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BOUSSOLE buoy deployment & maintenance log. April 01 2011 - September 16, 2011

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BOUSSOLE project

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Foreword

This report is part of the technical report series that is being established by the BOUSSOLE project.

BOUSSOLE is funded/supported by the following Agencies, Institutions or Programs

European Space Agency

Centre National d'Etudes Spatiales, France

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Centre National de la Recherche Scientifique, France

Institut National des Sciences de l'Univers, France

Université Pierre & Marie Curie, France

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1. SCOPE OF DOCUMENT

The BOUSSOLE buoy deployment and maintenance log is a record of all events that occur from the deployment to the recovery of one of the two upper sections of the buoy.

The aim is to keep track of all maintenance operations, such as instruments cleaning or rotations, instruments malfunctions, incidents with the buoy structure, if any, biofouling development and so on.

This information is crucial to a subsequent correct interpretation of the data.

Keeping track of these events also allows their analysis in view of the permanent improvement of protocols.

The present report concerns “buoy deployment XII”, from April 01 of 2011 to September 16 of 2011.

2. DESCRIPTION OF OPERATIONS

2.1 UPPER SECTION PREPARATION (2011-02)

The buoy System (called system #2) was delivered from Satlantic on February 2nd. Before starting the installation on the structure, a test to compare the radiometers was set-up (see annex at the bottom). The installation operations started 15th February having the deployment scheduled on March. The deployment had place on 01st April 2011.

The Buoy was equipped with sensors used for the deployment of the buoy X recovered on September 2010. The system was prepared in the CCI local in Villefranche-Sur-Mer and since 08th March was ready for deployment. Copper sheets and pieces were again fixed wherever possible to avoid biofouling arising. Some novelties were introduced on the fixation of the MVDS and J/Box that are non more beside solar panels but fixed to the buoy head with delrin plates. New delrin plates were also used for C-Stars, Stor-X, CLC, Strain-100 and HS4 to facilitate mounting/dismounting underwater.

The system was tested for some days running both with solar panel and battery. No anomalies were observed:

Dark IOPs measurements were also made for dark corrections.

An "in air" data collection was also performed to verify the consistency among similar radiometers before deployment (see appendix). The results showed a major problem on the Hyperspectral Es sensor that was sent back for calibration and reinstalled in time for the deployment.

2.2 MOORING DEPLOYMENT

2.2.1 Friday 01th April 2011

The upper structure to be deployed was brought to the Rochambeau field at local 06:15am with the help of 7 people from the LOV. The 4 arms were assembled and connected to the buoy, the helicopter left Carros at about 08:30am. As usual the go/return trip lasted about one hour. At about 13h the ARGOS messages arrived regularly. Divers on site also lowered the buoy of about 1m.








At this date, buoy is equipped with

- **DACNet #002**
- **CLC #004**
- **Junction Box #002**
- **Rads set: OCI #048_Eu4m, #050_Ed4m, #163_Eu9m, #164_Ed9m #030_Es, OCR #036_Lu4m and #037_Lu9m), MVDS #062, OCP#040(4m) and OCP#037(9m)**
- **Hyper spectral units HOCR #276_Lu4m, #277_Lu9m, #327_Es, STOR-X #068 (no bio-shutters).**
- **HS4 #H4080705**
- **Strain-100 #002**
- **Transmissometers C-Star #626-PR (4m) and #847-PR(9m)**
- **ECOFLNTUs #608 (4m) and #609 (9m)**
- **ARGOS beacon #003 (prog id#26021)**
- **CTD #37SI 30260-2404**
- **Strain gauge OML CSSPE00356**
- **PAR #061**

The lower part of the buoy is still equipped with the two emergency ARGOS beacons.

2.2.2 Monday 18th April 2011

This day the private boat Lollipop from Darkpelican company in Villefranche was rent to go to the Boussole site with two divers from Mare Nostrum. Optical sensors were cleaned and black measurements were made. Then the LISST was dismounted and data downloaded before putting it again at sea. A connection with the buoy was obtained through CISCO and data downloaded. A test with the GSM modem was also run (unsuccessfully).

2.2.3 Thursday 28th April 2011

This day is part of the B#110 cruise. When on site, divers went at sea to clean the optical sensors and put black caps on IOPs sensors. Divers noticed micro-bubbles coming out of the ventilation valve (far from what seen on buoy VIII). A verification of the Voltage recorded into data show that in the central part of the day it exceeds the maximal load (13.8 V) of 0.2-0.3 V. A CISCO connection was obtained but not all data were downloaded since the connection was lost. A second attempt was unsuccessful so the third attempt was made on the buoy head, connectors and sensors were also cleaned. A GSM modem test was again made unsuccessfully. But a test with a FreeWave GSM antenna was run successfully. The transmitting omni-directional antenna was on the *Tethys II* and the receiving directional antenna was positioned on the parking of the Fort de la

Revere (730 m a.m.s.l.) at 133.5° from Antoine Poteau. The connection was got easily between the two laptop relied to the antenna through HyperTerminal. Sending data was incomplete and slow with data files larger than 5 kb. From this size under, the transmission was complete and took as far as two seconds.

2.2.4 Sunday 8th May 2011

This day the ARGOS message dispatch stopped.

2.2.5 Thursday 12th May 2011

This day the *Tethys II*, that was in the neighbourhood for geological surveys, went to BOUSSOLE site and verified the presence of the buoy.

2.2.6 Wednesday-Friday 18th-21st May 2011

These days are part of the B#111 cruise. The first cruise day the connectors on the buoy head were cleaned and data downloaded. The ARGOS dispatch restarted. The second day divers went on board and dismounted the LISST from the buoy and brought it on the Zodiac. While LISST data were downloaded divers cleaned the optical sensors and put neoprene caps on the IOPs sensors. Only one (old) file was downloaded from the LISST because of communication problems and the slow download rate. The old file was deleted to leave space enough for one month record before putting again the instrument on the buoy. The third day the buoy ARGOS dispatch stopped again. Cleaning the connector fixed the problem.

2.2.7 Saturday 4th-June 2011

This day the ARGOS message dispatch stopped.

2.2.8 Thursday 16th-June 2011

This day is part of the B#112 cruise. Divers cleaned the optical sensors and performed the dark measurements for the IOPs. They also definitively removed the LISST from the buoy. In the meantime, data were downloaded from the top of the buoy and head sensors and connectors cleaned. The ARGOS dispatch restarted regularly. Divers also removed one of the lower buoy structure anodes as sample. The 4 anodes at the same level were much consumed and need to be replaced.

2.2.9 Wednesday 29th-June 2011

This day the private boat Lollipop from Darkpelican company in Villefranche was rent to go to the Boussole site with three divers from LOV. Optical heads were cleaned and dark measurements on IOPs were done. 1 anode on the lower part of the buoy was replaced. Sensors and connectors on the buoy head were also cleaned and data downloaded through a direct connection. The day after the ARGOS dispatch stopped.

2.2.10 Monday 11th-July 2011

These days are part of the B#113 cruise. The first day divers went at sea to clean the buoy instruments. They also put neoprene caps on the HS4 and on the transmissometers for acquiring dark measurements.

In parallel to diving operations, solar panels, sensors and ARGOS and CISCO connectors on the top of the buoy were cleaned and a direct connection with the buoy was established for data retrieval.
During the night, the ARGOS beacon on the head of the buoy seemed to stop transmitting data so when on site, the ARGOS connector was cleaned in despite of the sea state.

2.2.11 Wednesday 27th–July 2011

This day the private boat Kinka II from Darkpelican company in Villefranche was rent to go to the Boussole site with three divers from LOV. Optical instruments and emergency ARGOS beacons were cleaned and dark IOPs measurements performed. Sensors and connectors on the buoy head were also cleaned and data downloaded (some "bird traces" were present on the MVD-Es on two channels).

2.2.12 Wednesday 15th–17th August 2011

These days are part of the B#114 cruise. The first day a CISCO connection was attempted unsuccessfully. The second day divers went at sea to clean buoy instruments. A fishing line was illegally knotted on the buoy (depth ~6m). The divers cut the line before cleaning the instruments and putting neoprene caps on the HS4 and on the transmissometers for acquiring dark measurements. In parallel to diving operations, solar panels, sensors and ARGOS and CISCO connectors on the top of the buoy were cleaned and another fish hook was found around the ARGOS beacon. A direct connection with the buoy was established for data retrieval. The last day a CISCO connection with the buoy was established for data retrieval but the communication was lost before finishing the download.

2.2.13 Sunday 04th September 2011

This day divers from private company MARE NOSTRUM went to the BOUSSOLE site for cleaning the instruments and performing dark measurements.

2.2.14 Tuesday-Wednesday 13-14th September 2011

These days are part of the B#115 cruise. The first day a CISCO connection with the buoy was established for data retrieval.
The second day divers went at sea to clean the buoy instruments. The emergency ARGOS beacons were brought at surface for maintenance and tests and were re-installed after verification of messages arrival. Divers also put neoprene caps on the HS4 and on the transmissometers for acquiring dark measurements. In parallel to diving operations, solar panels, sensors and ARGOS and CISCO connectors on the top of the buoy were cleaned.

2.2.15 Friday 16th September 2011

This day the buoy upper structure was dismounted for the rotation with the system #1. The helicopter delivered the buoy at about

09h45. The structure was in good conditions but with much biofouling. The buoy was cleaned with the Karcher before being transported into the CCI local where it was dismounted in the following days. Data into the DACNET were recovered with an Ethernet (AM) connection, two days of dark measurements were also acquired. Instruments were shipped for calibration on September 23th, whereas the aluminium structure was sent to the CNB on October 6th.

3. QUANTITATIVE SUMMARY

The deployment lasted 169 days without interruption in data acquisition.

4. INSTRUMENT SCHEDULE

1 minute acquisition every 15 minutes.

5. ANY PROBLEMS ENCOUNTERED ?

1- In late summer a lot of biofouling developed though regular cleaning of sensors.

6. LESSONS LEARNED

1- An inter-comparison among radiometers is mandatory before deployment.

2- The slight overload in battery charge has been chosen from Satlantic to assure power with Hyperspectral instruments on during low sun periods.

7. ACKNOWLEDGEMENTS

The BOUSSOLE project has been set up thanks to the work of numerous people, and thanks to the support and funding of several Agencies and Institutions. The latter are listed in the foreword of this report. Specifically, the following contracts are acknowledged : the French Space Agency CNES provided funds through the TAOB and TOSCA scientific committees, ESA through ESTEC contract N°14393/00/NL/DC, including CCNs #1, #2 and #3, ESRIN through contract N° 17286/03/I-OL, and NASA through a “Letter of Agreement”. Funding has been also obtained from the French CSOA committee and the “Observatoire Océanologique de Villefranche”.

The crews and Captains of the following ships are also warmly thanked for their help at sea: the Castor-02 vessel from the Fosevel Marine company (buoy/mooring operations), the INSU R/V Téthys-II and Georges Petit (regular monthly cruises), the GG-IX from the Samar company and the Nika-III (on-demand short operations on site). Pilots and crew members of the Valair and Commerçair helicopter companies are also thanked for their willingness in accomplishing for us unusual survey missions above the BOUSSOLE site. Emmanuel Bosc, Maria Vlachou, Guillaume Lecomte, who have occasionally provided some help in collecting data, are also thanked for their help.

