

CERA-20C: Observation feedback

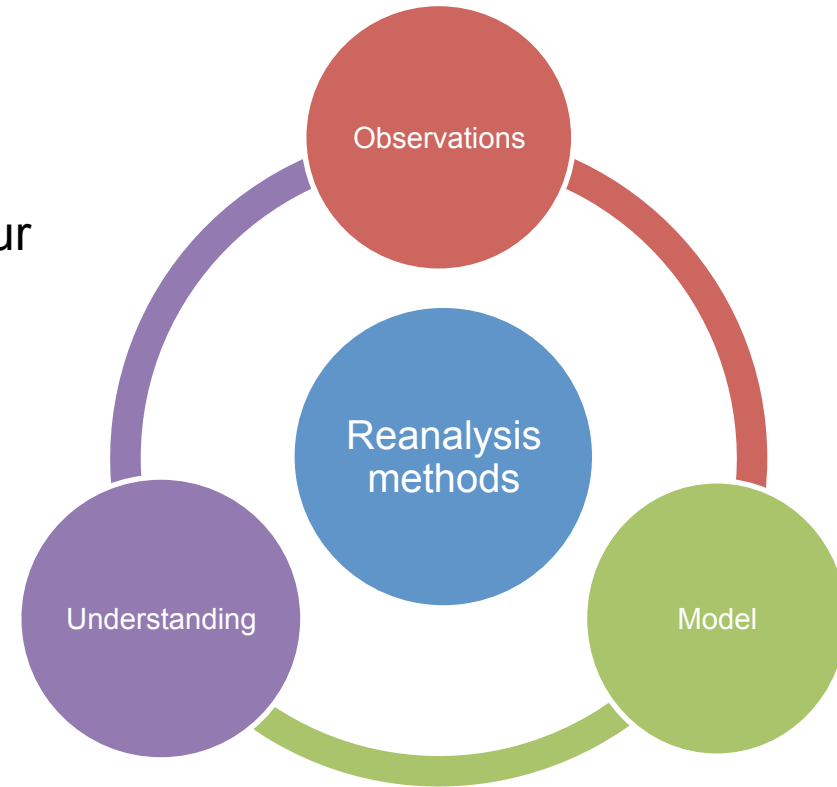
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Introduction

Infinite loop of reanalysis:

- Confronting observations with model in reanalysis, we improve our understanding of the climate
- This understanding can be fed back in the observation dataset
- The new (better) dataset will be used in the next reanalysis



- Objective

- Check quality of observations assimilated into the CERA-20C system
- Identify bad quality observations

Observation used in CERA-20C

- SYNOP
 - Station level pressure (SP) and mean sea level pressure (MSLP) from ISPD3.26, ICOADS2.5.1
- SHIP
 - Station level pressure (SP) and mean sea level pressure (MSLP) from ISPD3.26, ICOADS2.5.1
 - Zonal component of wind (U) and meridional component of wind (V) from ICOADS2.5.1
- ODB (Observational DataBase)
 - Observation identification information (date, position, station identification, ...)
 - Observed values for different observation types (pressure, temperature, wind, humidity, ...)
 - Various flags indicating quality and validity of an observation (active or rejected, whether the measurement can be trusted)
 - Departure from observed value (observed value minus background field (FG departure), observed value minus analysed (AN departure))
 - Other important observational processing and meteorological information

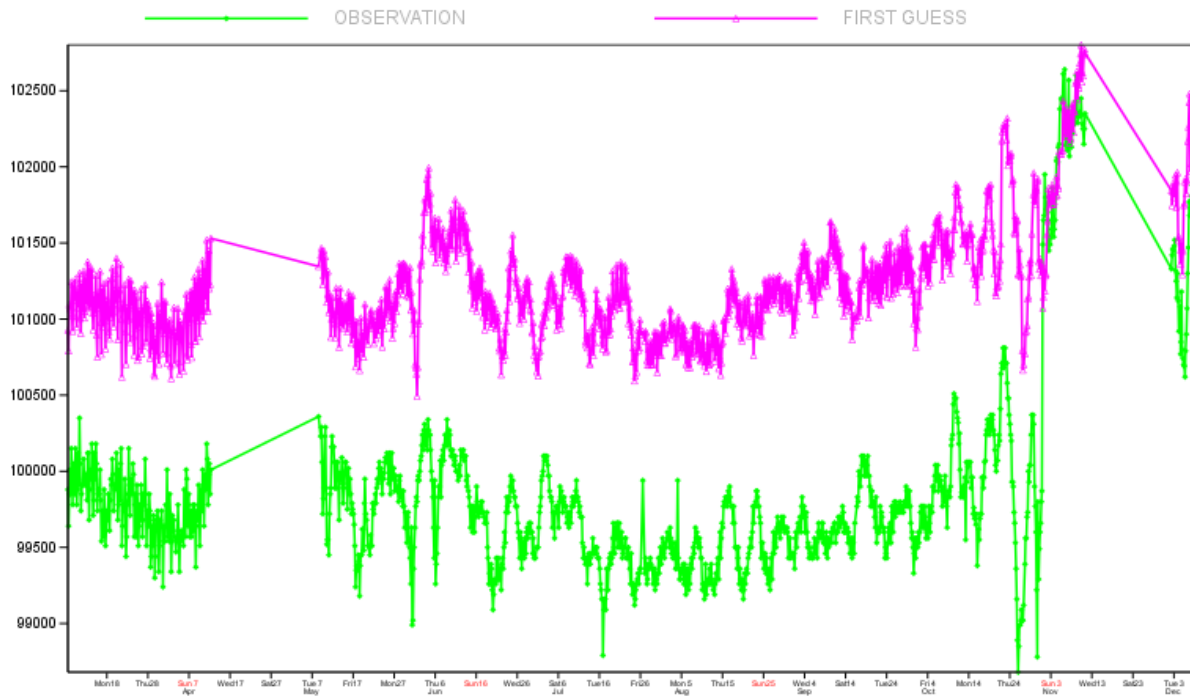
Method

- Criteria for both SYNOP and SHIP
 - Pickup stations whose bias or std of FG departure is large
 - $|\text{Bias}| \geq 4\text{hPa}$ or $\text{Std} \geq 6\text{hPa}$ (threshold for pressure)
 - $|\text{Bias}| \geq 4\text{m/s}$ or $\text{Std} \geq 8\text{m/s}$ (threshold for wind)
 - Rejection percentage (except blacklisted data) is high
 - Rejection percentage $\geq 75\%$
- Criteria for SHIP only
 - Track check
 - Pickup reports whose speed are more than 100 km/h.
 - Landsea check
 - Land mask rate is more than or equal to 0.96

