

# RINEX

## The Receiver Independent Exchange Format

Different manufacturers of GPS receivers had their own format of data file

During large GPS observation campaign different GPS receivers have been involved.  
Hence, a need for one common format of data file arised.

Until now three major versions have been developed and published:

- Version 1 (1989)
- Version 2 (1990)
- Version 3 (2015)

Several subversions have been defined

There are some RINEX-like exchange file formats, mainly used by the International GNSS service IGS e.g.:

IONEX – exchange format for ionosphere models

ANTEX – exchange format for phase center variations of geodetic GNSS antennae


## Version 3.XX

Three ASCII file types:

1. Observation data file
2. Navigation data file
3. Meteorological data file

Each file type consists of a header section and a data section.

Header section contains **header labels in columns 61-80**



```
3.03      OBSERVATION DATA      M (MIXED)      RINEX VERSION / TYPE
gfzrnrx-1.06-6962  FILE CONVERSION  20180108 010504 UTC COMMENT
gfzrnrx-1.06-6962  FILE MERGE      20180109 012015 UTC PGM / RUN BY / DATE
4075578.4000  931852.7500  4801569.9800  APPROX POSITION XYZ
GR50 V4.11      BKG-GOWettzell    20180107 235942 UTC COMMENT
```

## Observation data file

### Three quantities

1. Time

2. Pseudo-Range

3. Phase

#### Time

is receiver time of the received signals

Identical for the phase and pseudorange measurement

Identical for all satellites observed at that epoch

#### Pseudo-Range (PR)

is the distance from the receiver antenna to the satellite antenna including receiver and satellite clock offsets (and other biases, such as atmospheric delays:

$$PR = \text{distance} + c * (\text{receiver clock offset} - \text{satellite clock offset}) + \text{other biases}$$

#### Phase

is the carrier phase measured in whole cycles

## Satellite numbers

Starting with RINEX Version 2 the satellite numbers are preceded by a one-character system identifier

Satellite system identifier:

G: GPS

R: GLONASS

S: SBAS

E: Galileo

C: BeiDou

J: QZSS

I: IRNSS

## Recommended filename parameters

Recommended filename convention starting with RINEX Version 3.02

WTZR00DEU\_R\_20180080000\_01D\_30S\_MO.rnx

Name – 9 Characters  
– defining the site, station and  
country code

Start Time – 11 Characters  
YYYYDDHHMM

Data frequency  
– 3 Characters

Format  
– 3 Characters

Data source – 1 Character

Period – 3 Characters

Content – 2 Characters

## GNSS observation data file

## Mandatory records in header section

Header Label (columns 61-80)	Description
<b>RINEX VERSION / TYPE</b>	Format Version; File Type: e.g. Observation Data; Satellite System: <b>M</b> for mixed
<b>PGM / RUN BY / DATE</b>	Name of program creating current file; Name of agency creating current file; Date and time of file creation
<b>MARKER NAME</b>	Name of antenna marker
<b>MARKER TYPE</b>	Type of the marker
<b>OBSERVER / AGENCY</b>	Name of observer / agency
<b>REC # / TYPE / VERS</b>	Receiver number, type, and version
<b>ANT # / TYPE</b>	Antenna number and type
<b>APPROX POSITION XYZ</b>	Geocentric approximate marker position
<b>ANTENNA: DELTA H/E/N</b>	Antenna height; Horizontal eccentricity (east/north)
<b>SYS / # / OBS TYPES</b>	Satellite system code; Number of different observation types
<b>TIME OF FIRST OBS</b>	Time of first observation record (contain also information about time system)
<b>SYS / PHASE SHIFT</b>	Phase shift correction used to generate phases consistent w/r to cycle shifts
<b>GLONASS SLOT / FRQ #</b>	GLONASS slot and frequency numbers
<b>GLONASS COD/PHS/BIS</b>	GLONASS Phase bias correction used to align code and phase observations
<b>END OF HEADER</b>	Last record in the header section