The French institute IFREMER and the Norvegian Marintek company are also thanked for their help and fairness in the engineering studies that were ordered to them after the major failure of the buoy in spring of 2002.

The data that are collected for several years near the BOUSSOLE site by the French weather forecast Agency, “Meteo France”, and which are provided in real time on the internet, have been of great help in the day-to-day management of the monthly cruises.

Two companies have largely contributed to the BOUSSOLE project, namely the ACRI-in/Genimar company, Sophia Antipolis, France (buoy conception) and Satlantic Inc., Halifax, NS Canada (buoy centralized acquisition system and radiometers); their help is specifically acknowledged here.

8. APPENDIX

The following page contains the schema of the buoy, the list of the calibration files and a summary of the test made with the radiometers before the deployment.

Radiometer Test

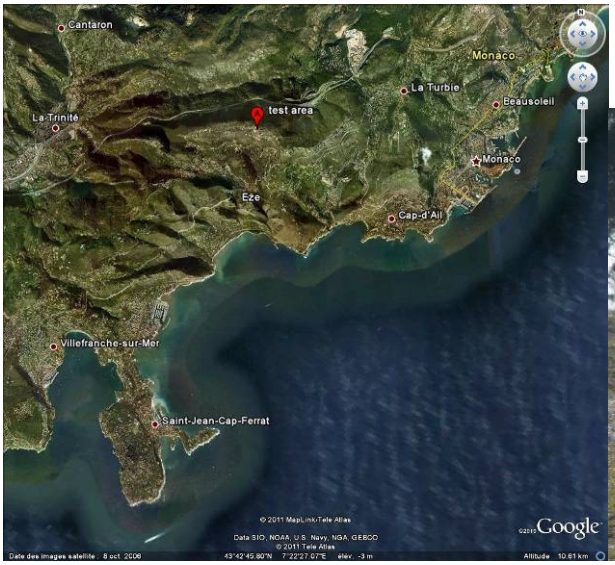
On February 10th 2011 a filed campaign to test the buoy radiometers relative performances was organized at the Fort de la Revere. The fort is located at north of the Eze village at about 700m on the sea level (see images below), and near the fort there’s a plane field free of obstacles that could cause shadow or glint above radiometers.

All the radiometers used for the buoy were fixed upon a table facing the zenith. The Lu and Eu sensors were covered with respectively one and two neutral filters to minimize saturation.

The instruments were all connected as for the buoy deployment (OCPs, DACNet, cables etc.) and powered with a battery. The schedule was modified to acquire data every 10 minutes instead of 15.

Data were acquired for about 6 hours.

Sky conditions were extremely variable so the choice was to compare single data by using the TIMETAG variable recorded in data files instead of making averages or medians over the 1 minute acquisition.



Results are displayed in the images below and here summarized:

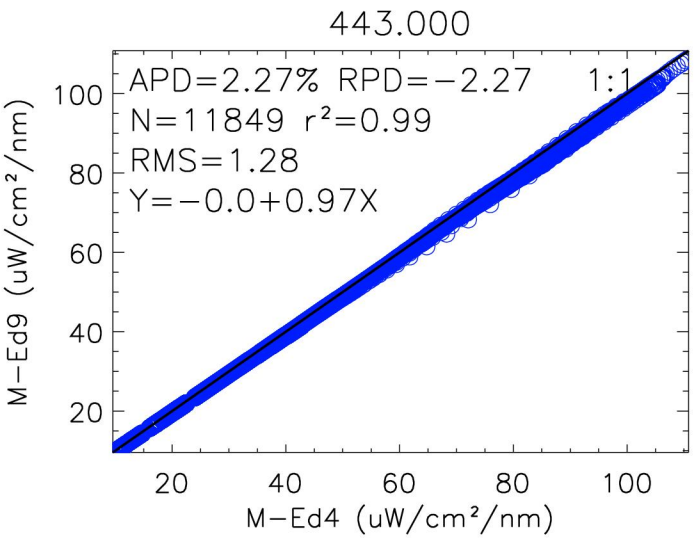
Comparison between OCR-I/200's

Only the two Ed sensors (the ones normally installed at 4 and 9m) compare well for all bands (within 2-3%). The two Lu are acceptable except at 510 (11%) and 560 (9%).

The Ed-4m versus Es, and Ed-9m versus Es are biased by up to 14% (Es lower than Ed's).
The two Eu are consistent only at 412 and 443 nm; other bands are off by as much as 35% (665nm)

Comparison between the two HyperOCR
The two HyperLU's compare "reasonably well" (3% to 10%...), although this is not within spec for state-of-the-art calibration.