Stations whose bias of fg departure is large

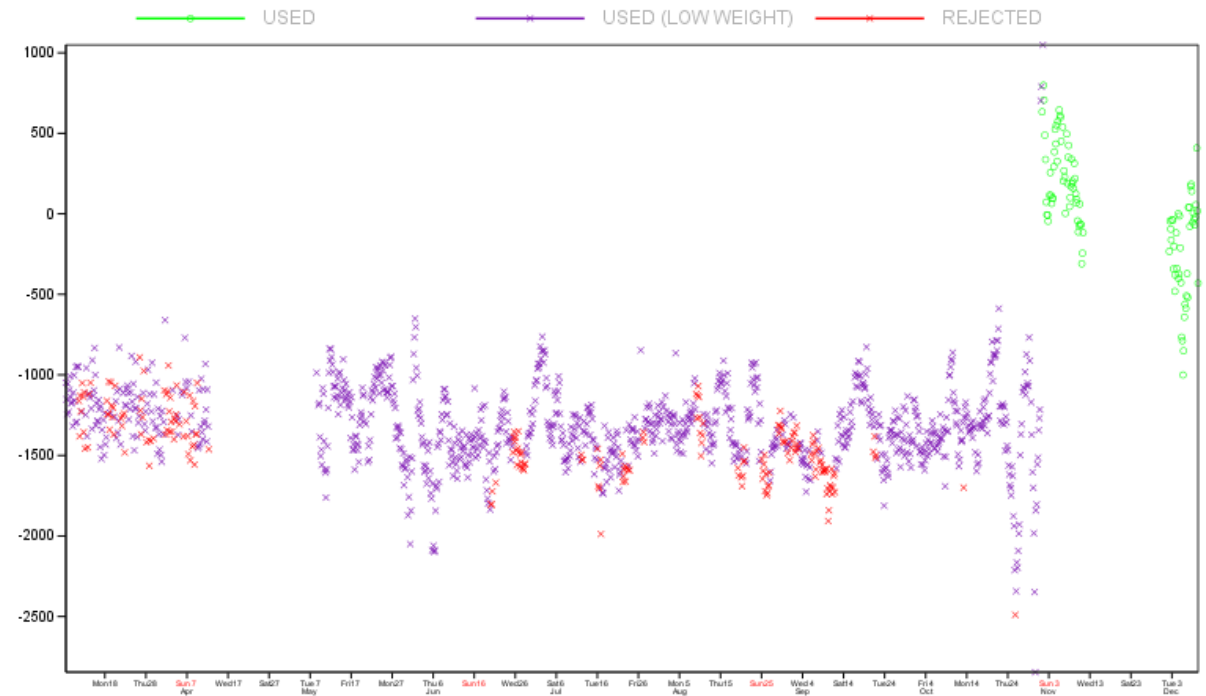
ISPD3.26

OBS AND FG (YEAR: 1918, STATID: 10SEVERN, ELEM: MSLP)



Magic 2.23.0 (94 bit) - fang - dyk - Fri Sep 9 11:19:20 2016

FG DEPARTURE (YEAR: 1918, STATID: 10SEVERN, ELEM: MSLP)



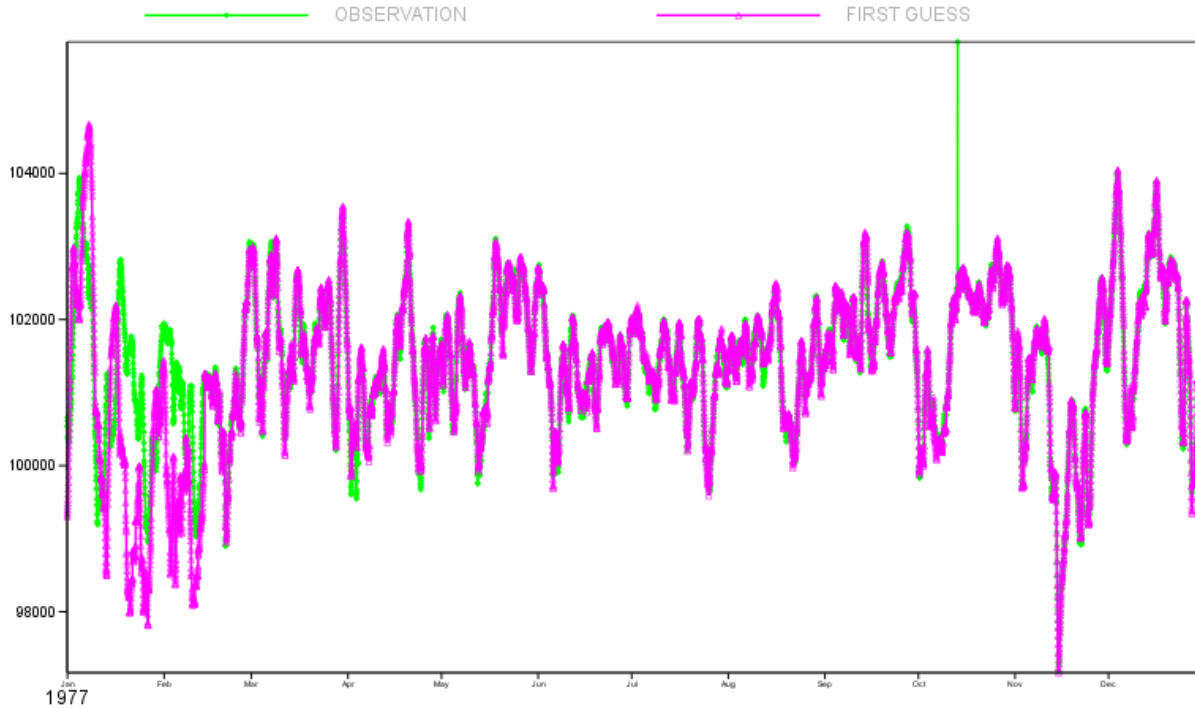
Magic 2.23.0 (94 bit) - fang - dyk - Fri Sep 9 11:19:47 2016

Value of observation is 10hPa lower than that of first guess.
Observation data whose quality considered to be low were assimilated (with low weight) into the CERA-20C system.