## THE ORDERING OF THE HEADER RECORDS ARE FREE !!!

### Exceptions:

The **SYS / # / OBS TYPES** record(s) should precede any **SYS / DCBS APPLIED** and **SYS / SCALE FACTOR** records

The **# OF SATELLITES** record (if present) should be immediately followed by the corresponding number of **PRN / # OF OBS** records

The **END OF THE HEADER** must be the last record in a file



## Search for Rinex-Files

<https://igs.bkg.bund.de/dataandproducts/rinexsearch>

The screenshot shows the BKG GNSS Data Center website. At the top, there is a header with the BKG logo and navigation links: Home, About Us, Data & Products, Real-Time, and Links. A login section is also present with fields for User and Password, and a login button. Below the header, the breadcrumb trail reads: Data & Products > Data Access > Rinex Search. The main heading is "Search for Rinex-Files". The search form consists of several sections: 1. Timeframe: Two date pickers for "from" (01/02/2018) and "to" (01/02/2018). 2. Station: A dropdown menu showing a list of stations, with "WTZR - Wettzell / Germany" selected. 3. Interval: Radio buttons for "daily", "hourly", "highrate", and "all". 4. RINEX Type: Radio buttons for "observation", "gps navigation", "glonass navigation", "galileo navigation", "qzss navigation", "mixed navigation", "meteo", "summary", and "all". 5. RINEX Version: Radio buttons for "2", "3", and "all". 6. RINEX Source: Radio buttons for "Files generated directly from receiver-data", "Files generated from streamed data", and "all". A "Search" button is at the bottom left. At the bottom of the page, there are links: <sitemap> <impressum> <privacy> <contact>.

**BKG GNSS DATA CENTER**

User:  Password:

Home About Us Data & Products Real-Time Links Help Project Filter: ALL

Data & Products > Data Access > Rinex Search

### Search for Rinex-Files

**Timeframe:** from: 01/02/2018 to: 01/02/2018

**Station:** WTZR - Wettzell / Germany

**Interval:** ☒ daily ☐ hourly ☐ highrate ☐ all

**RINEX Type:** ☒ observation ☐ gps navigation ☐ glonass navigation ☐ galileo navigation ☐ qzss navigation ☐ mixed navigation ☐ meteo ☐ summary ☐ all