Comparison between OCR-I/200 and HyperOCR-I
4m instruments (H-Lu4 vs M-Lu4): we are very rarely below 5%, and often above 10%. Scatter is large.
9m instruments (H-Lu9 vs M-Lu4) better, except at 665nm. Large scatter also.
H-Es vs M-Es: overall bias of about 10%.
H-PAR (is the PAR computed from integration of the H-Es measurements from 400 to 700nm, and PAR is the PAR measured by the PAR sensor. This comparison tends to confirm that the H-Es data are too low by ~10% (consistent with the H-Es versus M-Es comparison).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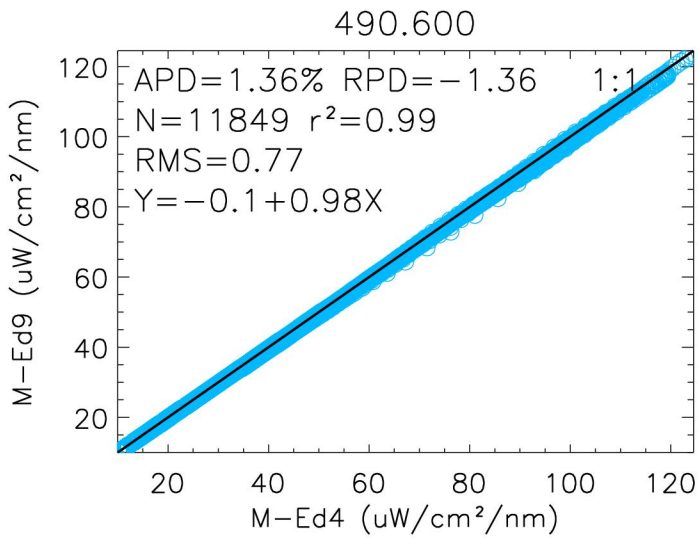
Y=−0.0+0.97X
M−Ed9 (uW/cm²/nm)
M−Ed4 (uW/cm²/nm)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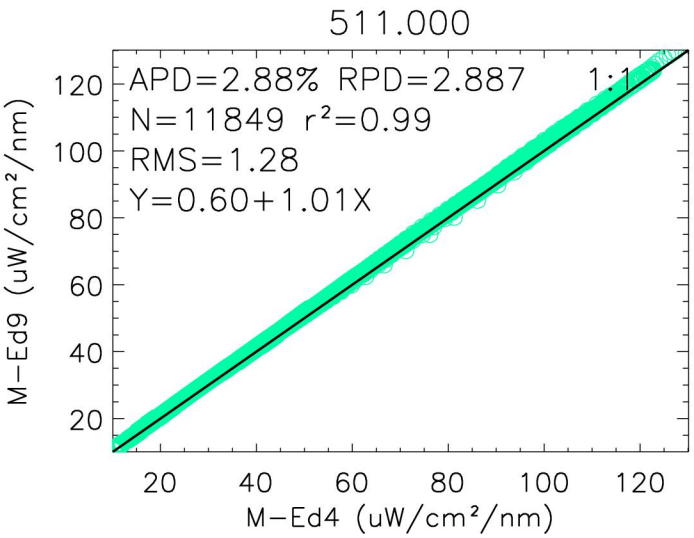
M−Ed9 (uW/cm²/nm)
M−Ed4 (uW/cm²/nm)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RMS=1.28
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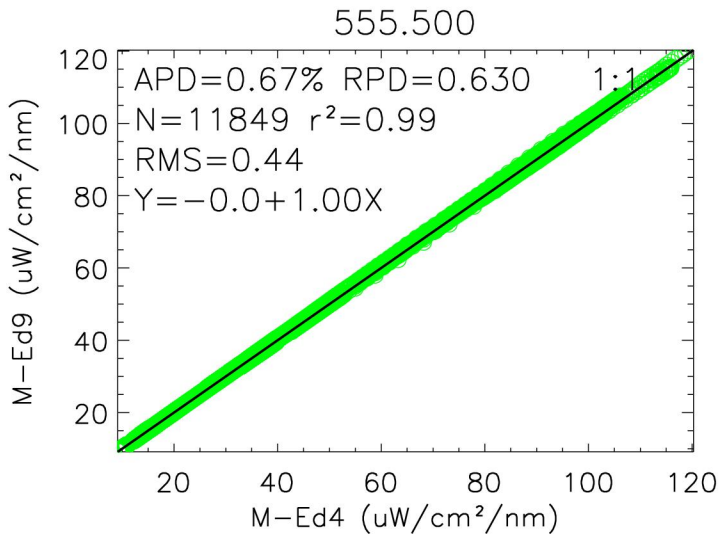
M−Ed4 (uW/cm²/nm)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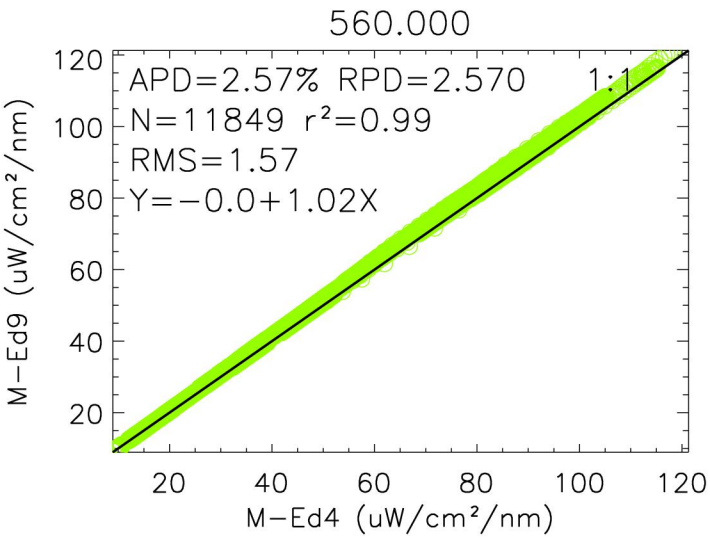
M−Ed4 (uW/cm²/nm)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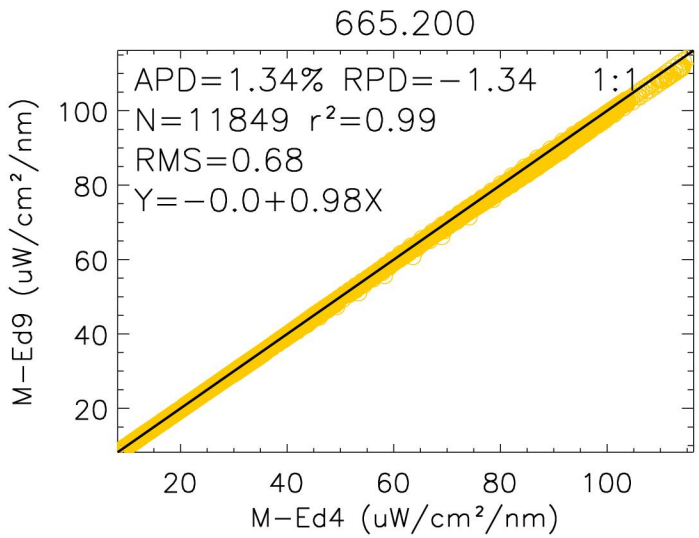
M−Ed4 (uW/cm²/nm)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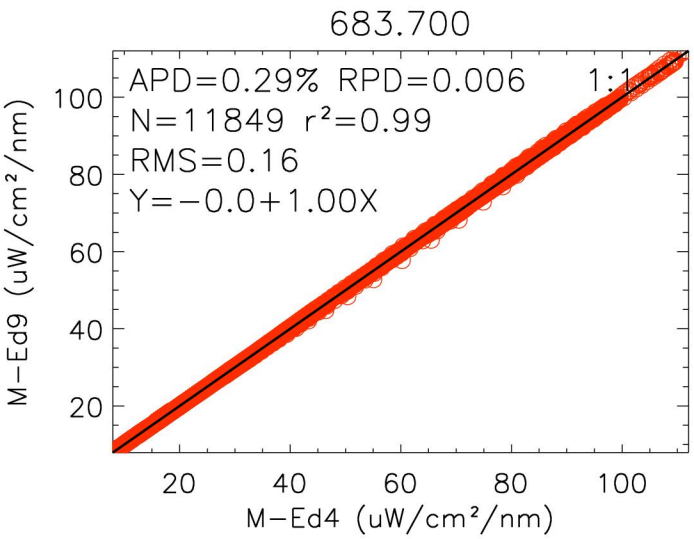
M−Ed4 (uW/cm²/nm)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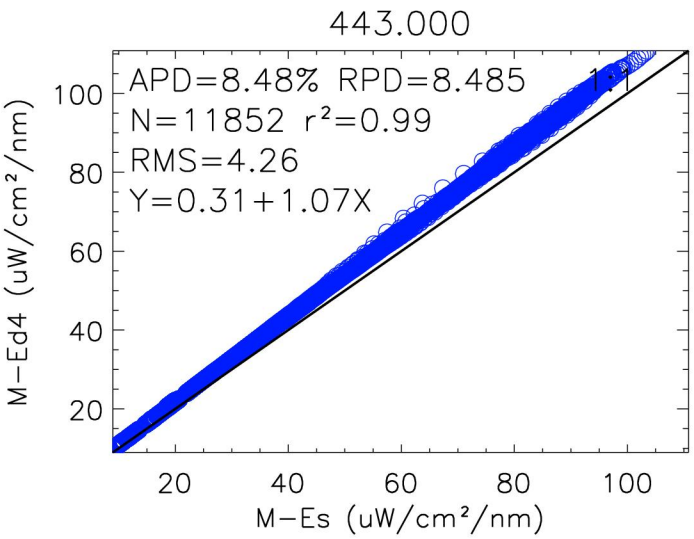
