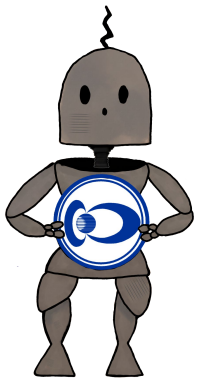
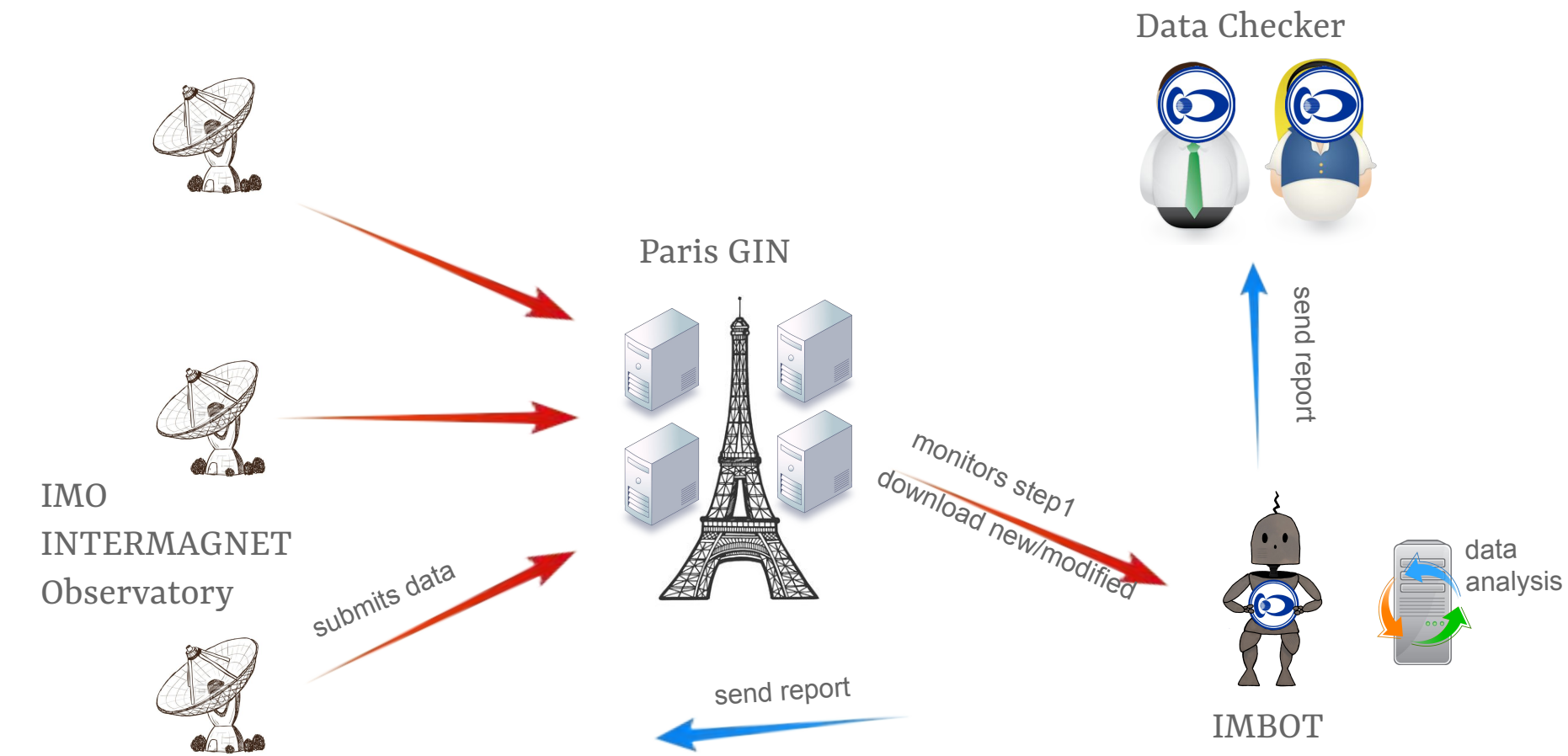
IMBOT – INTERMAGNET ROBOT

Principle idea

- Use an automatic information and data evaluation process to assist data providers and data checkers.
- Minimize workload for providers and checkers, especially for one-second submission.
- Publish one-second data as quickly as possible.

