-hv-> CH4 + CO	7.90E-09	6.19E-09	4.65E-09	3.29E-09	2.17E-09	1.30E-09	6.86E-10	3.10E-10	1.10E-10	2.44E-11

Contact Impressum Imprint

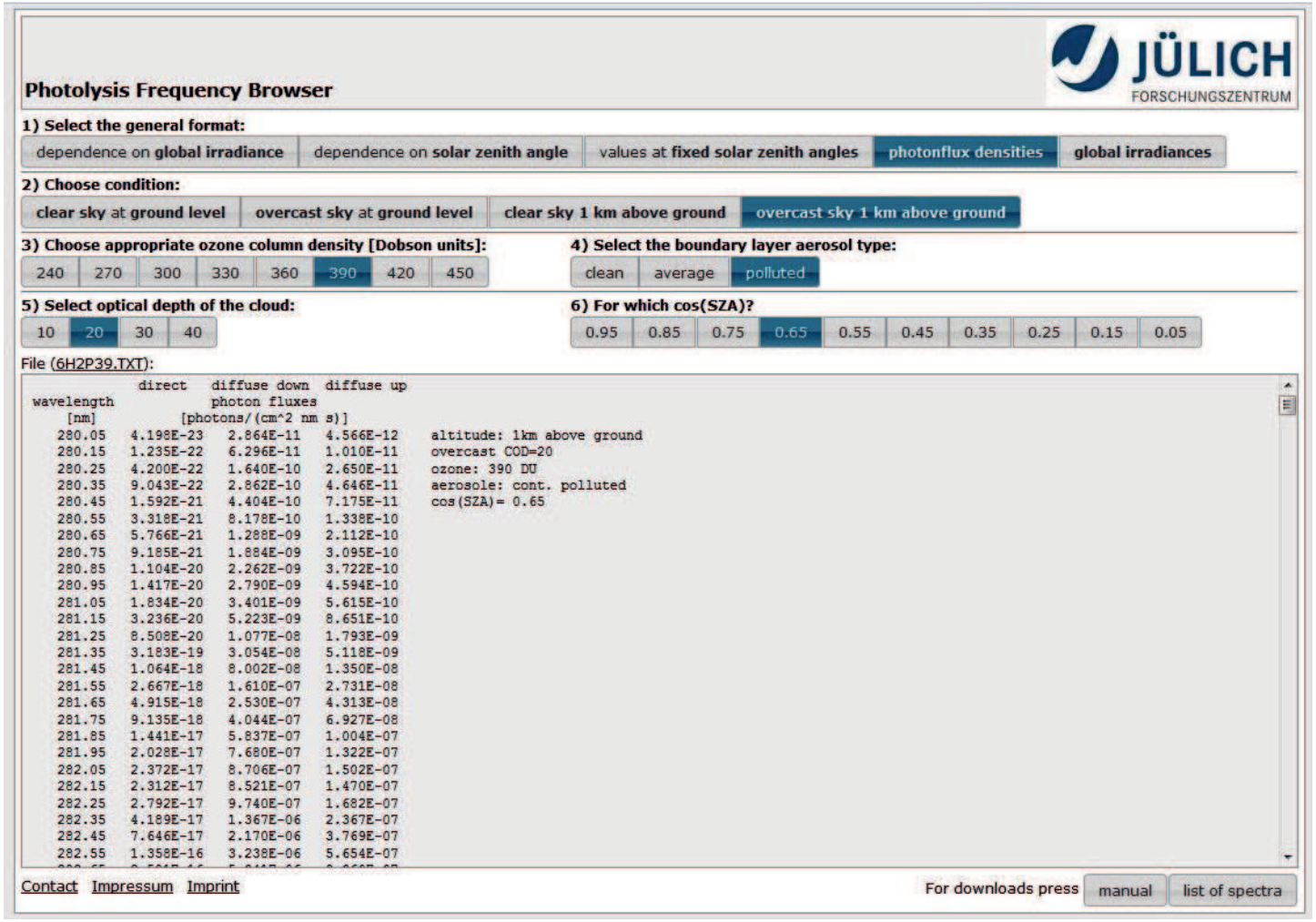
For downloads press manual | list of spectra

Likewise, the tables of the ‘Dependence on the global irradiance’ are displayed. They consist of the reactions, the values of the parameters and the type of the function:

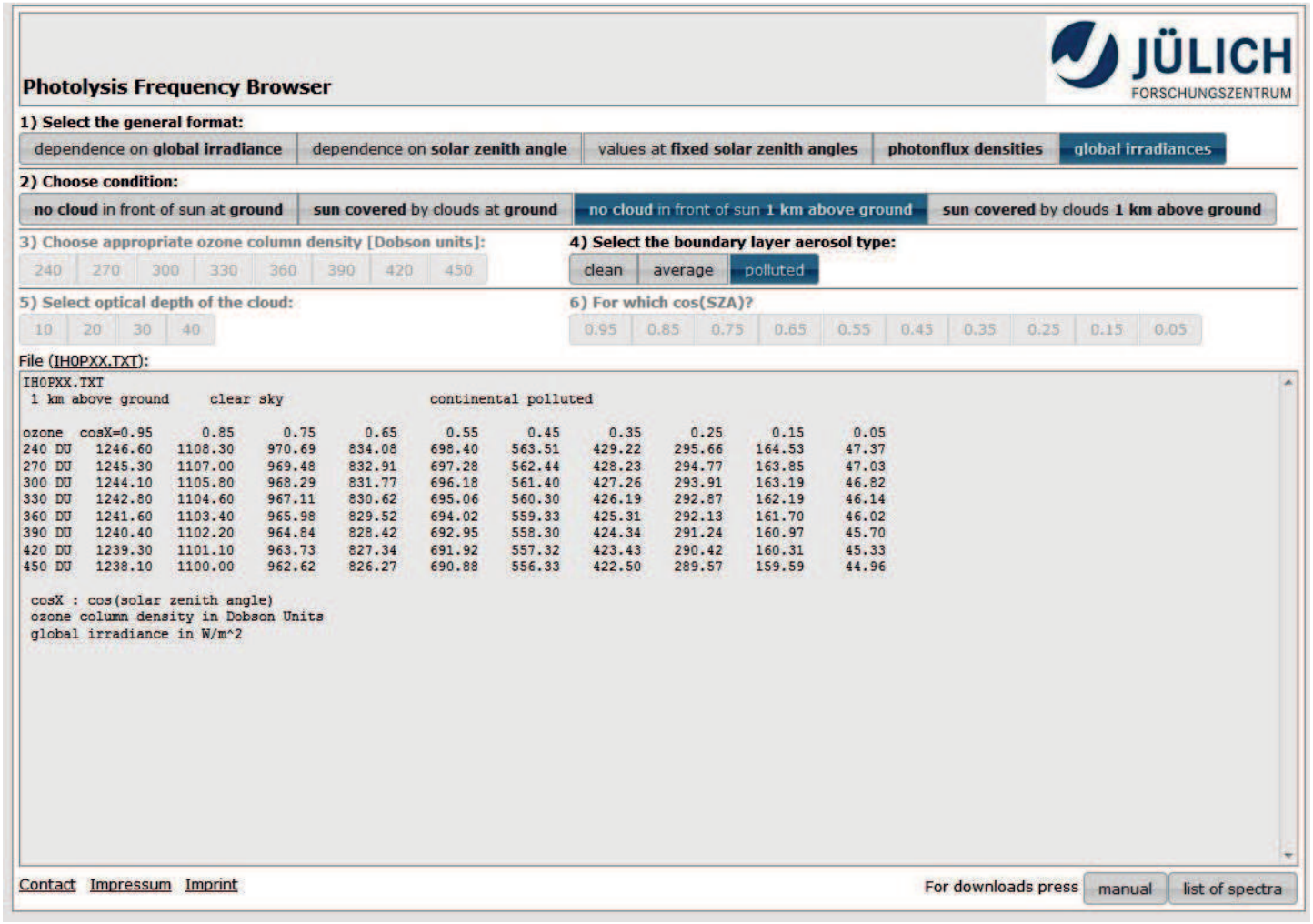


In this case the buttons of Bar 2 change their inscription: Here we distinguish between [no clouds in front of sun] and [sun covered by clouds], which better describe the situation than ‘clear sky’ and ‘overcast sky’.

To reach the files with the photon flux spectra, it is necessary to declare all four conditions: ozone column density, aerosol type, solar zenith angle, and, for overcast sky conditions, the optical cloud depth.



For the table with the dependence of the photolysis frequencies on the global irradiance, it is only necessary to press the relevant button for the general format and then click on the respective general condition:



For users of the VDI-Guideline 3783 part 19, the following table of the photolysis reaction numbers in this catalog and in the guideline may be useful:

VDI-Guideline 3783 sheet 19		**this catalog**	
reaction	**number**	**number**	**reaction**
$NO_2 \rightarrow O(^3P) + NO$	1	4	NO2-hv->NO+O
$O_3 \rightarrow O(^1D) + O_2$	6	1	O3-hv->O(D)+O2
$HCHO \rightarrow 2\ HO_2 + CO$	10	14	CH2O-hv->CHO+H
$O_3 \rightarrow O(^3P) + O2$	16	2	O3-hv->O(P)+O2
$NO_3 \rightarrow NO + O_2$	19	7	NO3-hv->NO+O2
$NO_3 \rightarrow NO_2 + O(^3P)$	20	6	NO3-hv->NO2+O
$HCHO \rightarrow H_2 + CO$	21	16	CH2O-hv->CO+H2

References are listed in the download file 'list of spectra'.