Stations whose sd of fg departure is large

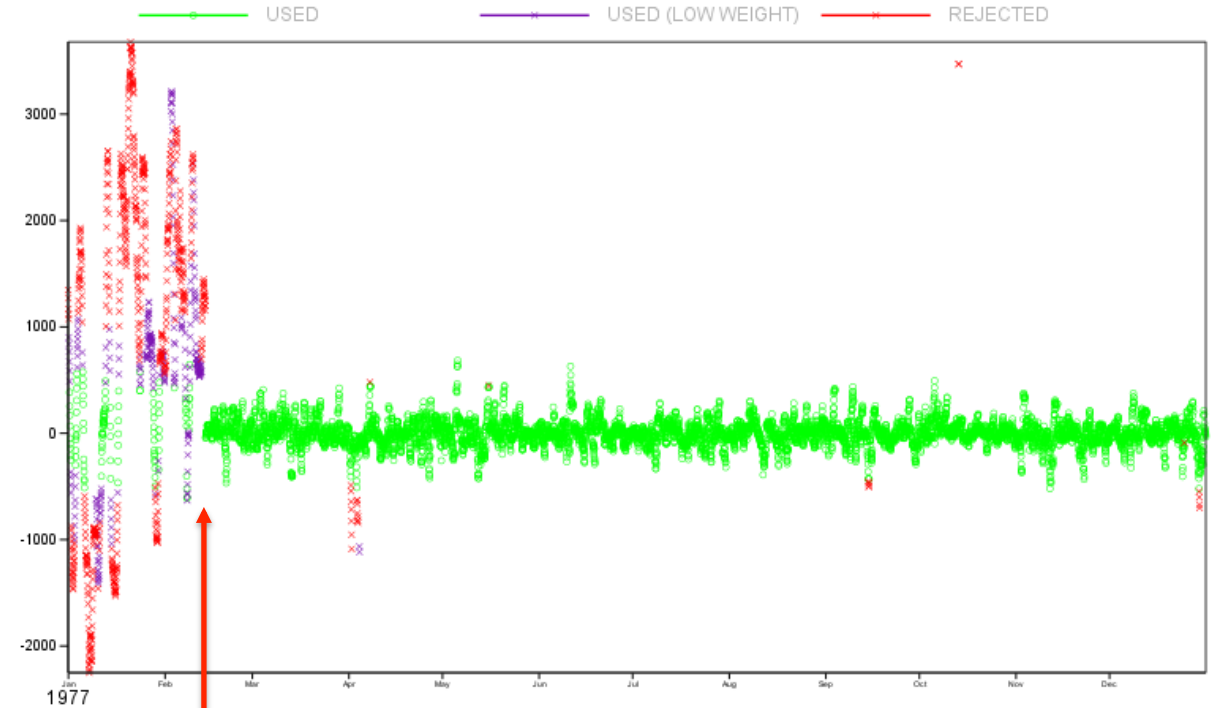
52.9N, 11.73W
ISPD3.26

OBS AND FG (YEAR: 1977, STATID: 092610, ELEM: MSLP)



Mega 2.28.5 (94 bit) - fang - dyk - Fri Jan 13 10:57:39 2017

FG DEPARTURE (YEAR: 1977, STATID: 092610, ELEM: MSLP)