M−Ed4 (uW/cm²/nm)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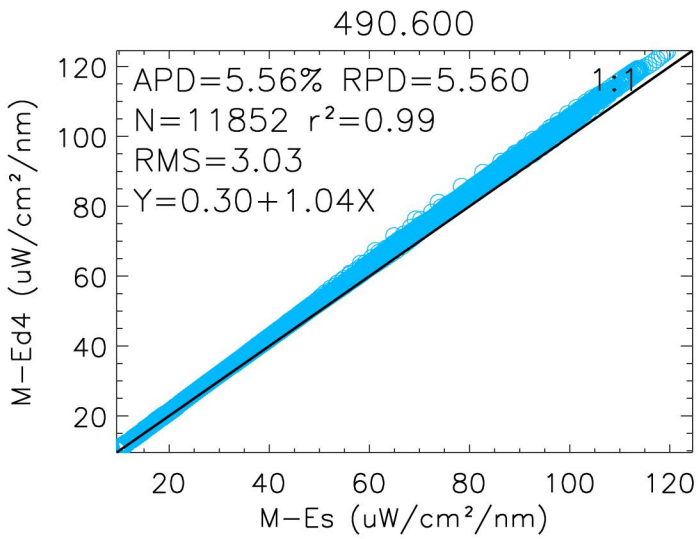
M−Es (uW/cm²/nm)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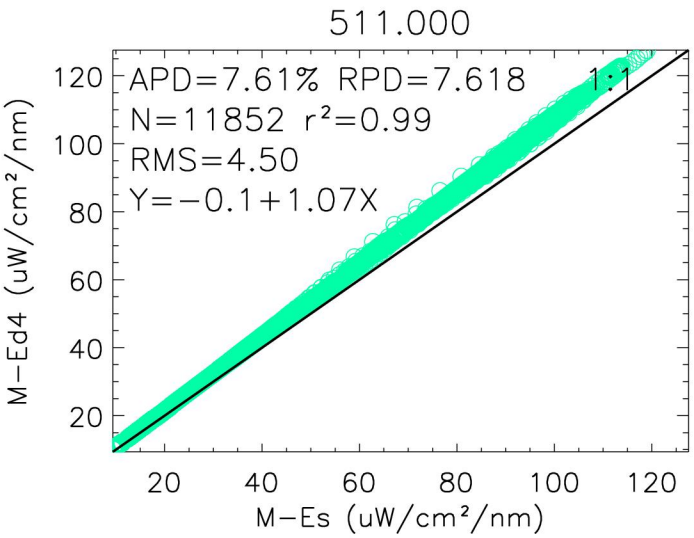
M−Es (uW/cm²/nm)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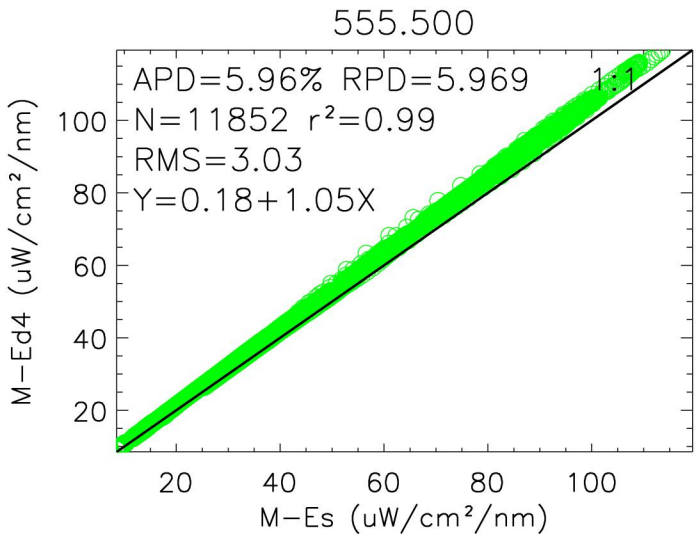
M−Es (uW/cm²/nm)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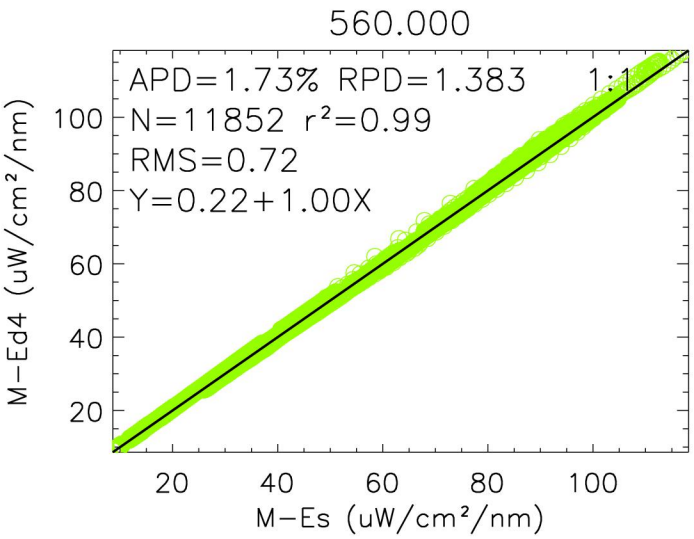
M−Es (uW/cm²/nm)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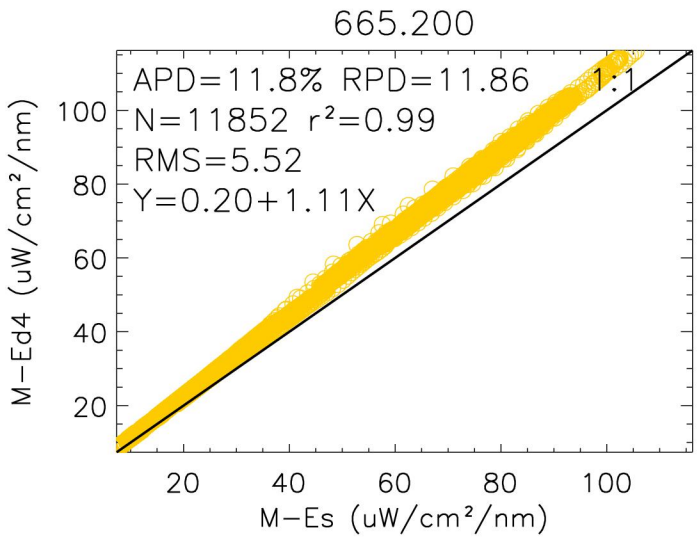
M−Es (uW/cm²/nm)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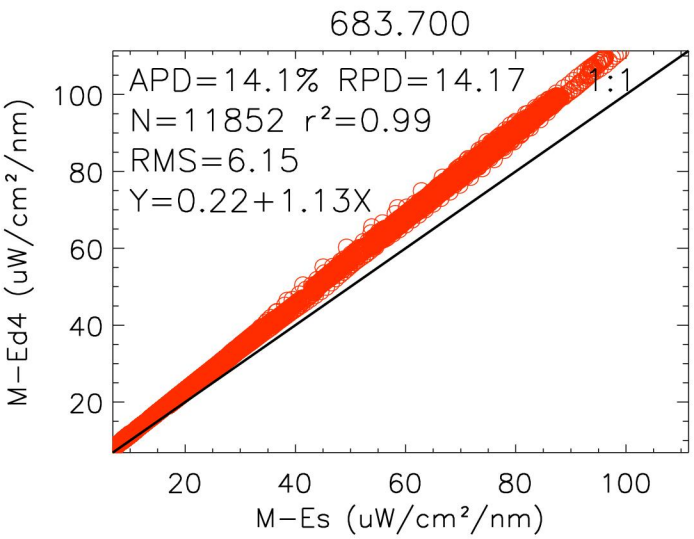
M−Es (uW/cm²/nm)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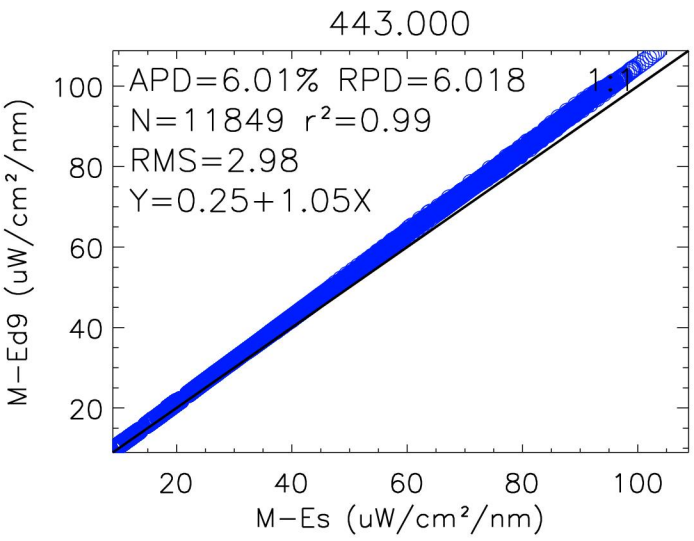
M−Es (uW/cm²/nm)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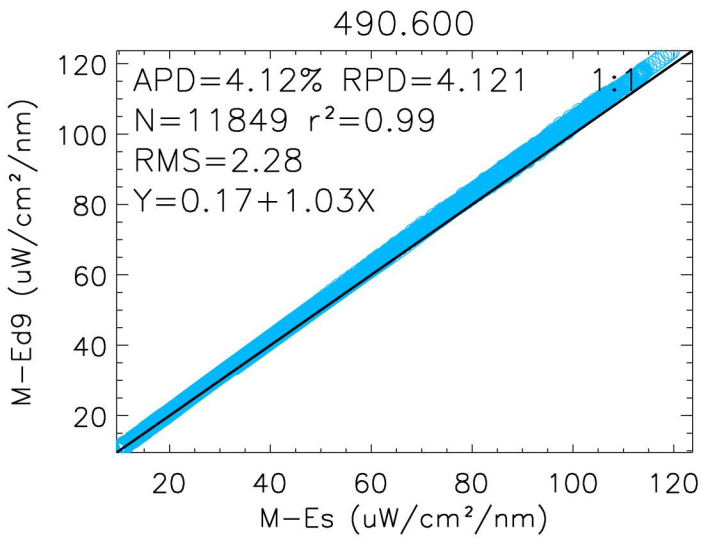
M-Es (uW/cm²/nm)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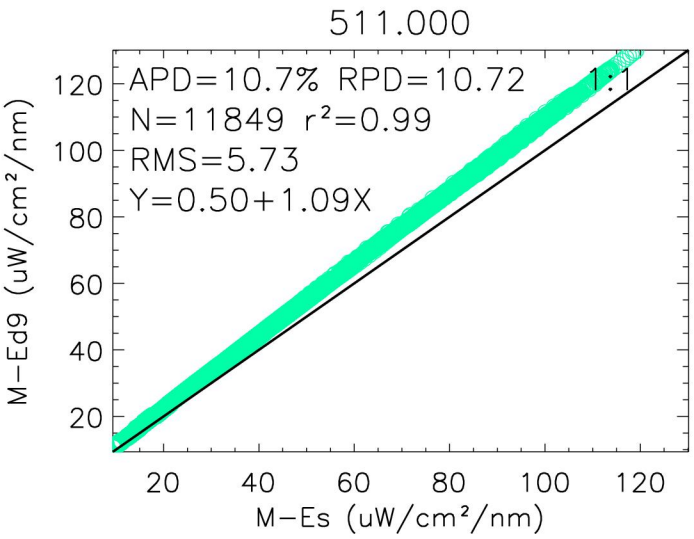
M-Es (uW/cm²/nm)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N=11849 r²=0.99
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Y=0.50+1.09X
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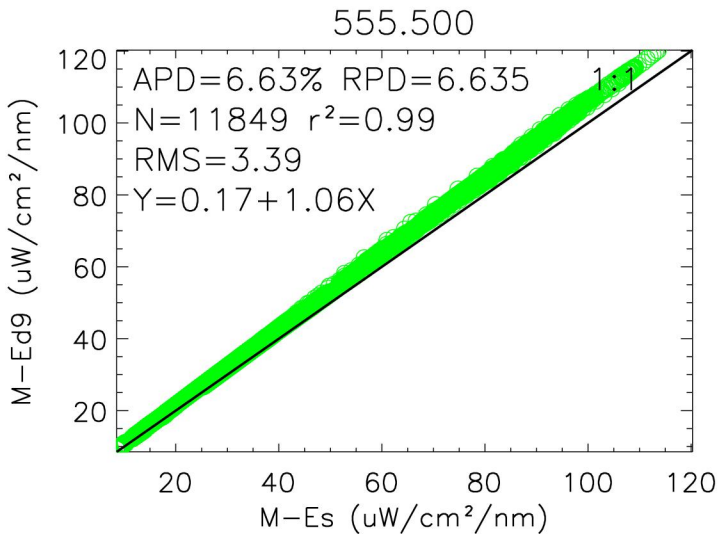
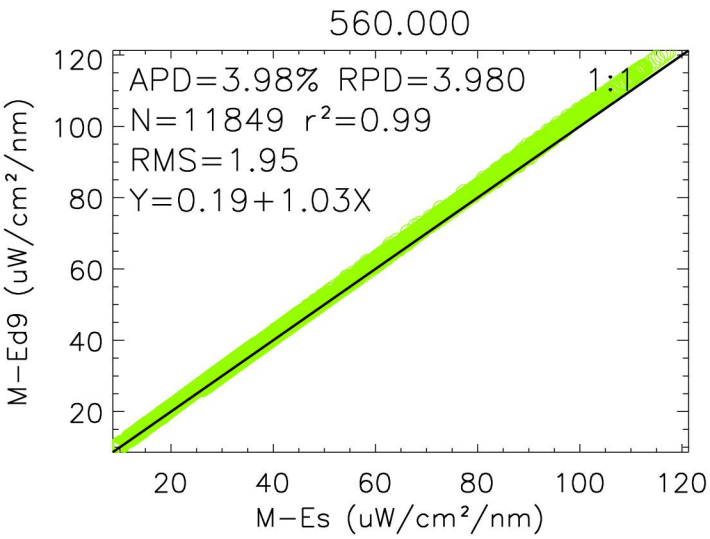
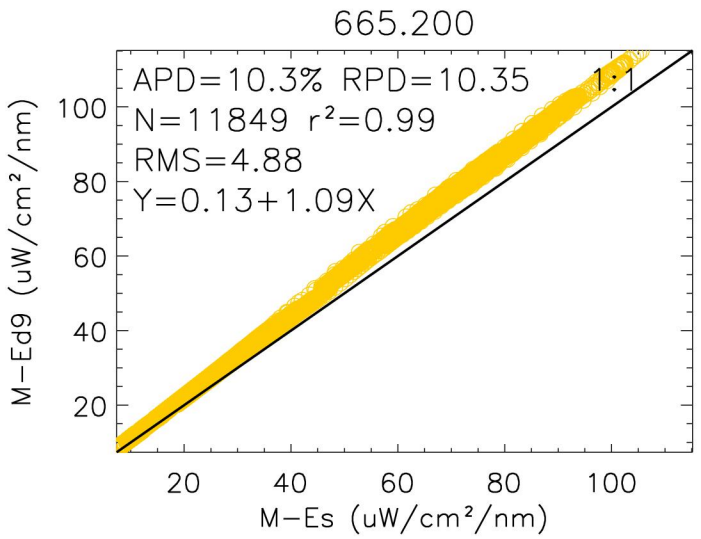
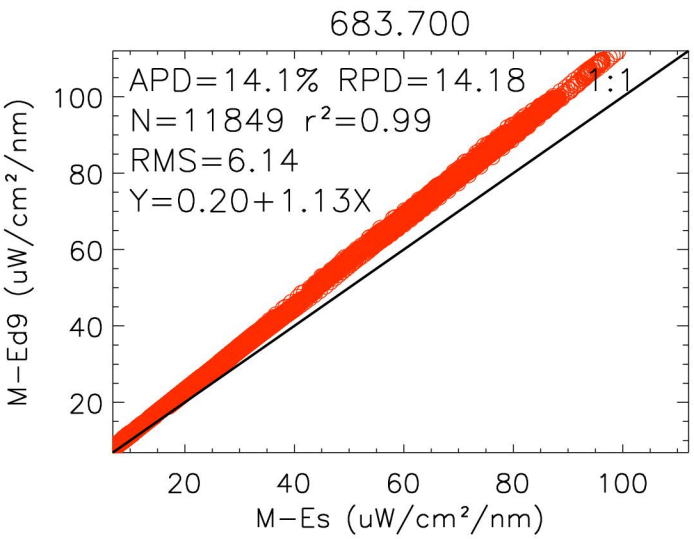
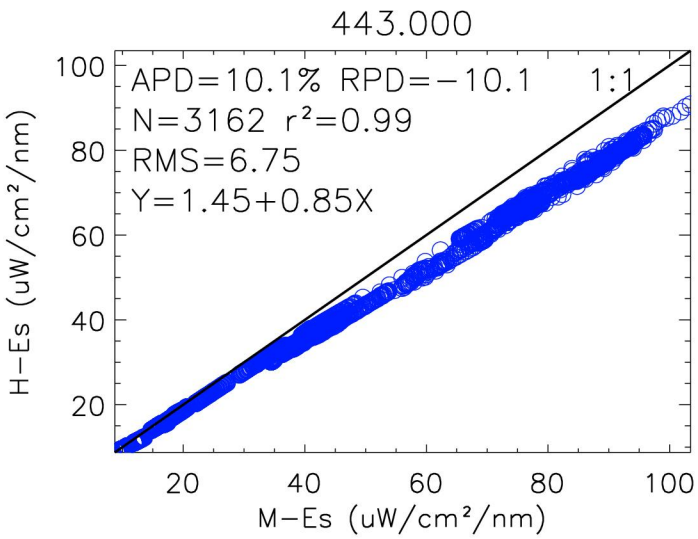
M-Ed9 (uW/cm²/nm)
M-Es (uW/cm²/nm)