**RINEX Version:** ☐ 2 ☒ 3 ☐ all

**RINEX Source:** ☐ Files generated directly from receiver-data ☐ Files generated from streamed data ☒ all

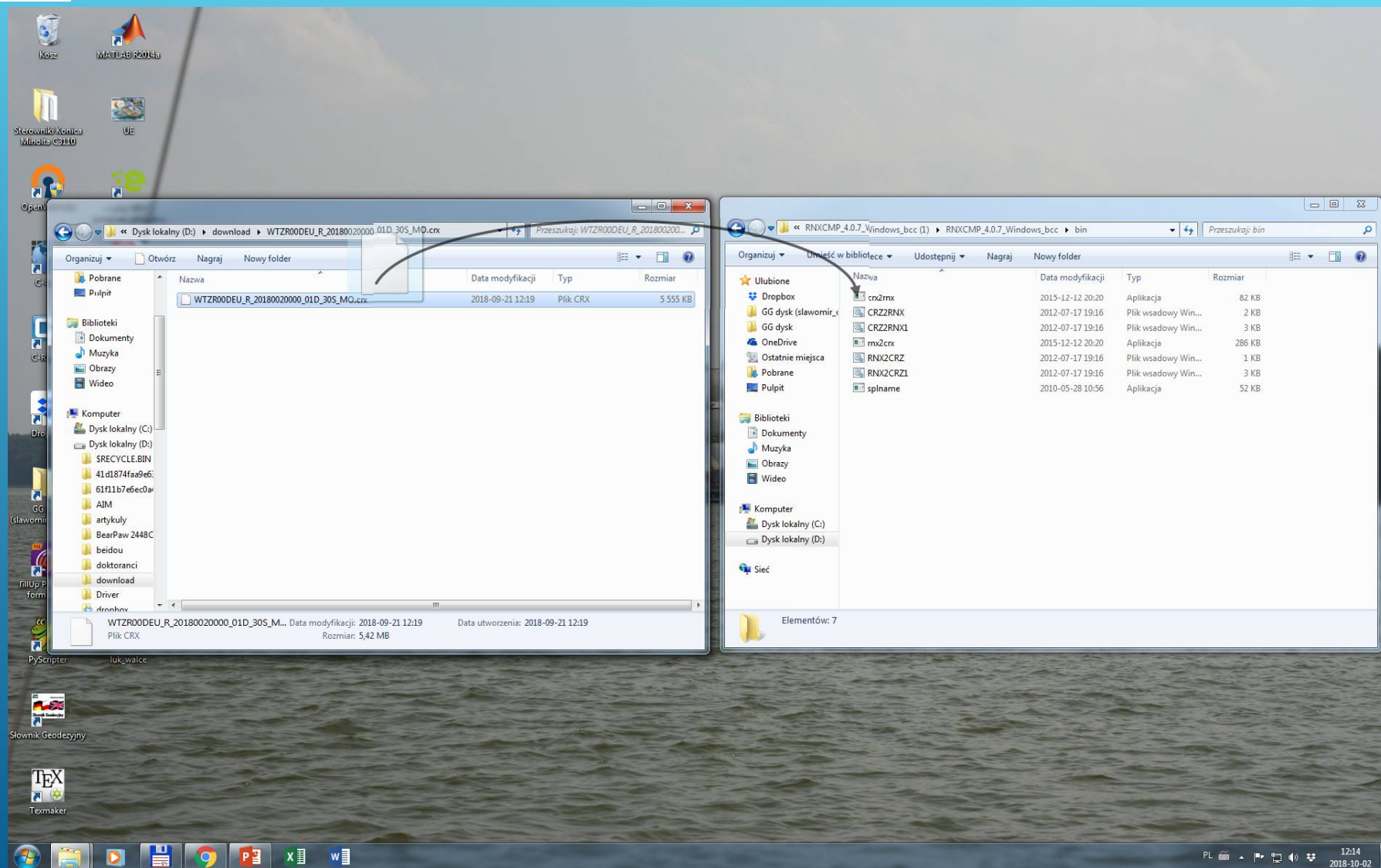
<sitemap> <impressum> <privacy> <contact>

