This file provides counts for Umkehr channels from all measurements during one day.


**Umkehr Files: UJJJYY.nnn**

As part of the End-of-Day process the Umkehr data in the B file is transferred into a U file which contains both morning and evening data if it has been collected. This file is used as the input data for Umkehr processing (see Appendix E).

The file is not annotated. Numbers are coded as scaled logarithms. The example of a file fragment (first 16 records) is given below:

<table>
<thead>
<tr>
<th>Record #3 in file (odd)</th>
<th>Record #2 in file (even)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2&lt;sup&gt;nd&lt;/sup&gt; in 2&lt;sup&gt;nd&lt;/sup&gt; Umkehr</td>
<td>1&lt;sup&gt;st&lt;/sup&gt; in 2&lt;sup&gt;nd&lt;/sup&gt; Umkehr</td>
</tr>
</tbody>
</table>

| 300107 209 0 395032 40 147712 414768 462531 516236 556097 564735 |
|-------------------------|--------------------------|
| 300107 205 0 395095 40 160206 550796 568465 580385 586873 569115 |
| **300107 205 0 395159 40 160206 415137 465954 519615 560115 568728** |
| 300107 201 0 395222 40 177815 554941 572132 583211 589436 571155 |
| 300107 203 0 395286 40 147712 418441 469408 523591 564357 572254 |
| 300107 201 0 395349 40 160206 558903 575960 585981 591645 573276 |
| 300107 201 0 395412 40 147712 420222 473376 528133 568473 576356 |
| 300107 200 0 395475 40 147712 562957 579744 588714 594107 575711 |
| 300107 200 0 395538 40 200000 421827 476989 532701 572545 580232 |
| 300107 198 0 395601 40 177815 567175 583826 592083 597085 578699 |
| 300107 198 0 395663 40 184510 425959 482582 538268 577627 585095 |
| 300107 196 0 395726 40 147712 573069 589131 596699 601290 582377 |
| 300107 188 0 396658 40 147712 445834 512714 570325 606016 611776 |
| 300107 188 0 396719 40 169897 599912 614254 617003 620018 600402 |
| 300107 188 0 396781 40 160206 448087 515957 573588 608646 614133 |
| 300107 188 0 396841 40 169897 602204 616308 618439 621173 601603 |
| 300107 188 0 396902 40 130103 449762 519008 575940 610129 615217 |

Each Umkehr measurement consists of two records for two sets of wavelengths at two different grating positions. The even records 0,2,4,... and odd records 1,3,5,... in the file need to be processed differently.
The u-file can be parsed and processed by `prepro.c` program available from the WOUDC archive in Toronto, Canada [http://www.woudc.org/data_e.html](http://www.woudc.org/data_e.html), (choose the LINK TO **DATA** **ARCHIVE** button, OK the data use agreement, and then follow the link Software/Analysis-QA/Umkehr/Brewer/newumk).

The gist of the `prepro.c` program has been distilled in the pseudo-code format by Paul Kouros and Irina Petropavlovskikh for NOAA. It is presented below:

```c
Program that reads data in is "PREPRO" the subroutine is called "get_data"

DDMMYY vt nf AMIN ic C0 0 C0 1 C0 2 C0 3 C0 4 C0 5
060186 192 0 405507 40 147712 556533 616300 665459 689125 686753
DDMMYY vt nf AMIN ic C1 0 C1 1 C1 2 C1 3 C1 4 C1 5
060186 192 0 405558 40 147712 659995 677584 670394 679843 654764

DD day;
MM month;
YY year;
vt voltage;
nf 0/1 (am/pm)
AMIN are minutes to calculate time: GMT=10^(AMIN*1.0E-5 - 1)/60
(subroutine zenith() calculates SZA)
ic time conversion
C0 0 is white noise for first set of measurements, dark count
C0 1 is counts for first wavelength (306 nm) in the first set of measurements
C0 2 is counts at 310
C0 3 is counts at 313
C0 4 is counts at 317
C0 5 is counts at 319
C1 0 is white noise for the second set of measurements
C1 1 is counts for first wavelength (317 nm) in the second set of measurements
C1 2 is counts at 319
C1 3 is counts at 323
C1 4 is counts at 326
C1 5 is counts at 329
```
Conversion of counts to intensities:

\[
\text{Time\_conversion} = 17.4368
\]
\[
\text{rate} = \frac{\text{Time\_conversion}}{\text{double precision}(ic)}
\]
\[
\text{tau} = 4.5E-8
\]
\[
\text{scale} = 10e-4
\]
\[
double \text{ tc}[11] = \{ 0.00, -2.04, -1.50, -1.16, -1.50, -2.59, -1.45, -2.59, -5.40, -8.10, -12.50 \};
\]

\[
\text{offset} = 0
\]
\[
\text{for (k in 0:1)}
\]
\[
\{ i=0 \\
\quad \text{noise co} = 10^\left(C[k,i]*1.E-5 - 1\right))*\text{rate} \\
\quad \text{vtu} = (0.16*\text{vt}[k]-30), \text{where } 16.0*0.01=0.16 \\
\quad \text{for (i in 1:5)}
\]
\[
\quad \{ f = 10^\left(C[k,i]*1E-5-1\right)*\text{rate}-\text{co} \\
\quad \quad \text{if (f<2)} \\
\quad \quad \quad f=2 \\
\quad \quad \quad g=f \\
\quad \quad \quad \text{//Dead time correction} \\
\quad \quad \quad \text{for (j 1:9)}
\]
\[
\quad \quad \{ \\
\quad \quad \quad g = f*\exp(\text{tau}*g) \\
\quad \quad \}
\quad \text{C[k,i]=log10(g)+scale*tc[i+offset]*vtu}
\]
\[
\}
\]
\[
\text{offset}=5
\]

**Note 1:** Time\_conversion 17.4368=(4/0.2294), where 4 divisor of counts prior to being counted and 0.2294 [sec] is integration time of one cycle.

**Note 2:** tau is dead time that can be read from the B-file.

**Note 3:** These elements of tc array are applied to the 1\text{st} record, i.e., C0’s (even records)

**Note 4:** These elements of tc array are applied to the 2\text{nd} record, i.e., C1’s (odd records)

**Note 5:** This is a recursive dead time correction.

**Note 6:** The final C values are later multiplied by 100 as it is in traditional Dobson measurements.
In Figure 1 we present example of u-file processed data as a function of SZA. In the top panel C times 100 for 305, 313, 323, 326 and 329 nm channels is depicted. In the middle panel differences between 319 channels (odd-even) and 317nm channel (odd-even) are plotted. And in the bottom panel differences 329-313, 326-310 and 323-306 channels are plotted. The differences from the third panel are the ones that are utilized in the Umkehr algorithm.

Figure 1. Example of processed u-file data.