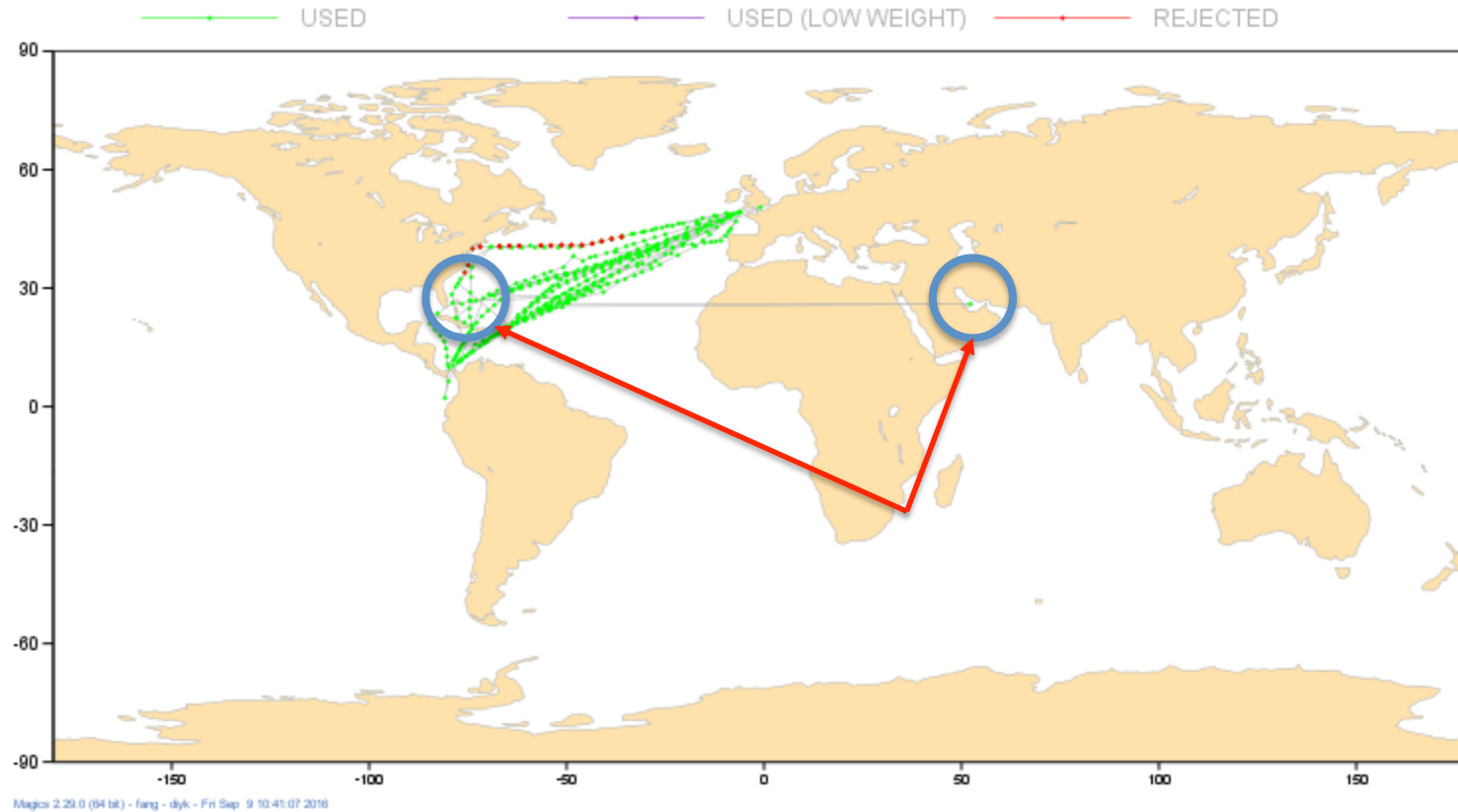


Mega 2.28.5 (94 bit) - fang - dyk - Fri Jan 13 10:58:49 2017

Longitude sign was corrected.
(11.73W → 11.73E)

Track check

OBSERVATION POSITION (YEAR: 2007, STATID: C6JS, ELEM: MSLP)



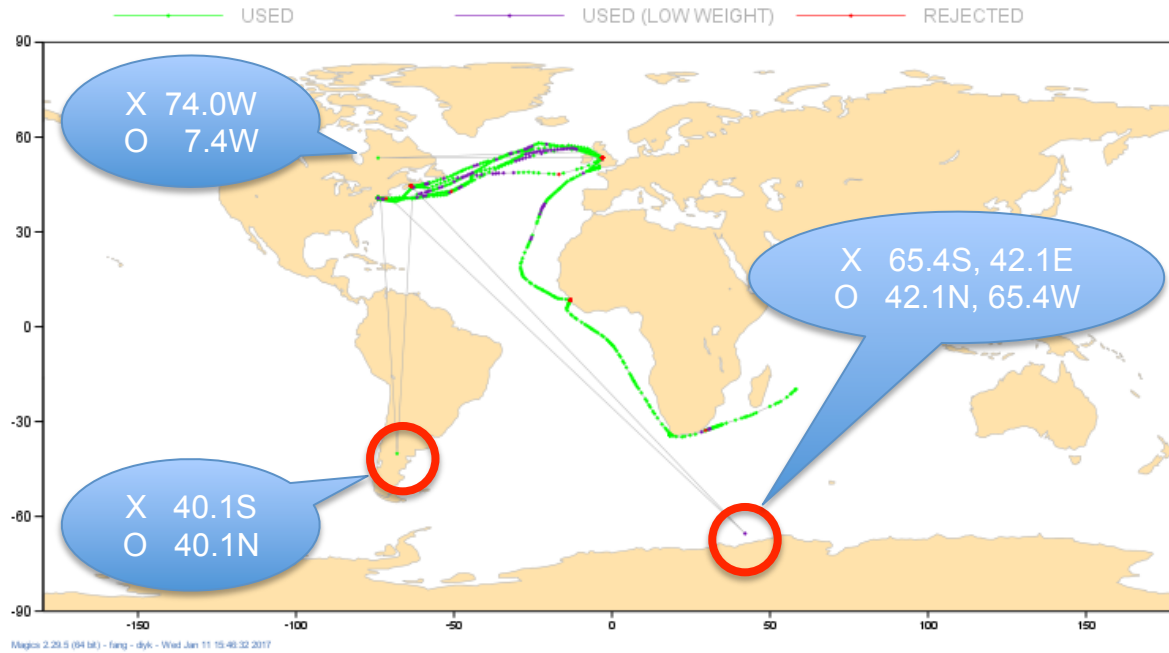
ISPD3.26
ICOADS2.5.1

- Two observations, whose longitudes are opposite each other, were reported at one observation time. (maybe correction report)
- Both of them were assimilated into the CERA-20C system.