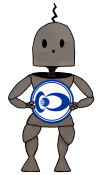


IMBOT


Data Checker
Paris GIN
send report
monitors step1
download new/modified
IMO
INTERMAGNET
Observatory
submits data
send report
data
analysis
IMBOT

IMBOT – one-minute

IMO provides their definitive to step1 directory,
and then IMBOT sends report to the cross-checker and IMO



Cross-checking by volunteers, if OK copying to step2 directory

Checking by DD subcommittee, of OK copying to step3
(step3 corresponds to public IM web)

DD Subcom

Compilation IRDS by DD subcommittee

DD Subcom

Publication IRDS as DOI by GFZ

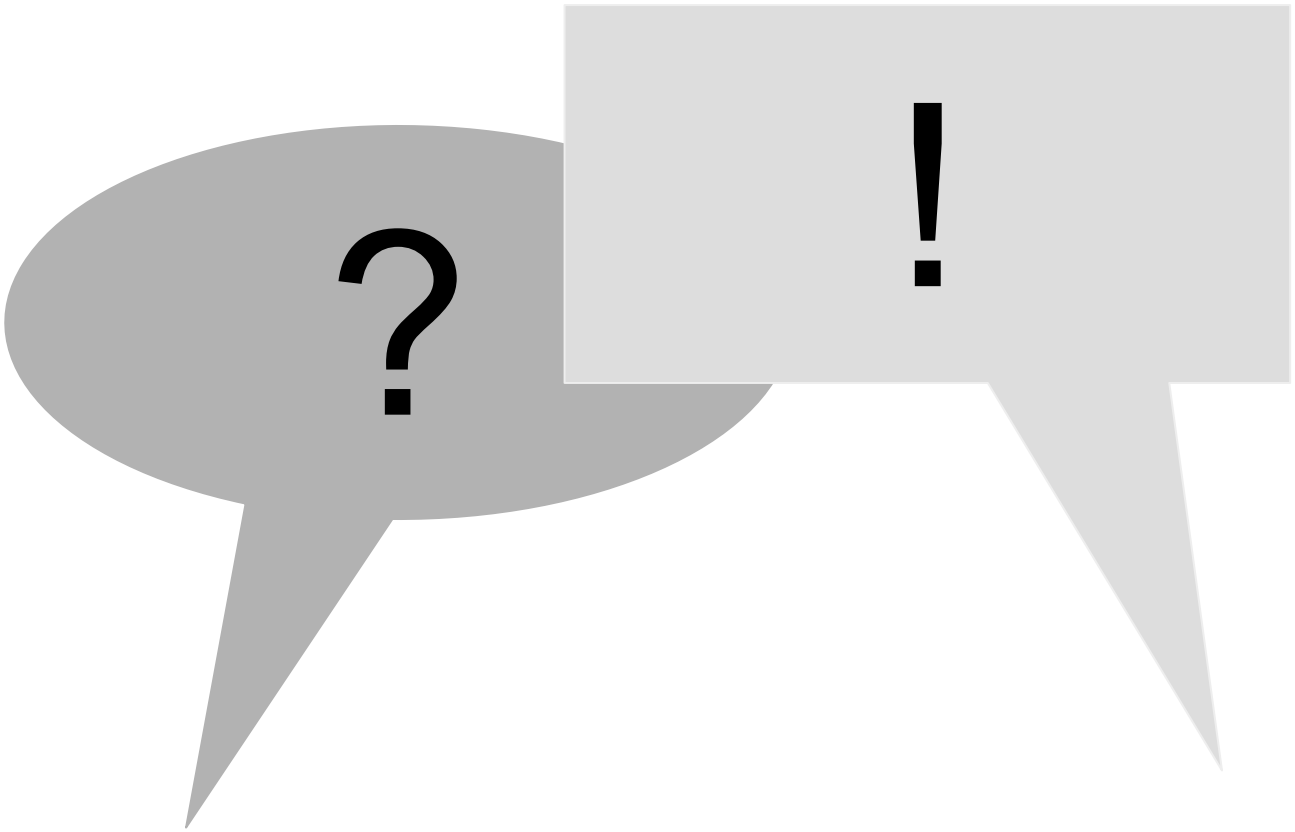
GFZ team

IMBOT – one-minute

If new/modified data appears within step1 on Paris GIN, IMBOT automatically downloads that data

- Simple „read“ test with MagPy
- Run Check1min on data (vers 1.71)
- Construct e-mail: result of automatic analysis (level), check1min report, basic acknowledgment
- Inform referee and provider

IMBOT one-minute discussion



IMBOT one-second

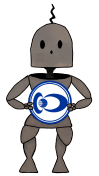
- Since 2014 INTERMAGNET welcomes data submission in one second resolution
- For archiving and providing such data, the IMAGCDF format was introduced, based on NASA CDF*
- Currently about 38 observatories are submitting definitive one second data
- So far, one second data products are not checked and/or provided to end users by INTERMAGNET

*2014 requested IAGA2002, 2015 onwards reqested IMAGCDF

IMBOT – one-second

IMO provides their definitive to step1 directory

Automatic checking by IMBOT, reporting to IMO and instructions for updates/corrections. Copy to step2 directory



Checking by human referees. Reporting to DD subcom.

Compilation by DD subcommittee, copying to step3.
(step3 corresponds to public access - not yet existing)

