RINEX
The Receiver Independent Exchange Format

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

During large GPS observation campain 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
gfzrnx-1.06-6962    FILE CONVERSION     20180108 010504 UTC COMMENT
gfzrnx-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 = distance + c * (receiver clock offset –satellite clock offset) + other biases

Phase

is the carrier phase measured in whole cycles

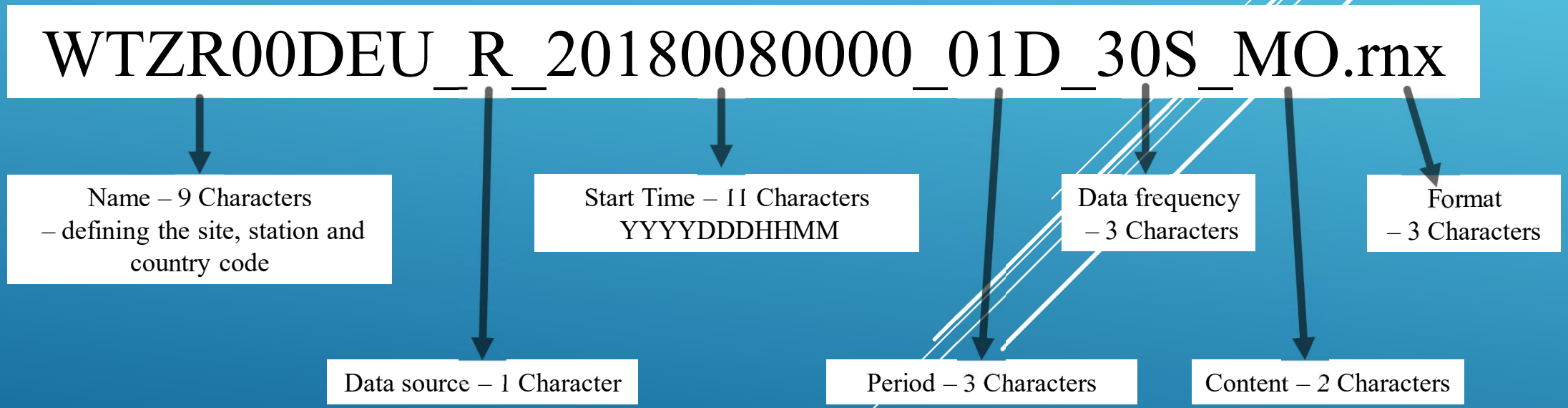
Satellite numbers

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



GNSS observation data file

Mandatory records in header section

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

THE ORDERING OF THE HEADER RECORDS ARE FREE !!!

Exceptions:

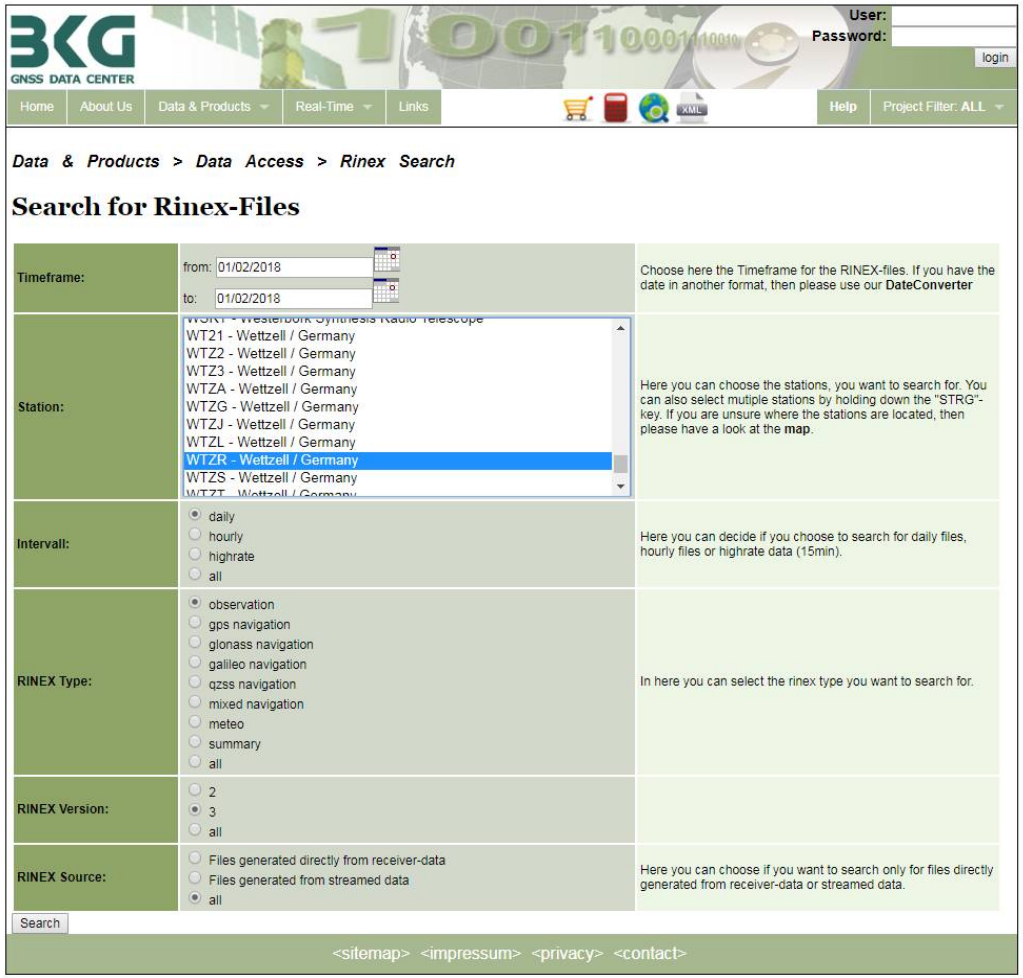
The **SYS / # / OBS TYPES** record(s) should precede any **SYS / DCBS APPLIED** and **SYS / SCALE FACTOR** records