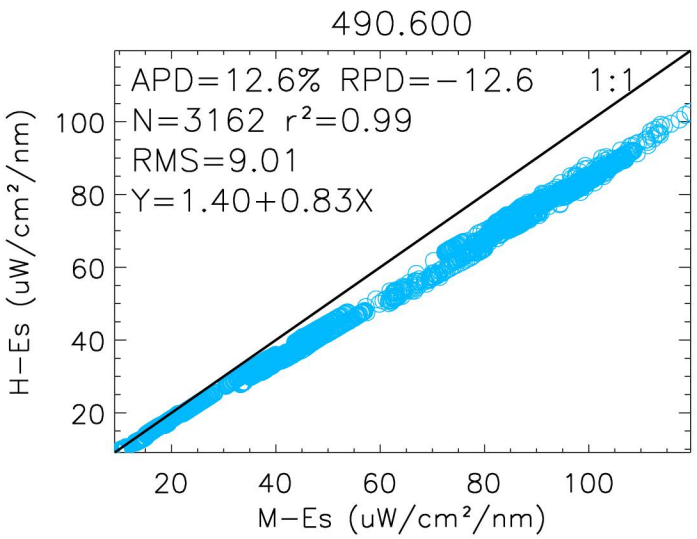

555.500
APD=6.63% RPD=6.635
N=11849 r²=0.99
RMS=3.39
Y=0.17+1.06X
1:1
M-Ed9 (uW/cm²/nm)
M-Es (uW/cm²/nm)

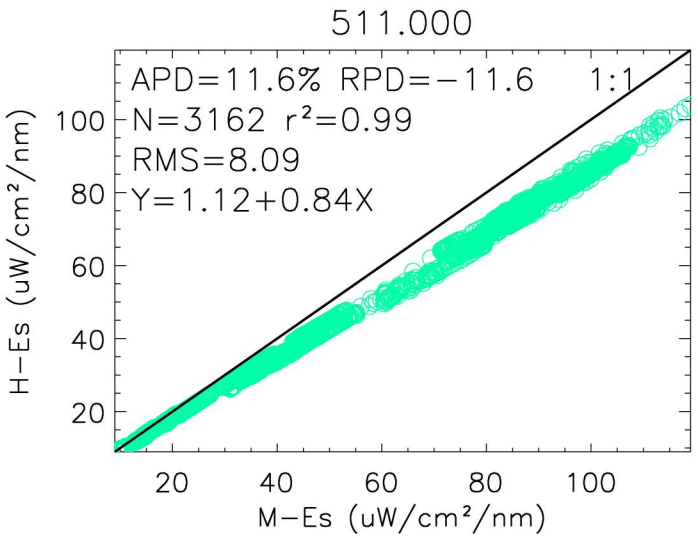

560.000
APD=3.98% RPD=3.980
N=11849 r²=0.99
RMS=1.95
Y=0.19+1.03X
1:1
M-Ed9 (uW/cm²/nm)
M-Es (uW/cm²/nm)

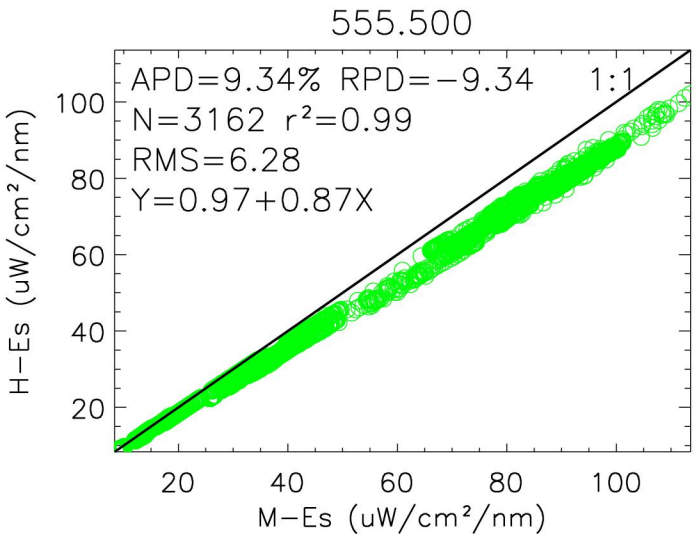

665.200
APD=10.3% RPD=10.35
N=11849 r²=0.99
RMS=4.88
Y=0.13+1.09X
1:1
M-Ed9 (uW/cm²/nm)
M-Es (uW/cm²/nm)

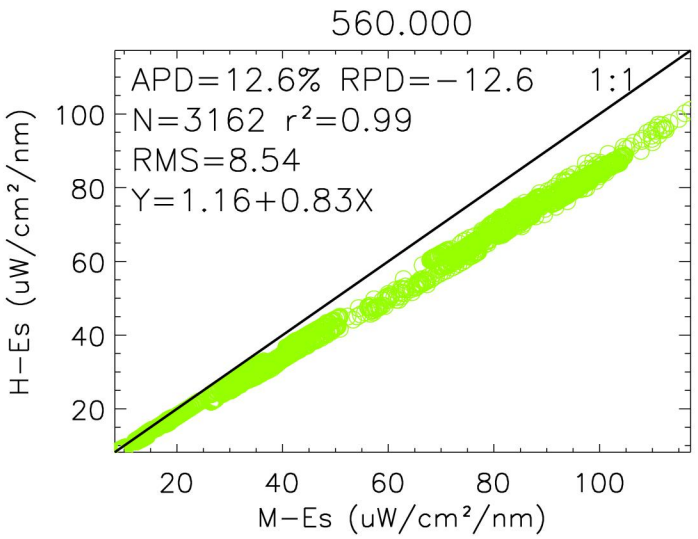

683.700
APD=14.1% RPD=14.18
N=11849 r²=0.99
RMS=6.14
Y=0.20+1.13X
1:1
M-Ed9 (uW/cm²/nm)
M-Es (uW/cm²/nm)

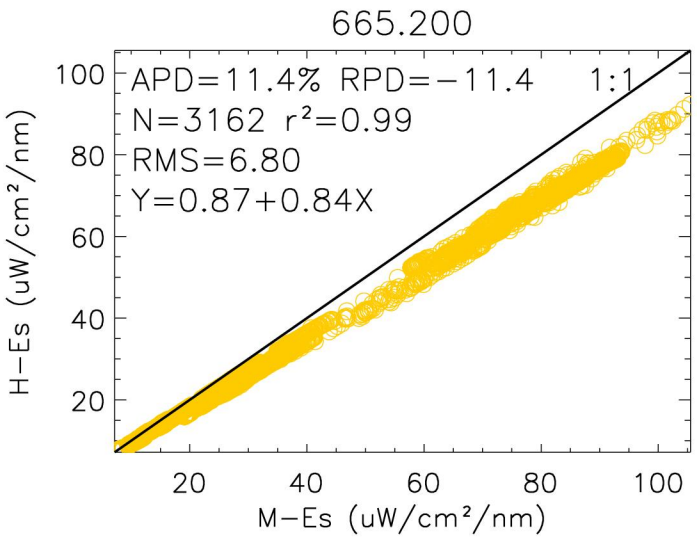

443.000
APD=10.1% RPD=−10.1 1:1
N=3162 r²=0.99
RMS=6.75
Y=1.45+0.85X
H−Es (uW/cm²/nm)
M−Es (uW/cm²/nm)

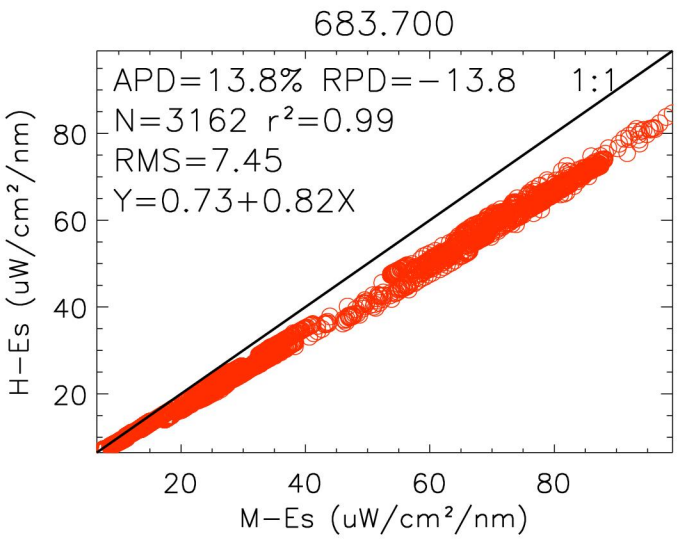

490.600
APD=12.6% RPD=−12.6 1:1
N=3162 r²=0.99
RMS=9.01
Y=1.40+0.83X
H−Es (uW/cm²/nm)
M−Es (uW/cm²/nm)

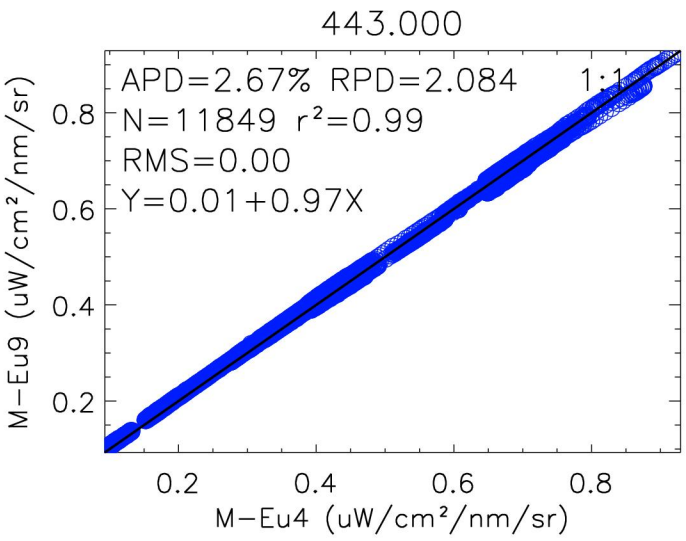

511.000
APD=11.6% RPD=−11.6 1:1
N=3162 r²=0.99
RMS=8.09
Y=1.12+0.84X
H−Es (uW/cm²/nm)
M−Es (uW/cm²/nm)

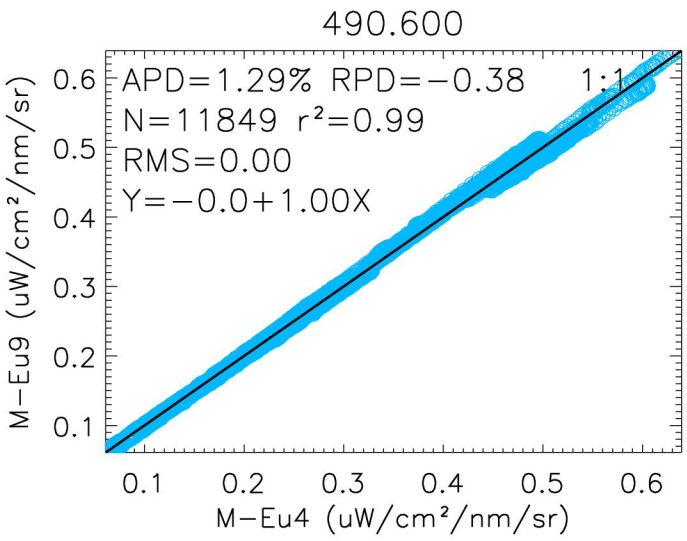

555.500
APD=9.34% RPD=−9.34 1:1
N=3162 r²=0.99
RMS=6.28
Y=0.97+0.87X
H−Es (uW/cm²/nm)
M−Es (uW/cm²/nm)

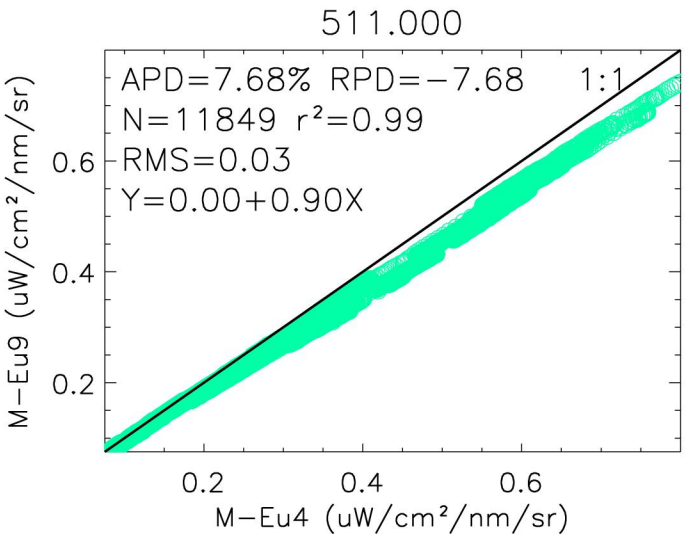