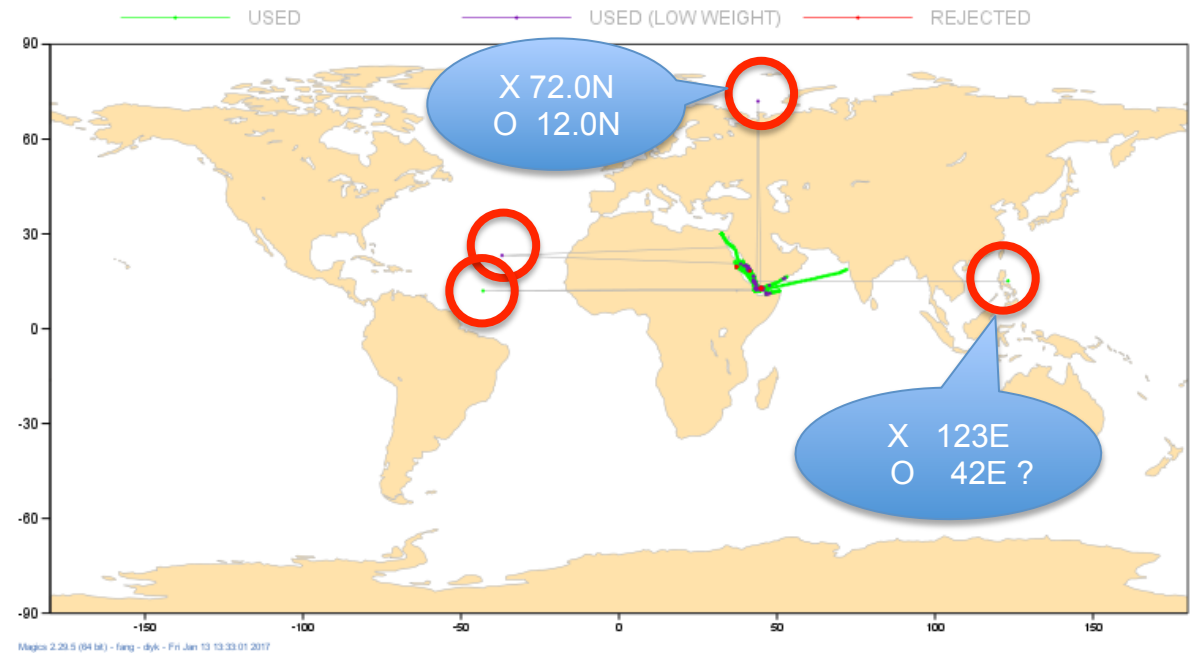
Track check

ISPD3.26

OBSERVATION POSITION (YEAR: 1917, STATID: 10CORNWA, ELEM: MSLP)



OBSERVATION POSITION (YEAR: 1917, STATID: 10PERTH, ELEM: MSLP)



- There are many causes of wrong track
 - Number of digits is wrong
 - Latitude sign is opposite
 - Order of latitude and longitude is wrong
 - ...

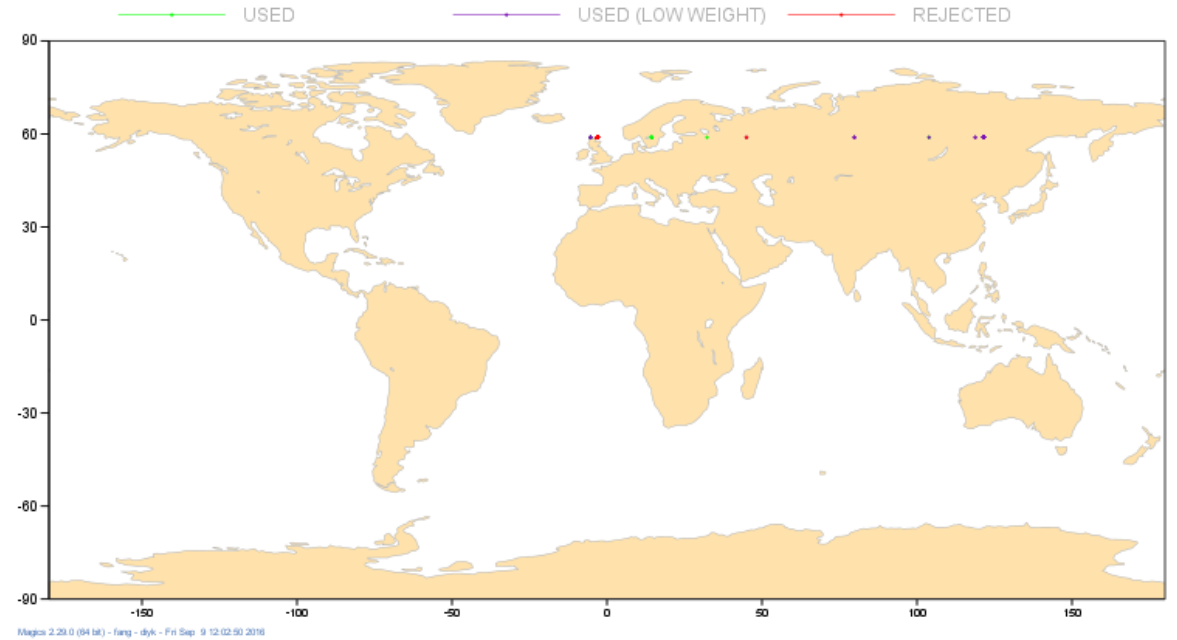
Landsea check

ISPD3.26

OBS AND FG (YEAR: 1913, STATID: 10YARMOU, ELEM: MSLP)



OBSERVATION POSITION (YEAR: 1913, STATID: 10YARMOU, ELEM: MSLP)