DD Subcom

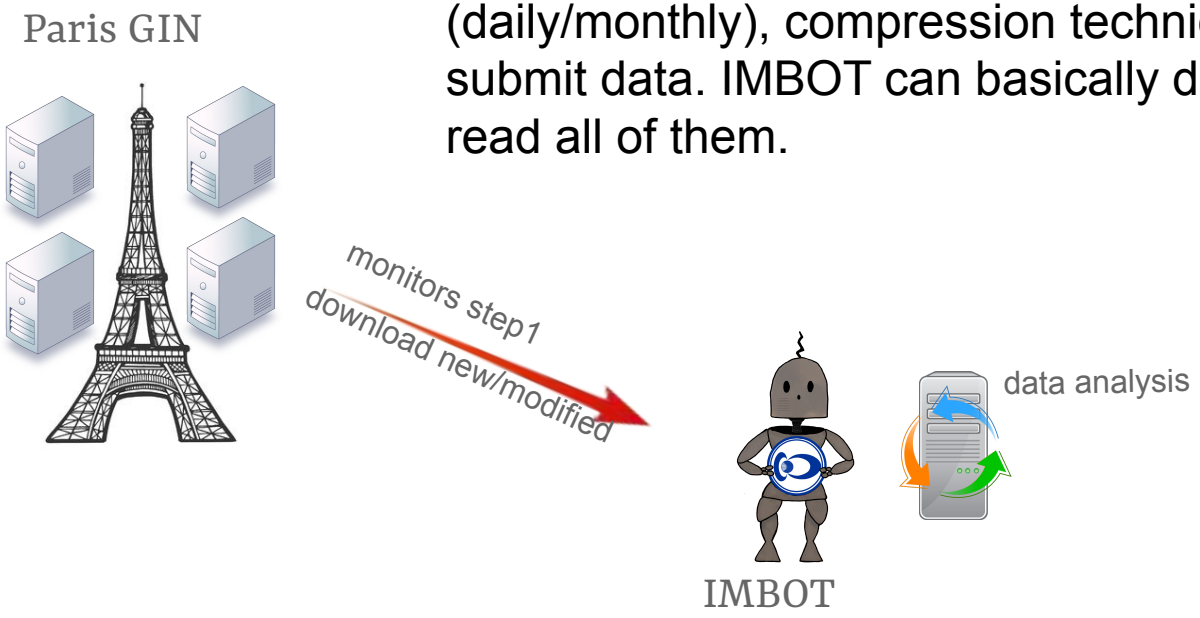
Publication and DOI by GFZ

GFZ team

suggested parts - not yet approved and details unclear

IMBOT step1sec download

Various different data formats, coverages (daily/monthly), compression techniques are used to submit data. IMBOT can basically decompress and read all of them.



IMBOT – one-second data checking

Submitted files and formats
accepted are all readable formats (e.g. IAGA2002, IMAGCDF)