560.000
APD=12.6% RPD=−12.6 1:1
N=3162 r²=0.99
RMS=8.54
Y=1.16+0.83X
H−Es (uW/cm²/nm)
M−Es (uW/cm²/nm)

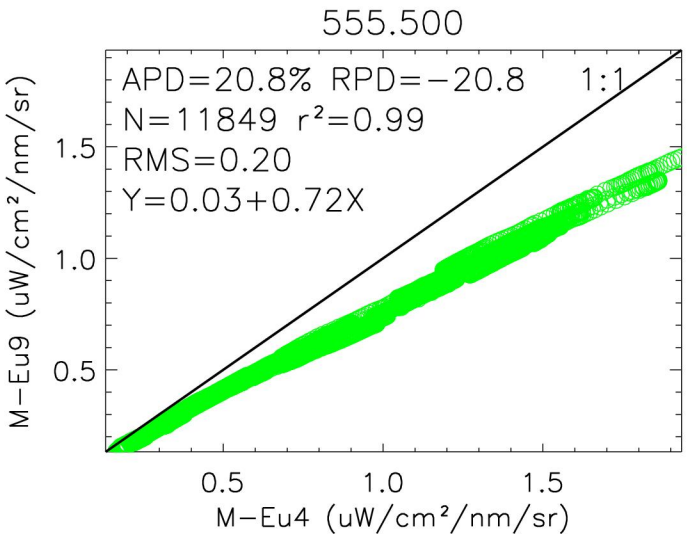

665.200
APD=11.4% RPD=−11.4 1:1
N=3162 r²=0.99
RMS=6.80
Y=0.87+0.84X
H−Es (uW/cm²/nm)
M−Es (uW/cm²/nm)

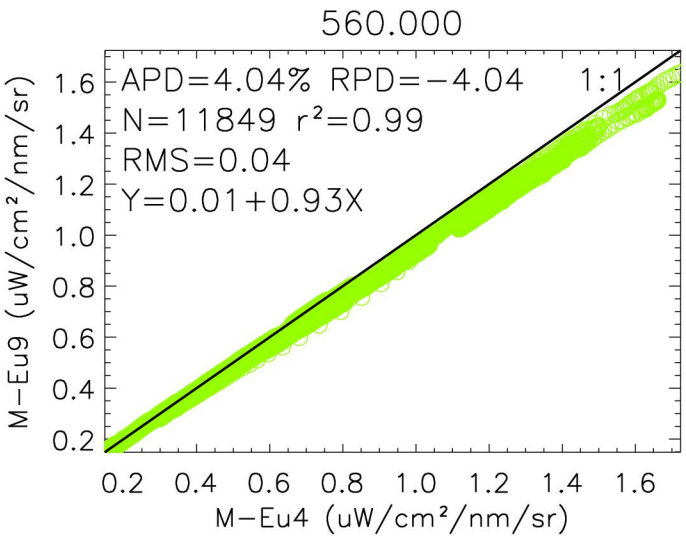

683.700
APD=13.8% RPD=−13.8 1:1
N=3162 r²=0.99
RMS=7.45
Y=0.73+0.82X
H−Es (uW/cm²/nm)
M−Es (uW/cm²/nm)

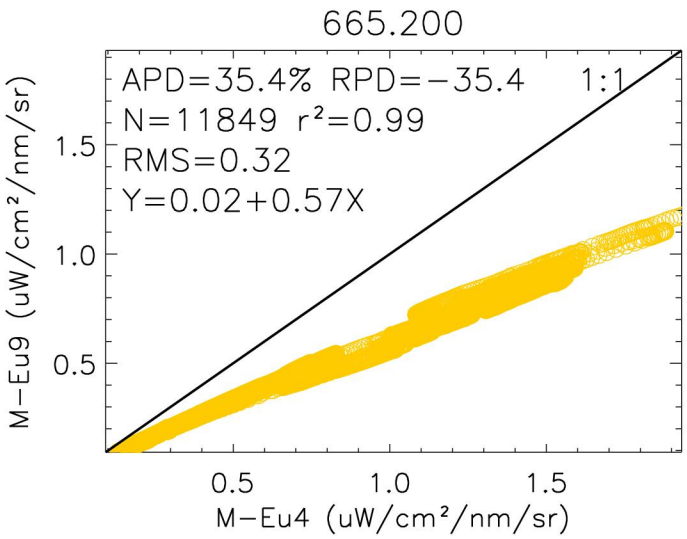

443.000
APD=2.67% RPD=2.084 1:1
N=11849 r²=0.99
RMS=0.00
Y=0.01+0.97X
M−Eu9 (uW/cm²/nm/sr)
M−Eu4 (uW/cm²/nm/sr)

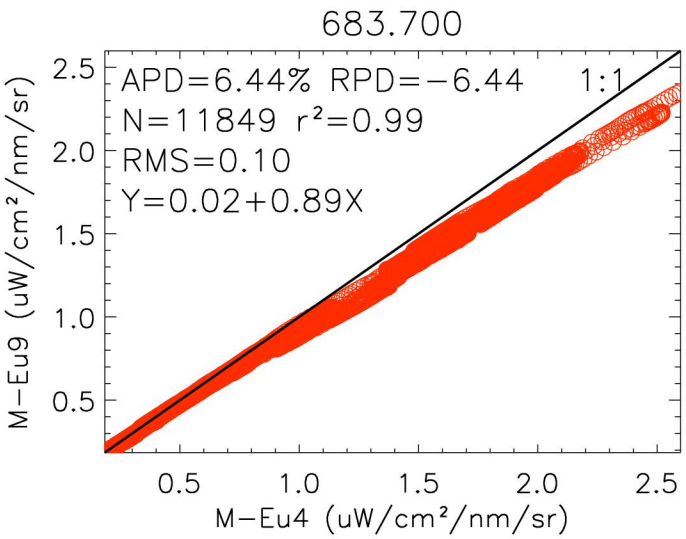

490.600
APD=1.29% RPD=−0.38 1:1
N=11849 r²=0.99
RMS=0.00
Y=−0.0+1.00X
M−Eu9 (uW/cm²/nm/sr)
M−Eu4 (uW/cm²/nm/sr)

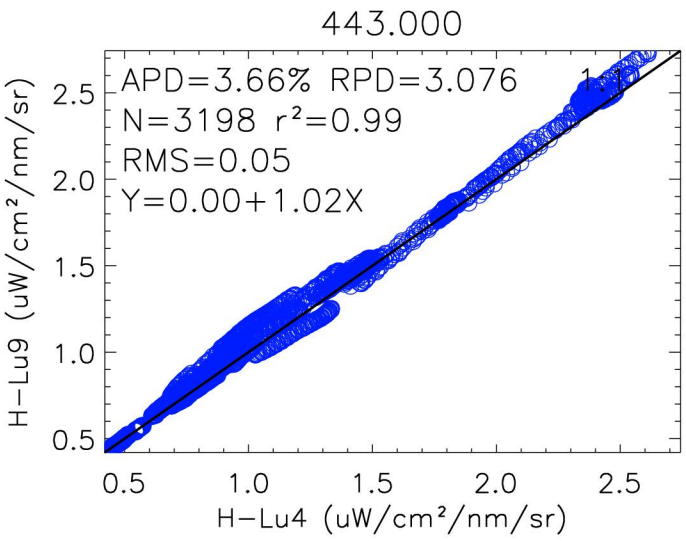

511.000
APD=7.68% RPD=−7.68 1:1
N=11849 r²=0.99
RMS=0.03
Y=0.00+0.90X
M−Eu9 (uW/cm²/nm/sr)
M−Eu4 (uW/cm²/nm/sr)

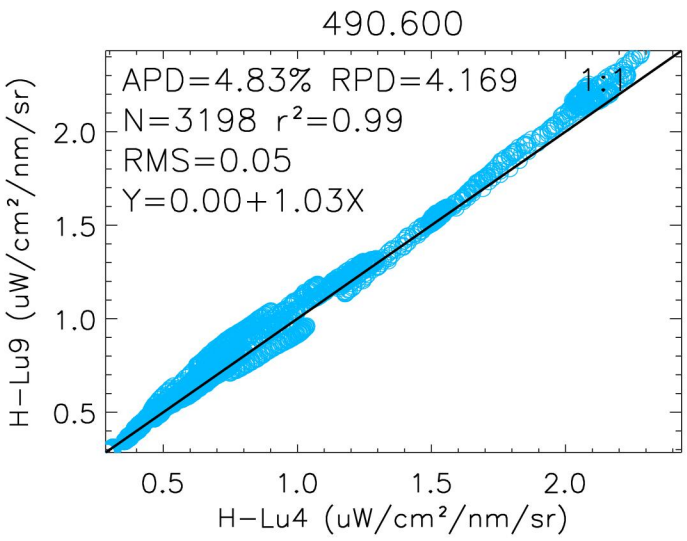

555.500
APD=20.8% RPD=−20.8 1:1
N=11849 r²=0.99
RMS=0.20
Y=0.03+0.72X
M−Eu9 (uW/cm²/nm/sr)
M−Eu4 (uW/cm²/nm/sr)

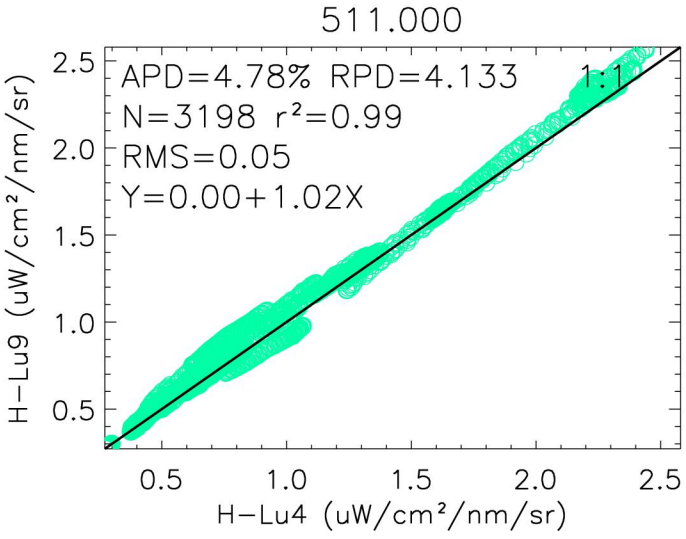

560.000
APD=4.04% RPD=−4.04 1:1
N=11849 r²=0.99
RMS=0.04
Y=0.01+0.93X
M−Eu9 (uW/cm²/nm/sr)
M−Eu4 (uW/cm²/nm/sr)

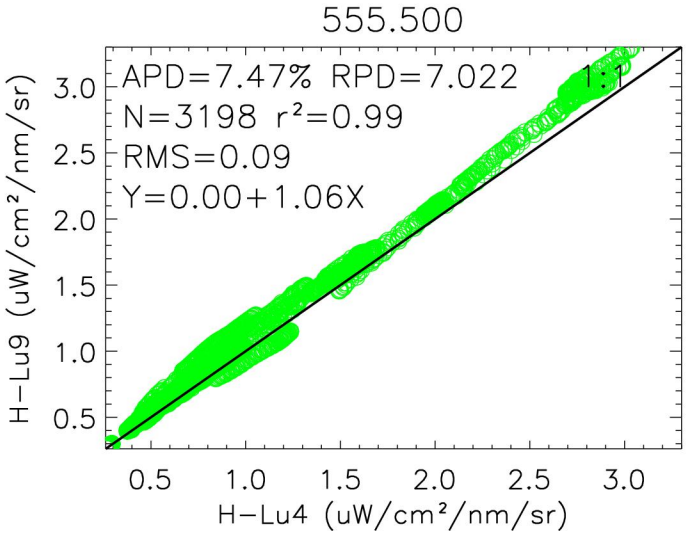