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

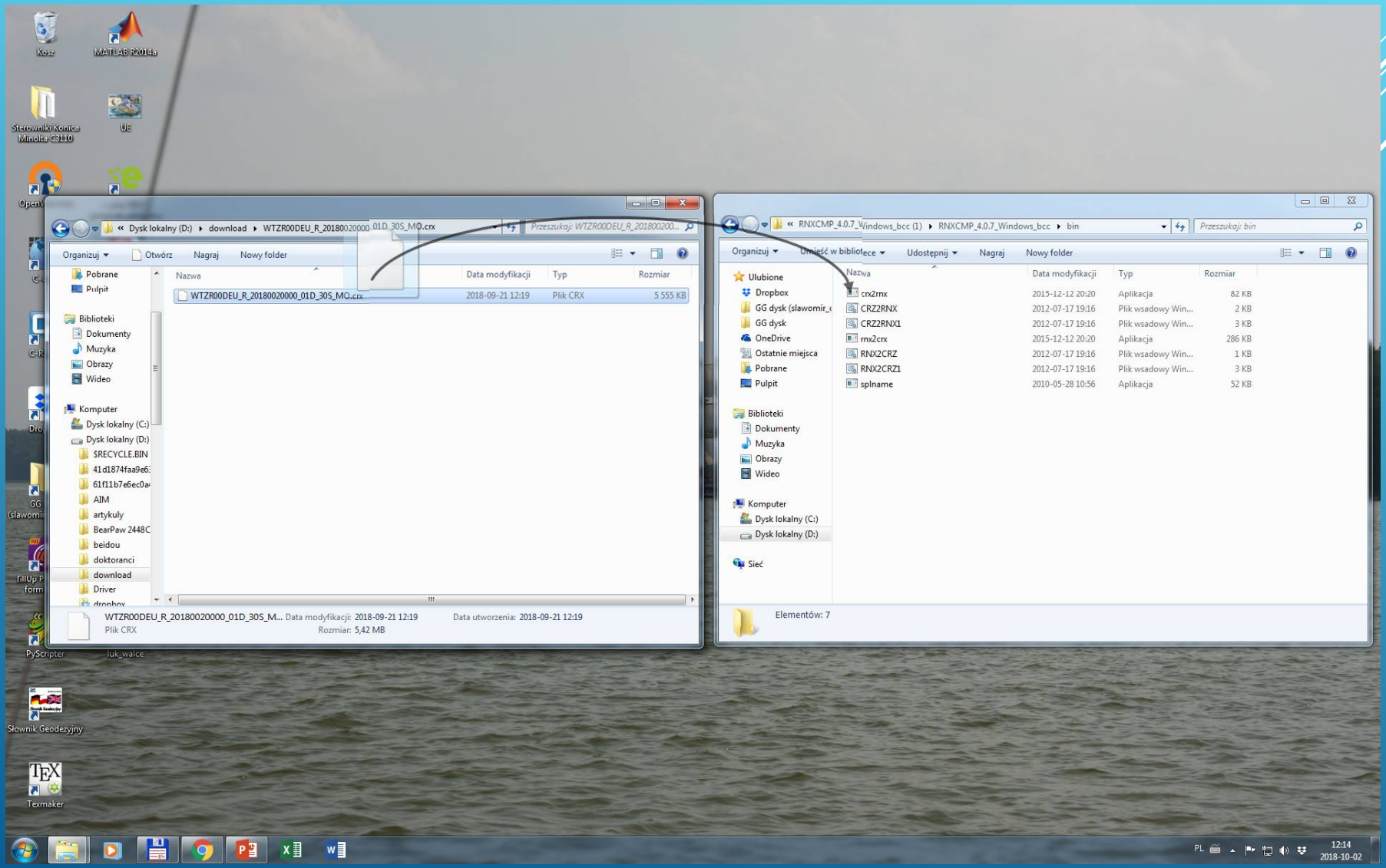


Conversion *.crx → *.rnx

crx2rnx.exe

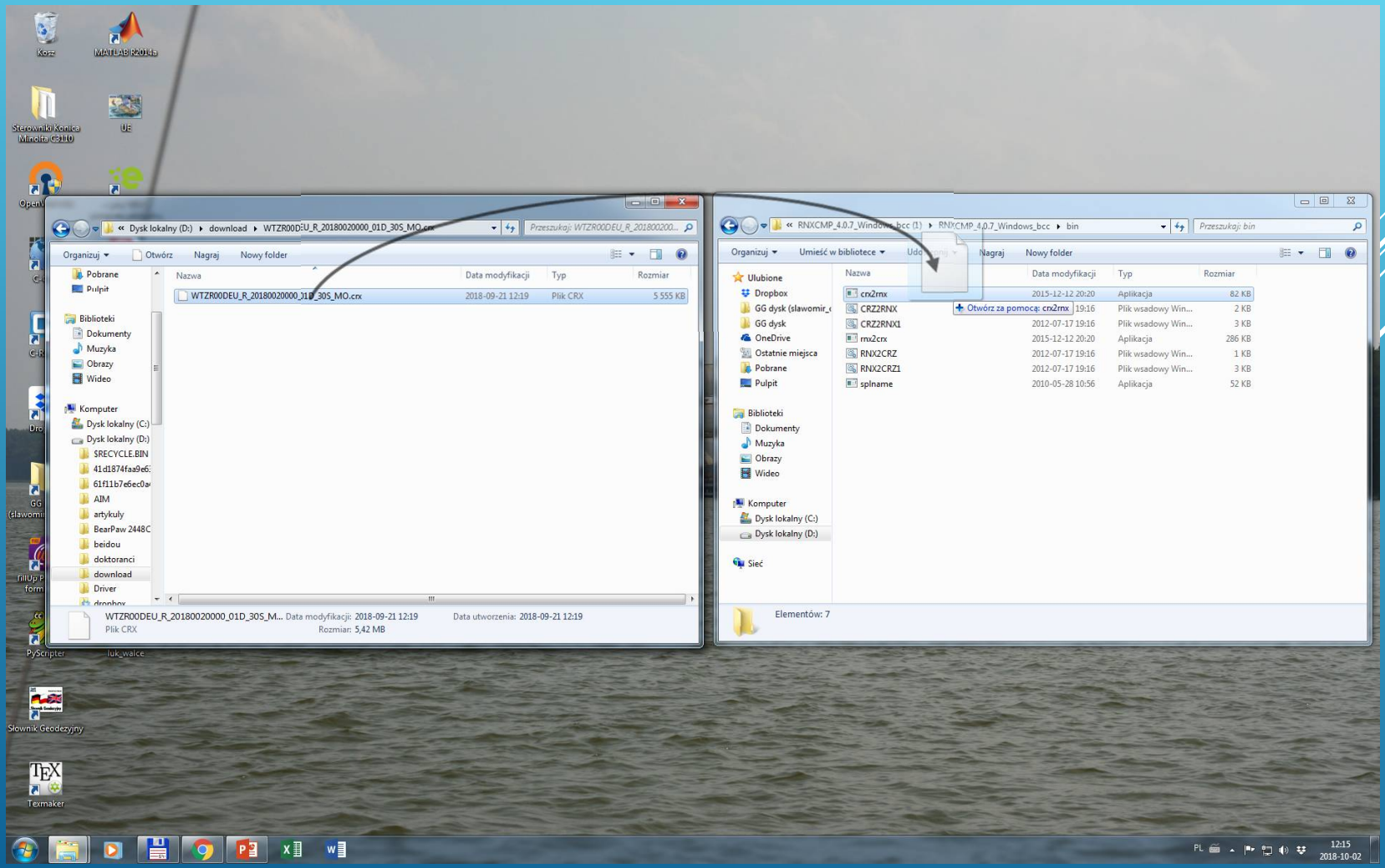
crx2rnx.exe

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 eccentrity 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) – ekstract str1 from line

frewind(fid) – move to the beginning of file

str2num(str1) or str2double(str1) – convert string to numer

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