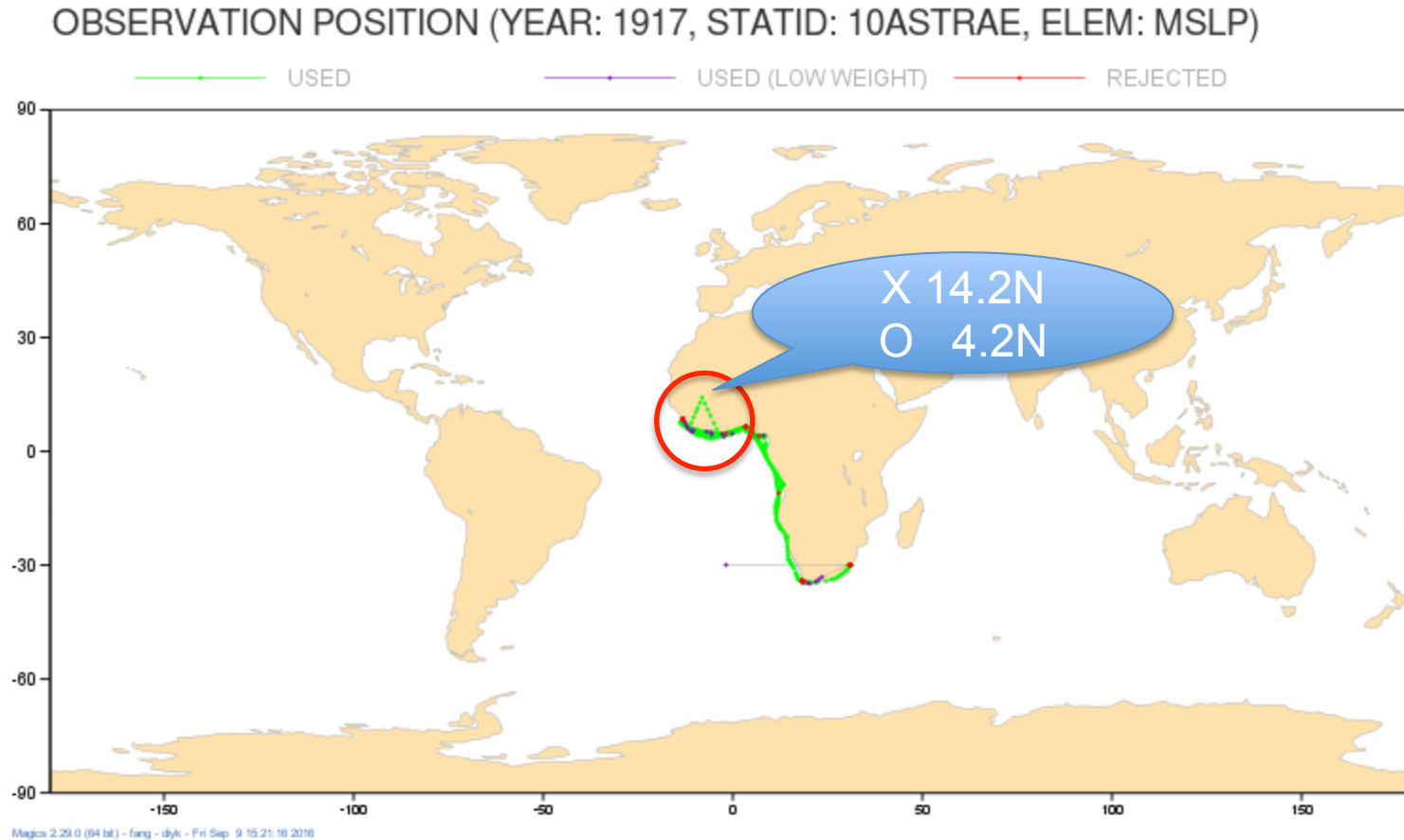


Tendency of FG seems to be suspicious.

There are multiple of reporting points which include land. (Value of latitude is constant in this case.)

Some of observations from this station was assimilated into the system.

Landsea check



1. One of the reported latitude was wrong.
2. Some of observation positions were calculated by performing interpolation by using this wrong position report.

Summary

- Investigated quality of observation used in CERA-20C system
 - Biased observation
 - Wrong meta data (e.g. longitude, latitude, altitude)
 - Duplicated report
 - SHIP report from land
 - Wrong reporting unit (knot → m/s)
- Update blacklists for future reanalysis
 - High percentage of rejection
 - Ships with erroneous track
 - Ships over land
- Provide feedback information to data provider, to be included in their dataset

Backup slides

Wrong metadata (altitude)

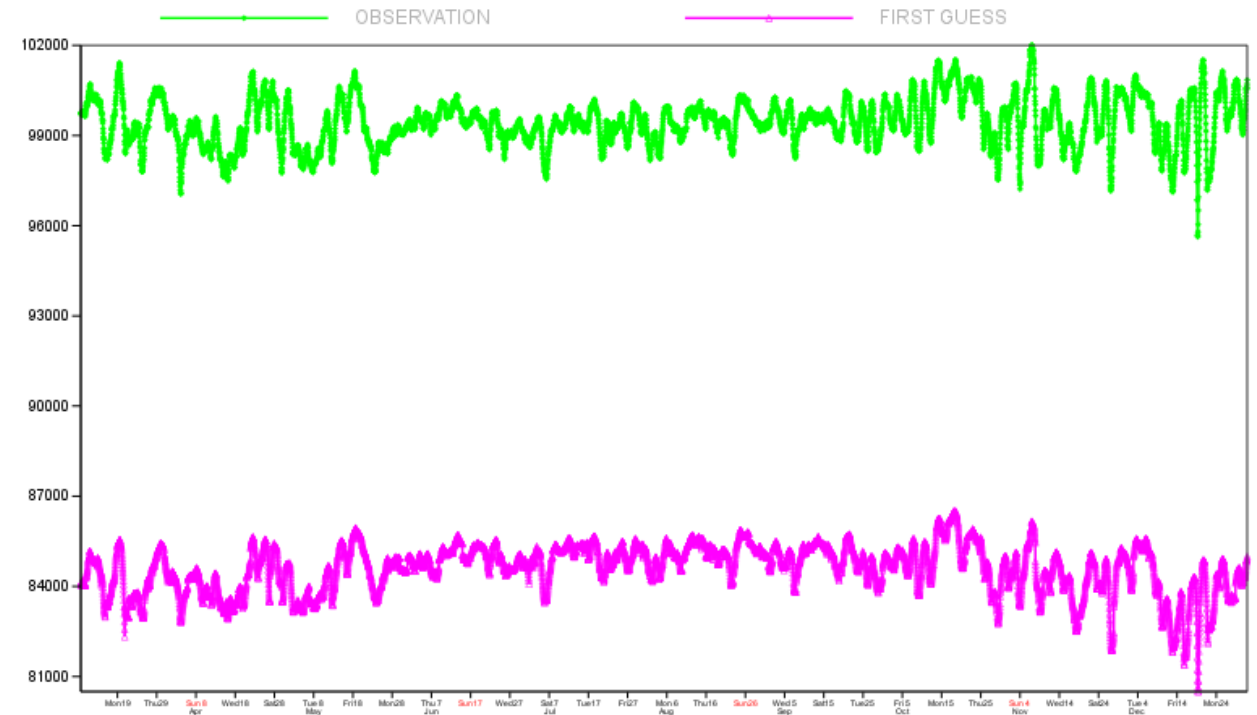
46.68N,
68.05W
ISPD3.26

OBS AND FG (YEAR: 1951, STATID: 727130PS, ELEM: MSLP)



Magic 2.29.0 (94 bit) - fang - dyk - Wed Jul 13 13:39:53 2016

OBS AND FG (YEAR: 1951, STATID: 727130PS, ELEM: SP)