Meta information
meta information contained and consistent between all different files

Data content
Correct coverage and content

Data quality
Noise level, delta F variation

Data consistency
data consistent with minute submission, definitive status

IMBOT – one-second reporting

Asign Level
Level 0-2, 2 is best

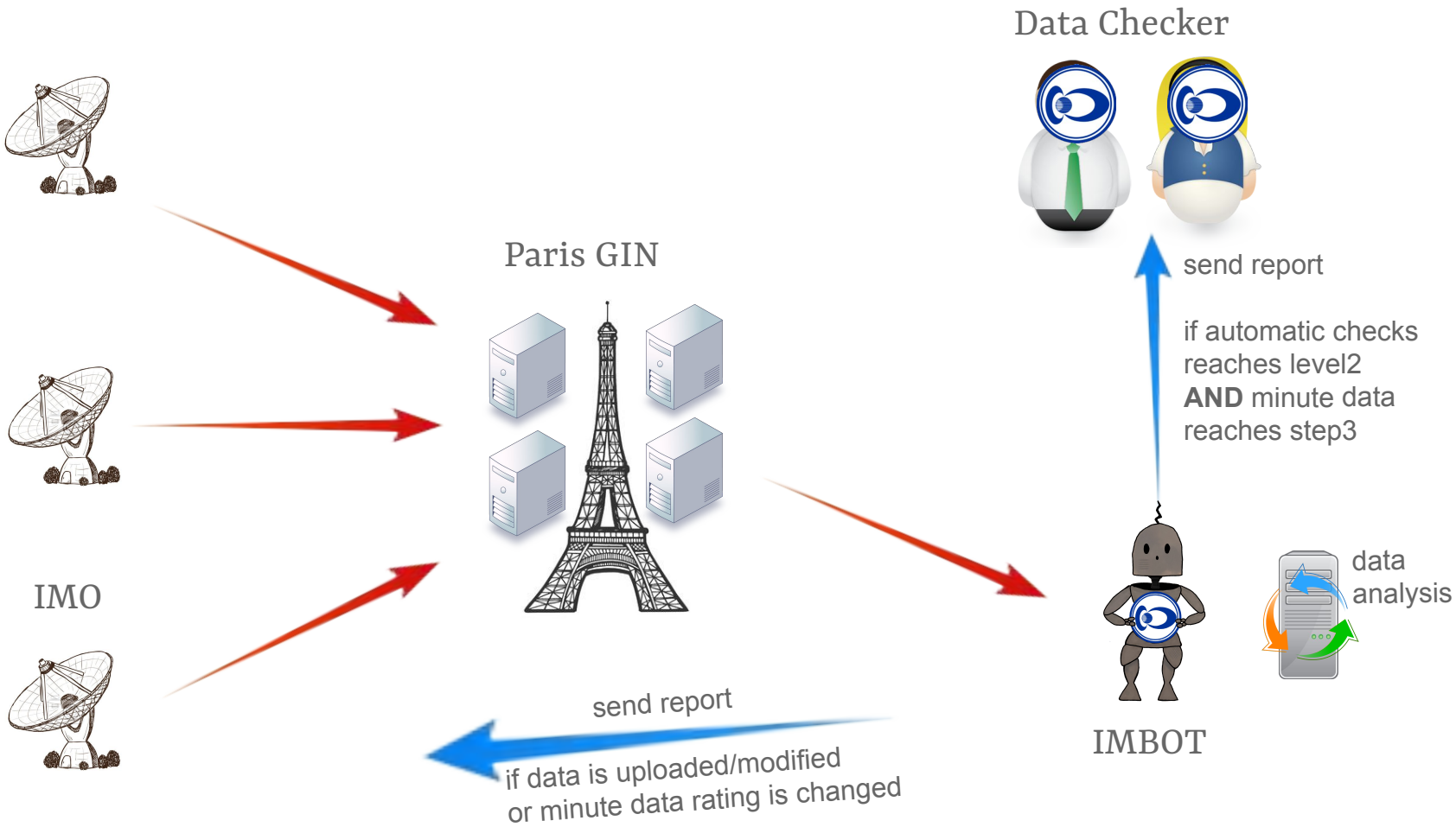
Construct report
Contains meta information, monthly analysis results and suggestions for providers/checkers