665.200
APD=35.4% RPD=−35.4 1:1
N=11849 r²=0.99
RMS=0.32
Y=0.02+0.57X
M−Eu9 (uW/cm²/nm/sr)
M−Eu4 (uW/cm²/nm/sr)

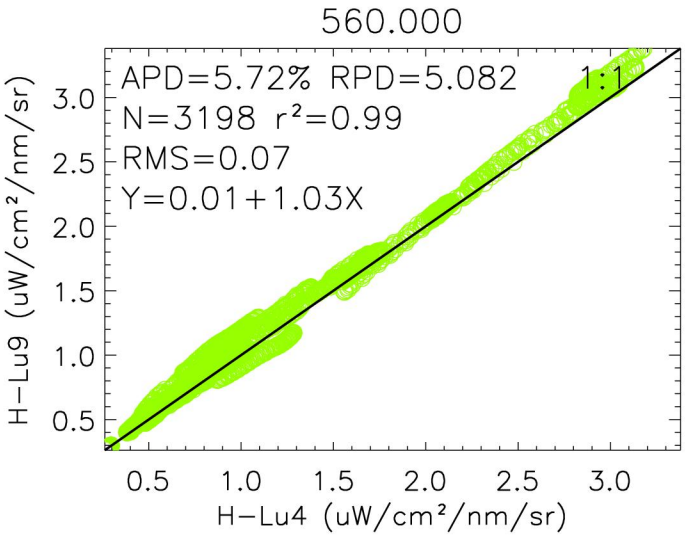

683.700
APD=6.44% RPD=−6.44 1:1
N=11849 r²=0.99
RMS=0.10
Y=0.02+0.89X
M−Eu9 (uW/cm²/nm/sr)
M−Eu4 (uW/cm²/nm/sr)

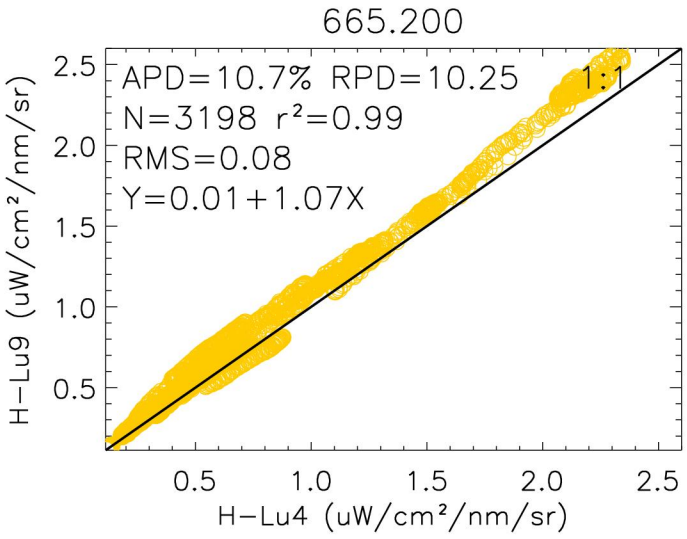

443.000
APD=3.66% RPD=3.076
N=3198 r²=0.99
RMS=0.05
Y=0.00+1.02X
1:1
H-Lu9 (uW/cm²/nm/sr)
H-Lu4 (uW/cm²/nm/sr)

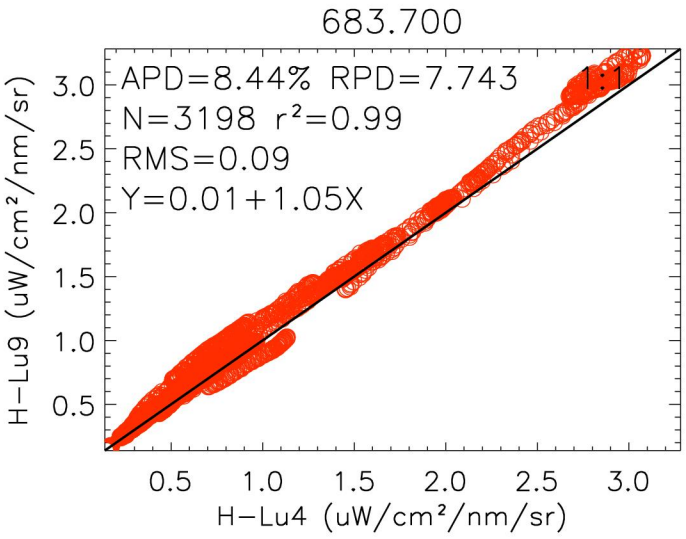

490.600
APD=4.83% RPD=4.169
N=3198 r²=0.99
RMS=0.05
Y=0.00+1.03X
1:1
H-Lu9 (uW/cm²/nm/sr)
H-Lu4 (uW/cm²/nm/sr)

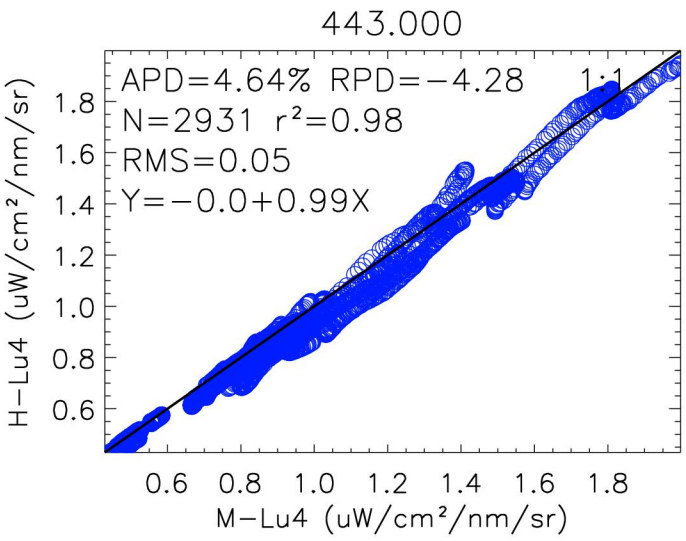

511.000
APD=4.78% RPD=4.133
N=3198 r²=0.99
RMS=0.05
Y=0.00+1.02X
1:1
H-Lu9 (uW/cm²/nm/sr)
H-Lu4 (uW/cm²/nm/sr)

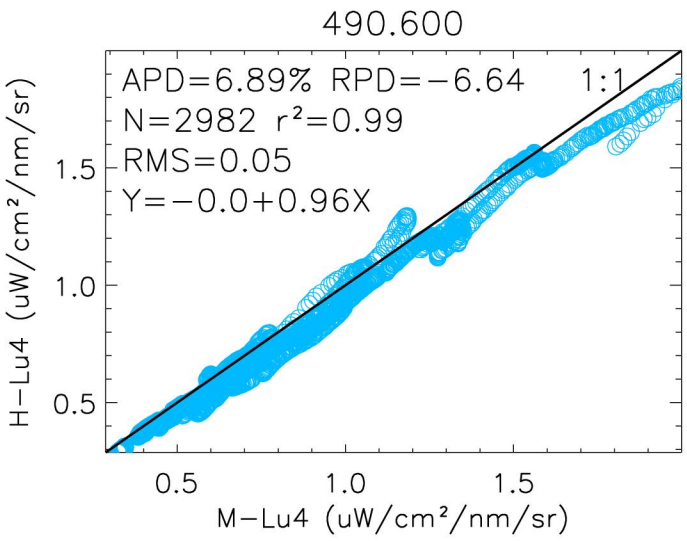

555.500
APD=7.47% RPD=7.022
N=3198 r²=0.99
RMS=0.09
Y=0.00+1.06X
1:1
H-Lu9 (uW/cm²/nm/sr)
H-Lu4 (uW/cm²/nm/sr)

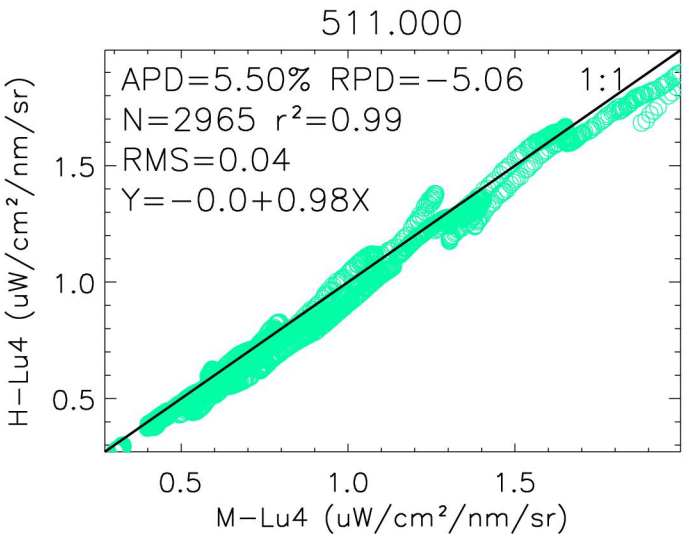

560.000
APD=5.72% RPD=5.082
N=3198 r²=0.99
RMS=0.07
Y=0.01+1.03X
1:1
H-Lu9 (uW/cm²/nm/sr)
H-Lu4 (uW/cm²/nm/sr)

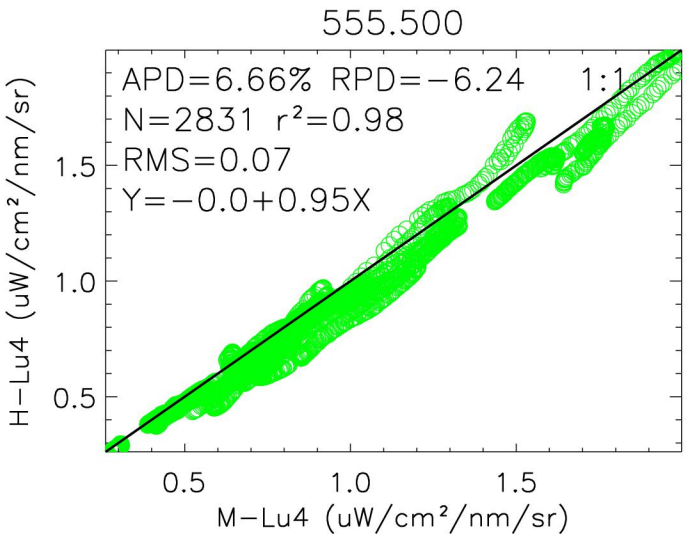

665.200
APD=10.7% RPD=10.25
N=3198 r²=0.99
RMS=0.08
Y=0.01+1.07X
1:1
H-Lu9 (uW/cm²/nm/sr)
H-Lu4 (uW/cm²/nm/sr)