Magic 2.29.0 (94 bit) - fang - dyk - Wed Jul 13 13:41:55 2016

Bias of fg_depar seen in SP time series disappeared since 1953 when the station altitude was changed. (1480m → 148m)

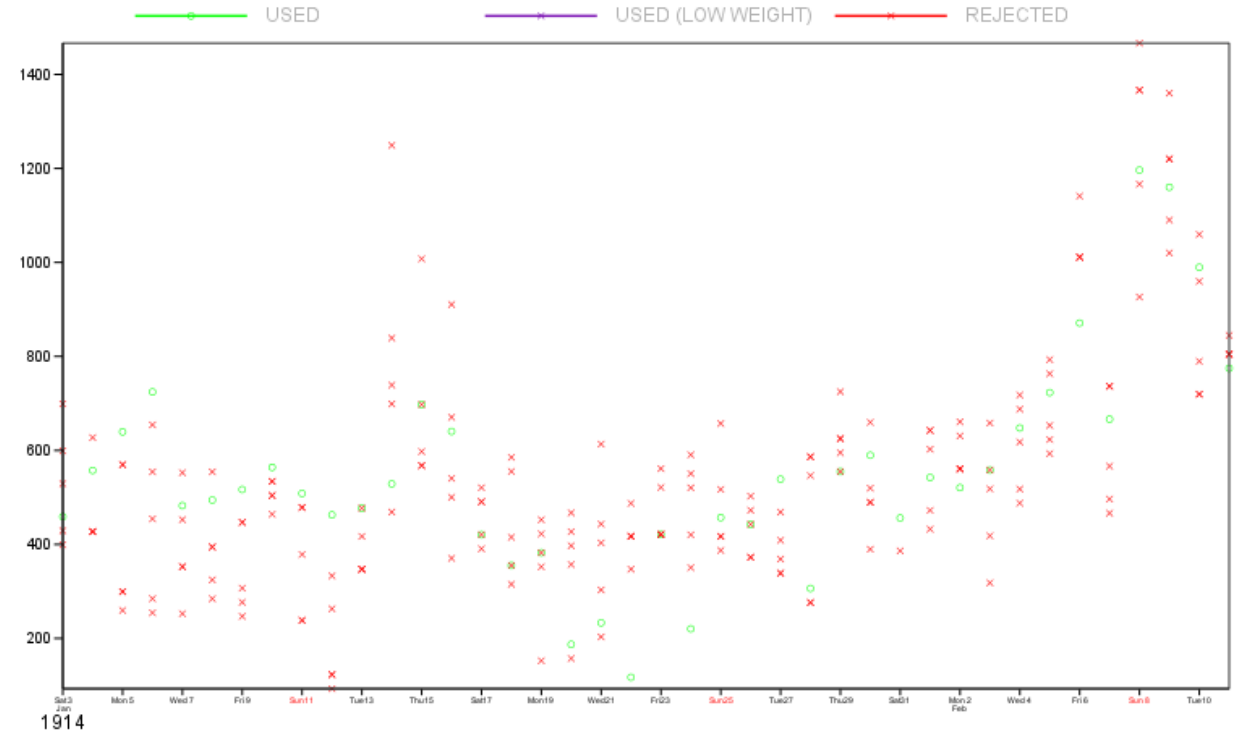
Observed time is always 00UTC

ISPD3.26

OBS AND FG (YEAR: 1914, STATID: 10FAME, ELEM: MSLP)



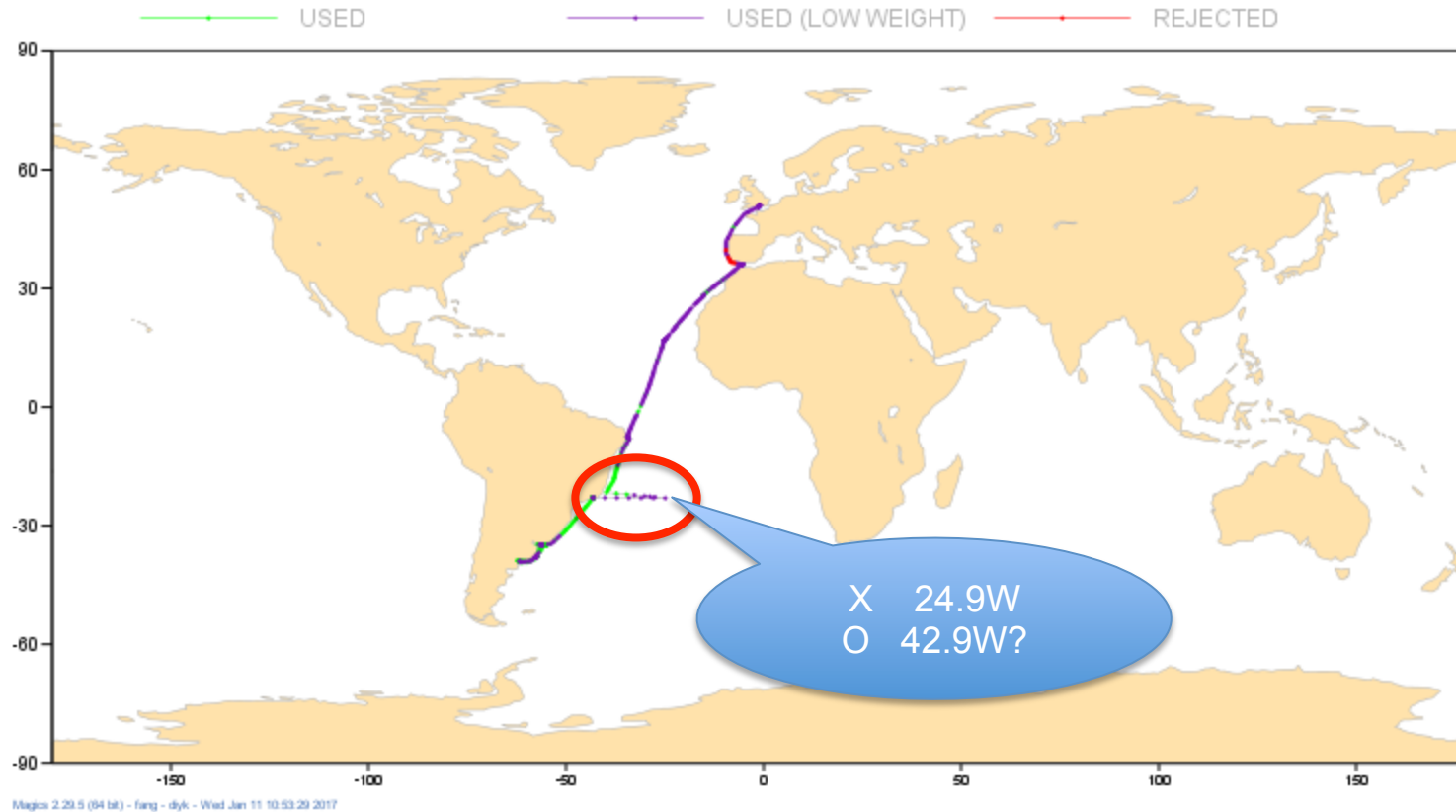
FG DEPARTURE (YEAR: 1914, STATID: 10FAME, ELEM: MSLP)