Send e-mail to provider
Report, level classification, instructions for improvements, template for meta information updates

Send e-mail to referee (and provider)
If level2 is reached and one-minute data appears in step3

Upload to step2
All data is converted to monthly IMAGCDF archives

IMBOT


Data Checker
Paris GIN
send report
if automatic checks
reaches level2
AND minute data
reaches step3
IMO
data
analysis
IMBOT
send report
if data is uploaded/modified
or minute data rating is changed

IMBOT – the report

https://github.com/geomagpy/IMBOT/blob/master/examples/level1_underreview.md

OBSCODE - Level 1

Analysis report for one second data from OBSCODE

Issues to be clarified for level 2:

Issue	Observed in months
header StandardLevel missing	1,2,3,4,5,6,7,8,9,10,11,12
StandardLevel full or partial - see TN8: 4.7 Relevant data standards	1,2,3,4,5,6,7,8,9,10,11,12
PartialStandDesc required for partial - see TN8: 4.7 Relevant data standards	1,2,3,4,5,6,7,8,9,10,11,12

Possible improvements (not obligatory):

Improvements	Applicable for months
provide information on Terms	1,2,3,4,5,6,7,8,9,10,11,12

ImagCDF standard levels as provided by the submitter

StandardLevel	Description	Validity
IMOS-01	Time-stamp accuracy (centred on the UTC second): 0.01s	not provided
IMOS-02	Phase response: Maximum group delay: ±0.01s	not provided
IMOS-03	Maximum filter width: 25 seconds	not provided
IMOS-04	Instrument amplitude range: ≥±4000nT High Lat., ≥±3000nT Mid/Equatorial Lat.	not provided
IMOS-05	Data resolution: 1pT	not provided
IMOS-06	Pass band: DC to 0.2Hz	not provided
IMOS-11	Noise level: ≤100pT RMS	not provided - IMBOT indicates success
IMOS-12	Maximum offset error (cumulative error between absolute observations): ±2. 5 nT	not provided

IMBOT – the report

Basic analysis information

- amount : 1
- type : .zip
- lastmodified : 1594113906.112519
- obscode : OBSCODE
- Readability test file : /media/leon/Images/DataCheck/tmp/OBSCODE/raw/obs20160210dsec.sec
- Readability : OK
- Data format : IAGA-2002
- Year : 2016
- MagPyVersion : 0.9.7
- Noiselevel : 10 pT
- NoiselevelStdDeviation : 1 pT

Details on monthly evaluation

Month 1	Value
mean difference - x component	0.00629 nT
mean difference - y component	0.00528 nT
mean difference - z component	0.0056 nT
stddev of difference - x component	0.041 nT
stddev of difference - y component	0.0409 nT
stddev of difference - z component	0.0404 nT
amplitude of difference - x component	0.229 nT
amplitude of difference - y component	0.898 nT