Conversion \*.crx → \*.rnx

crx2rnx.exe

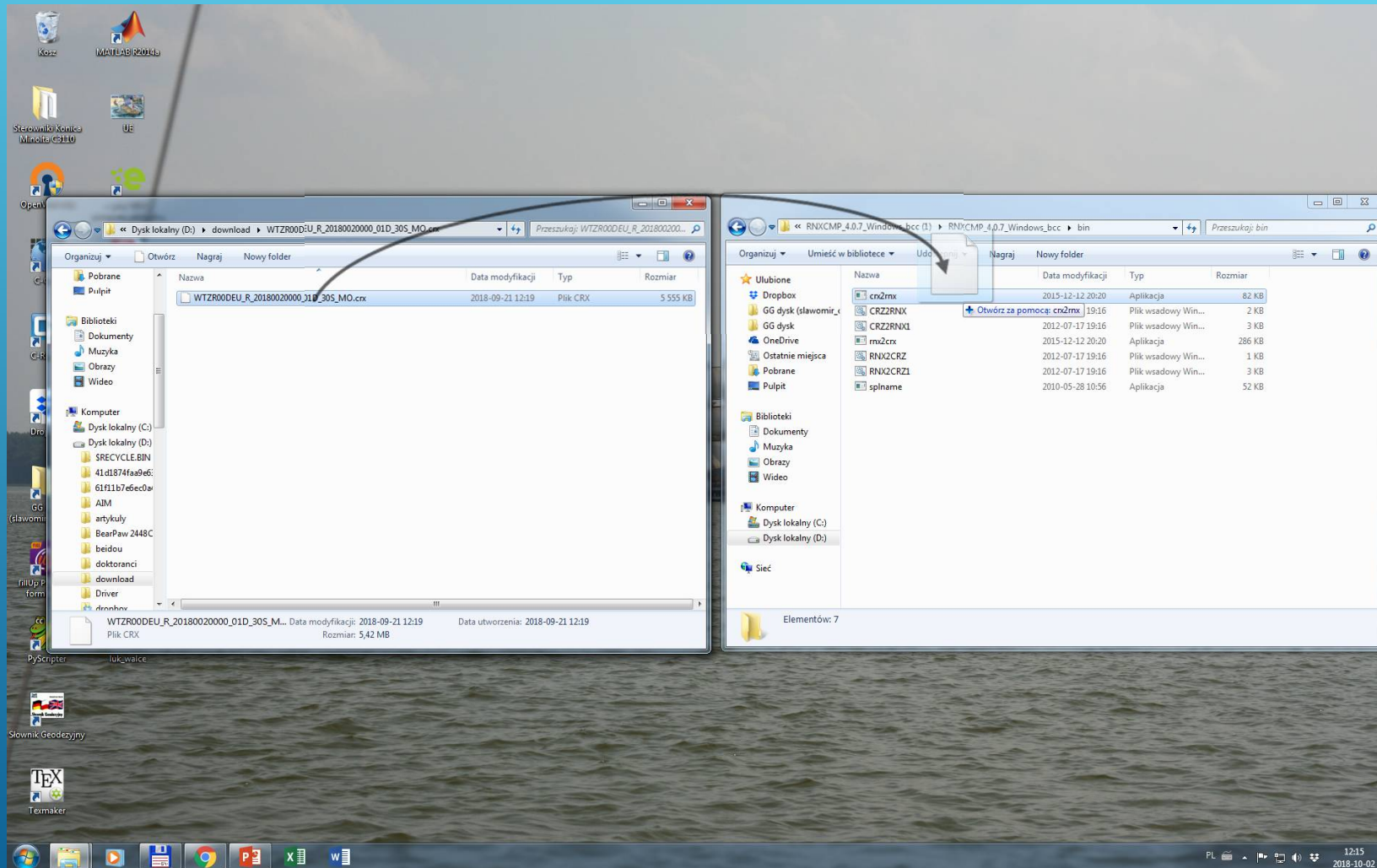
crx2rnx.exe

Conversion \*.crx → \*.rnx



crx2rnx.exe

Conversion \*.crx → \*.rnx



## Excercise 1

Prepare Matlab function for reading header Section of observation file.

```
function [Rnx_type, Sta_name, Rec_type,Ant_type,XYZ_RNX, Ant_dNEU,obs_num,obs_type,time_of_first_obs,time_system]=  
Ex1_headerread_ studentname
```

The results shuld be assigned to the following variables:

Rnx\_type (Rinex Version - string)

Sta\_name (Station name - string)

Rec\_type (Receiver type - string)

XYZ\_RNX (Approximate position XYZ – column vector 3x1)

Ant\_type (Antenna Type - string)

Ant\_dNEU (North East Up eccentricity of antenna column vector 3x1)

obs\_num (Number of observation types of GPS system – integer number)

obs\_type (Observation types – cell of strings)

time\_of\_first\_obs (time of first observation column vector 6x1)

time\_system (time system - string) (make sure that this is GPS)

## Useful Matlab functions

`fid = fopen(filename)` – open file

`fclose(fid)` – close file

`status = feof(fid)` test for end of file (returns 1 if there is end)

`line = fgetl(fid)` – read line from file `fid`

`strfind(line, str1)` – find `str1` within `line` (returns 0 or 1)

`str1 = line(integer_vector)` – extract `str1` from `line`

`frewind(fid)` – move to the beginning of file

`str2num(str1)` or `str2double(str1)` – convert string to number

`break` - terminate execution of *for* or *while* loop

`while expression`  
`statements`  
`end`

repeatedly executes  
*statements* as long as an  
*expression* remains true

`if expression`  
`statements`  
`end`

evaluates an *expression*,  
and executes a group of  
*statements* when the  
*expression* is true