All observed times are 00UTC because they probably weren't recorded. Only one observation per each time was assimilated, but we can't know whether assimilated data are exactly 00UTC observation or not.

Track check

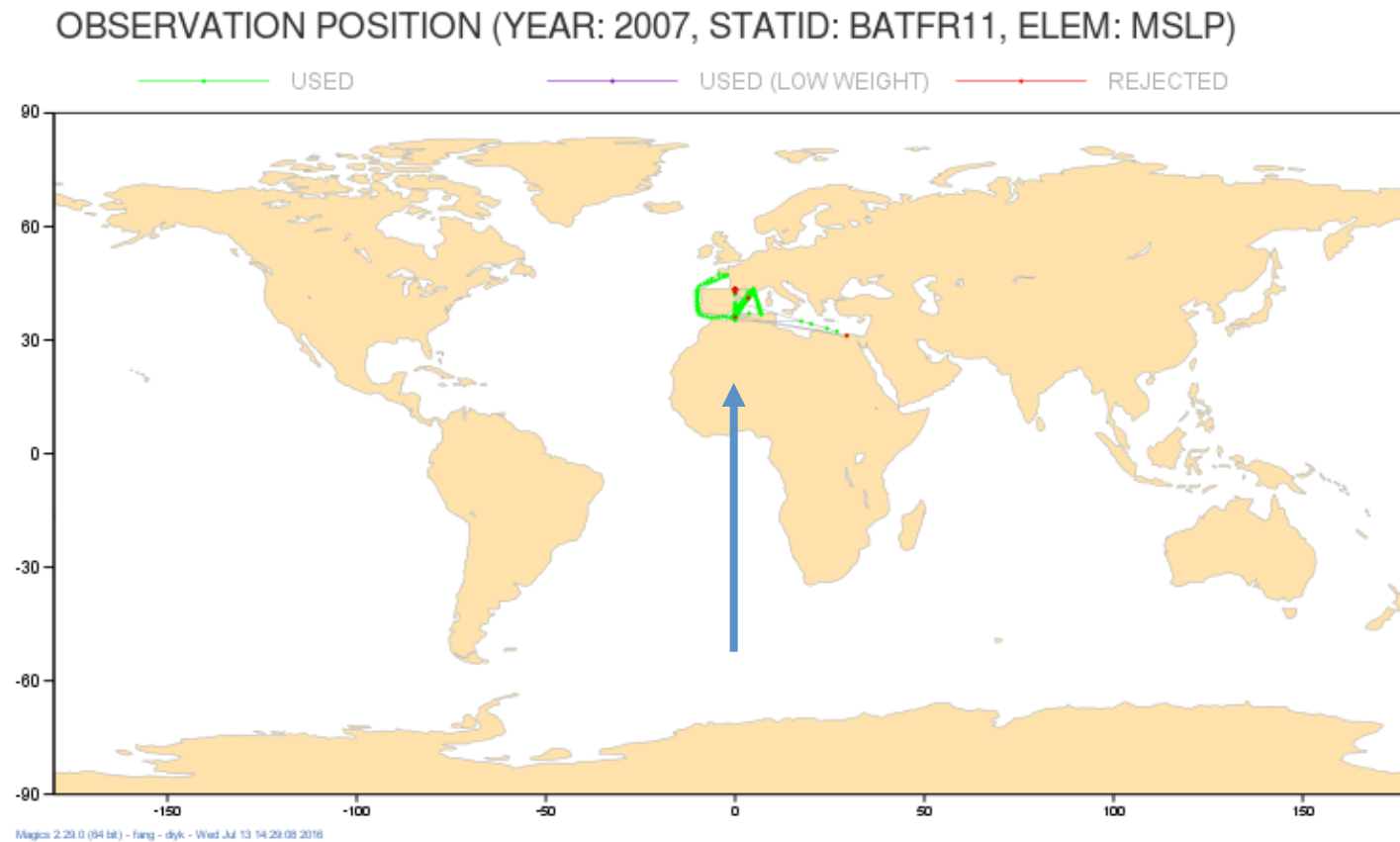
OBSERVATION POSITION (YEAR: 1921, STATID: 10PETERS, ELEM: MSLP)



ISPD3.26

1. One of the reported latitude was wrong.
2. Some of observation positions were calculated by performing interpolation by using this wrong position report.

Landsea check



ISPD3.26
ICOADS25

Value of longitude sometimes becomes 0.

Updating blacklists for future reanalysis

- High percentage of rejection (first guess departure too large)
 - if number of observations in a month ≥ 30 and rejection percentage $\geq 75\%$, all observations of this station in the month are blacklisted
- Ships with erroneous track
 - if speed of ship ≥ 100 km/h, observations from the ship in such period are blacklisted
- Ships over land
 - if the land sea mask value is ≥ 0.96 , observations from the ship are blacklisted