IMBOT – the report

Month 1	Value
mean difference - x component	0.00629 nT
mean difference - y component	0.00528 nT
mean difference - z component	0.0056 nT
stddev of difference - x component	0.041 nT
stddev of difference - y component	0.0409 nT
stddev of difference - z component	0.0404 nT
amplitude of difference - x component	0.229 nT
amplitude of difference - y component	0.898 nT
amplitude of difference - z component	0.202 nT
DataIimits	[datetime.datetime(2016, 1, 1, 0, 0), datetime.datetime(2016, 1, 31, 23, 59, 59)]
N	2678400
Leap second update	None
Filled gaps	0
Difference to expected amount	0.0
Level	1
Samplingrate	1.0 sec
delta F	mean delta F of 0.084 with a std of 0.199
F	found independend f with sampling period: 1.0 sec
Definitive comparison	differences in peak amplitudes between definitive one-minute and one-second data products observed
Contact	['observer@observatory.obs']

IMBOT – the meta template

```
## Parameter sheet for additional/missing metainformation
## ------------------------------------------------------
## Please provide key - value pairs as shown below.
## The key need to correspond to the IMAGCDF key. Please
## check out the IMAGCDF format description at INTERMAGNET
## for details. Alternatively you can use MagPy header keys.
## Values must not contain special characters or colons.
## Enter "None" to indicate that a value is not available
## Comments need to start in new lines and every comment line.
## must start with a hash.
## Please note - you can also provide optional keys here.
##
## Example:
## Providing Partial standard value descriptions as requested:
# StandardLevel  :  partial
# PartialStandDesc  :  IMOS11,IMOS14,IMOS41


# Provide a valid standard level (full, partial), None is not accepted
StandardLevel  :  partial

# If Standard Level is partial, provide a list of standards met
PartialStandDesc  :  IMOS-01,IMOS-02,IMOS-03,IMOS-04,IMOS-05,IMOS-11,IMOS-14,IMOS-41

# If data is not available please confirm by MissingData  :  confirmed
MissingData  :  confirmed
```

IMBOT one-second automatic rating

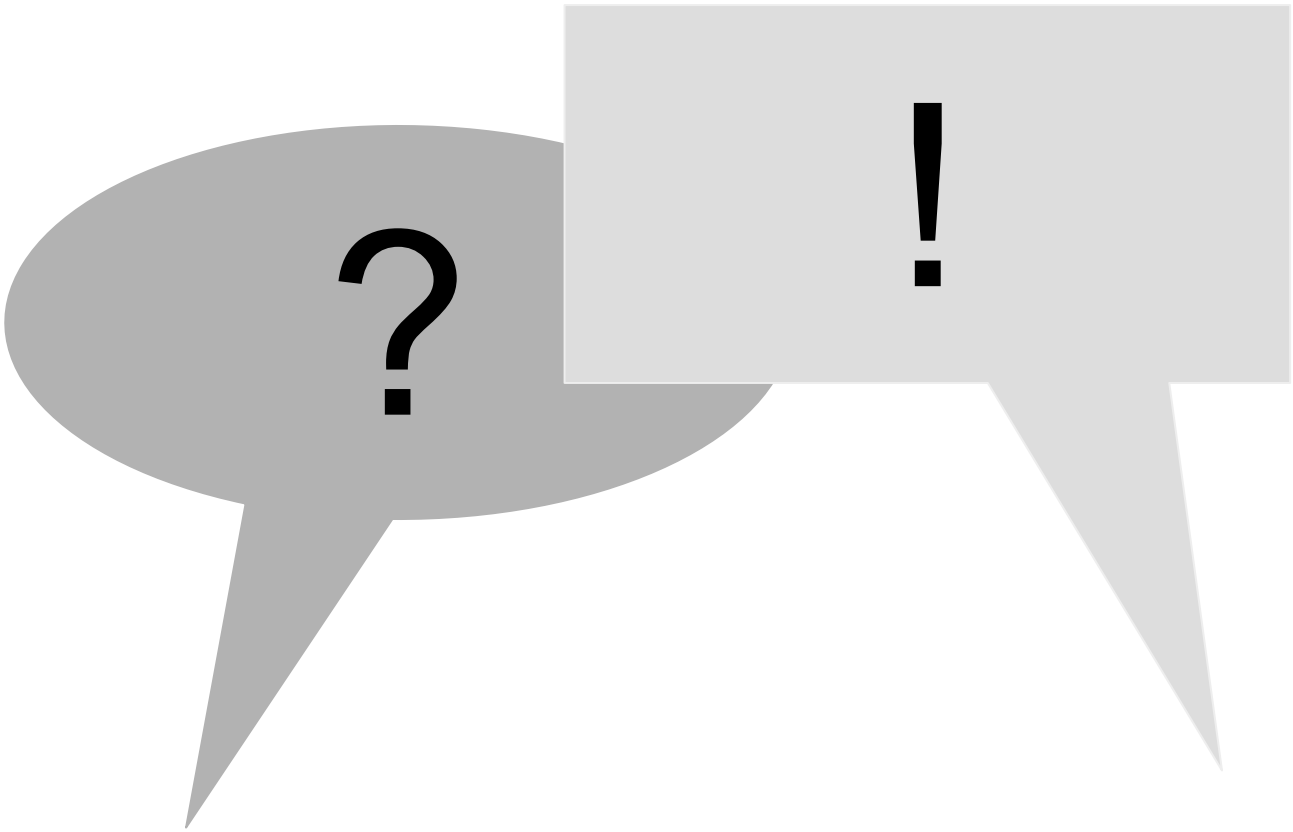
One second data at level 0 or level 1:

- IMO needs to check reports and correct the submission.
- Dominant level 1 reason is missing meta information → use meta_OBSCODE.txt template
- Contact for questions and help (IMBOT manager → R. Leonhardt)

One second data at level 2:

- IMO does not need to do anything → anyway check reports for suggested improvements
- if minute-data reaches step3 a reanalysis is triggered and data checkers are informed automatically

IMBOT one-second discussion



IMBOT one-second manual data checking

Issues to be checked:

- IMBOT report, particularly „considerations for manual checking“
- basic credibility of provided meta information
- data quality

Please note: One-second data is an optional product. The definitive status of an IMO is solely related to one-minute data.

Tools for data checking:

- Autoplot (http://autoplot.org/)
- MagPy (https://cobs.zamg.ac.at/ → software)
- Matlab, Mathematica, etc (https://intermagnet.github.io/)

IMBOT one-second manual data checking

Suggestion:

Training phase until end of 2022 with regular online meetings to discuss reports and issues.

Aspects to be clarified:

1) useable software
2) aspects to be checked,
3) thresholds for acceptable data
4) possible exceptions

End of 2022: Cookbook for one-second manual data checking.

IMBOT one-second data checkers

Suggestion for re-allocation of 1-second checking between the agreed 1-second checkers:

Andrew Lewis:	EBR; FUR; API; HER; LYC
Benoit Heumez:	BOU; BRW; BSL; CMO; DED
Kusumita Arora:	ASP; CSY; CTA; CLF; KOU
Achim Morschhauser:	KDU; LRM; MAW; MCQ; PHU
Sergey Khomutov:	BOX; UPS; GUA; HON
Seiki Asari:	ABK; HRN; NEW; SHU
Anca Isac:	KAK; KNY; MMB; TAM; WIC
Jan Reda:	BDV; SIT; SJG; TUC
Tero Raita:	CKI; CNB; GNG; PEG

*please note: this list is to be modified

IMBOT one-second manual check discussion