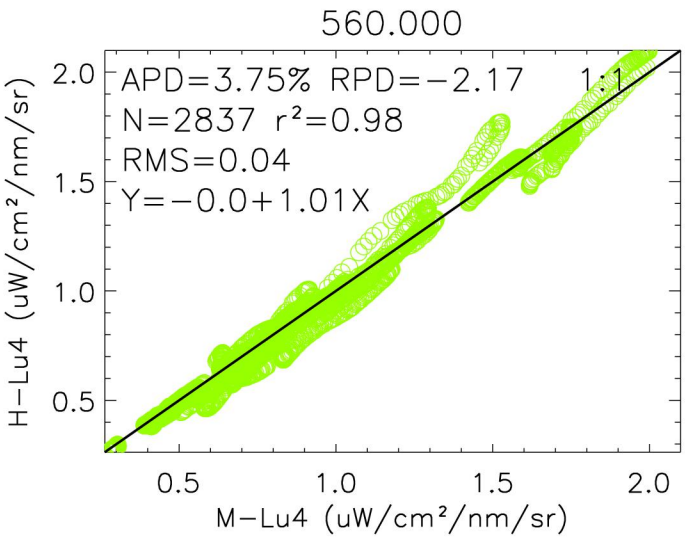

683.700
APD=8.44% RPD=7.743
N=3198 r²=0.99
RMS=0.09
Y=0.01+1.05X
1:1
H-Lu9 (uW/cm²/nm/sr)
H-Lu4 (uW/cm²/nm/sr)

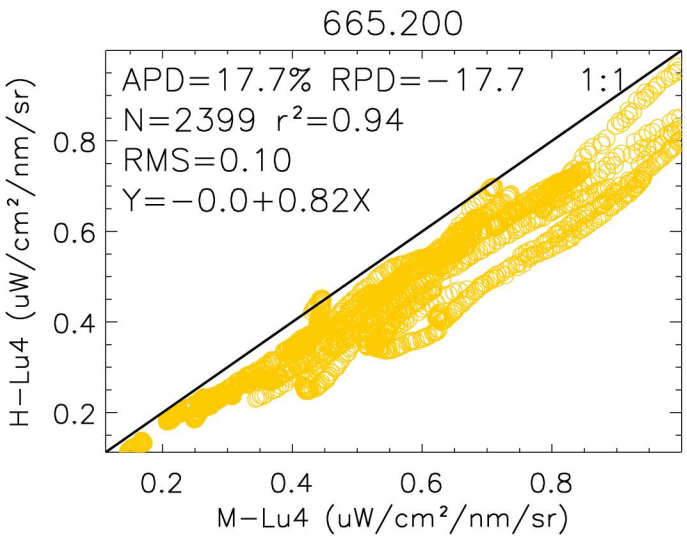

443.000
APD=4.64% RPD=−4.28 1:1
N=2931 r²=0.98
RMS=0.05
Y=−0.0+0.99X
H−Lu4 (uW/cm²/nm/sr)
M−Lu4 (uW/cm²/nm/sr)

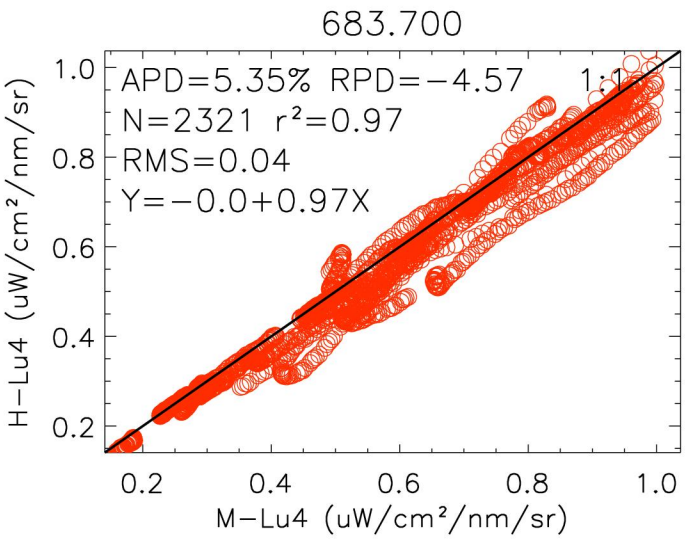

490.600
APD=6.89% RPD=−6.64 1:1
N=2982 r²=0.99
RMS=0.05
Y=−0.0+0.96X
H−Lu4 (uW/cm²/nm/sr)
M−Lu4 (uW/cm²/nm/sr)

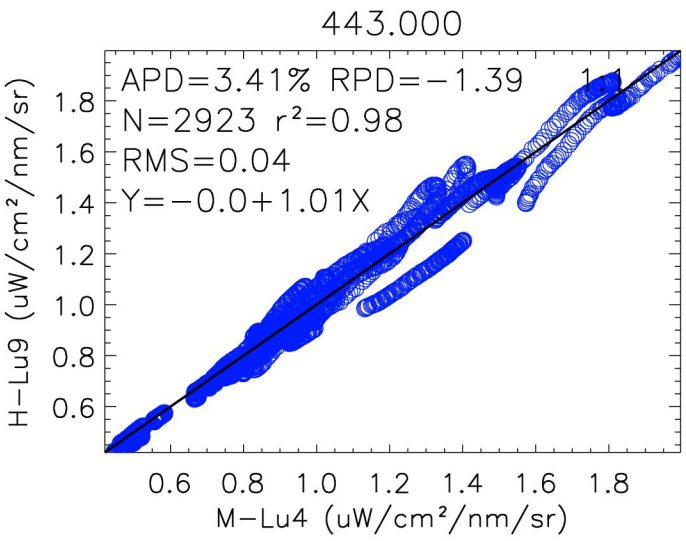

511.000
APD=5.50% RPD=−5.06 1:1
N=2965 r²=0.99
RMS=0.04
Y=−0.0+0.98X
H−Lu4 (uW/cm²/nm/sr)
M−Lu4 (uW/cm²/nm/sr)

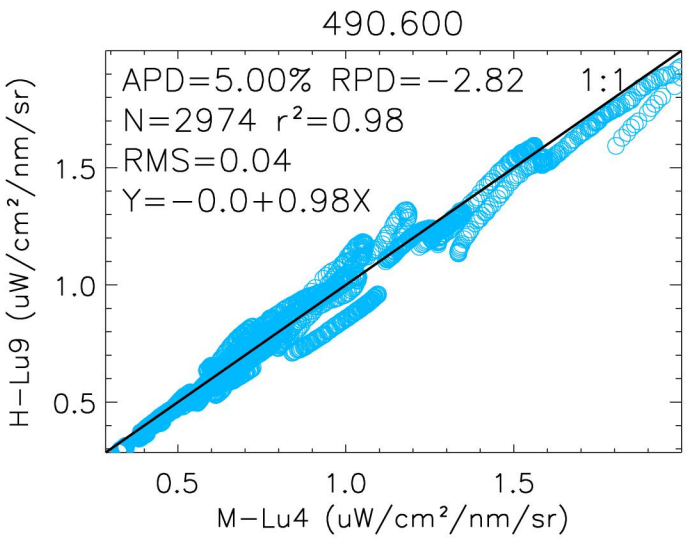

555.500
APD=6.66% RPD=−6.24 1:1
N=2831 r²=0.98
RMS=0.07
Y=−0.0+0.95X
H−Lu4 (uW/cm²/nm/sr)
M−Lu4 (uW/cm²/nm/sr)

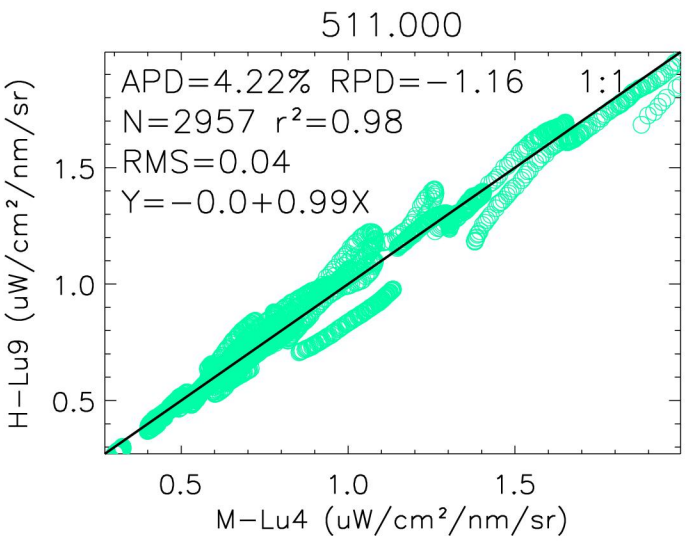

560.000
APD=3.75% RPD=−2.17 1:1
N=2837 r²=0.98
RMS=0.04
Y=−0.0+1.01X
H−Lu4 (uW/cm²/nm/sr)
M−Lu4 (uW/cm²/nm/sr)

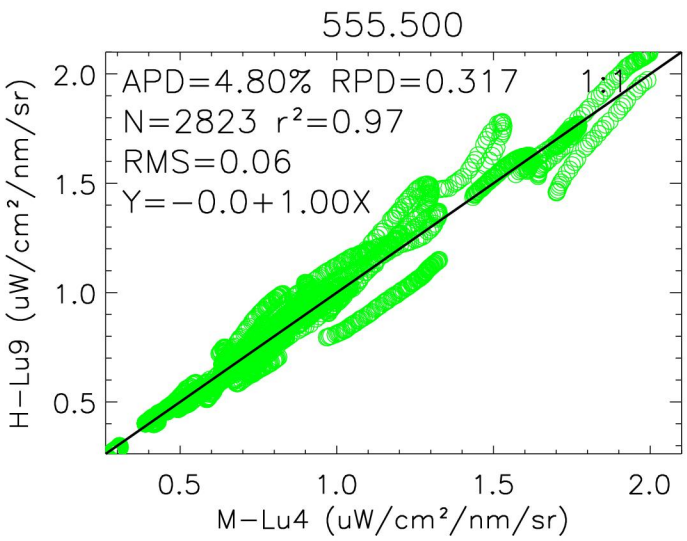

665.200
APD=17.7% RPD=−17.7 1:1
N=2399 r²=0.94
RMS=0.10
Y=−0.0+0.82X
H−Lu4 (uW/cm²/nm/sr)
M−Lu4 (uW/cm²/nm/sr)

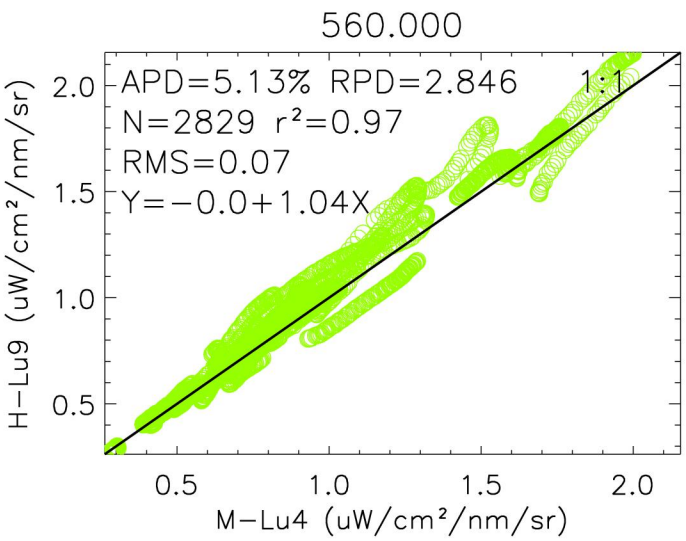

683.700
APD=5.35% RPD=−4.57 1:1
N=2321 r²=0.97
RMS=0.04
Y=−0.0+0.97X
H−Lu4 (uW/cm²/nm/sr)
M−Lu4 (uW/cm²/nm/sr)

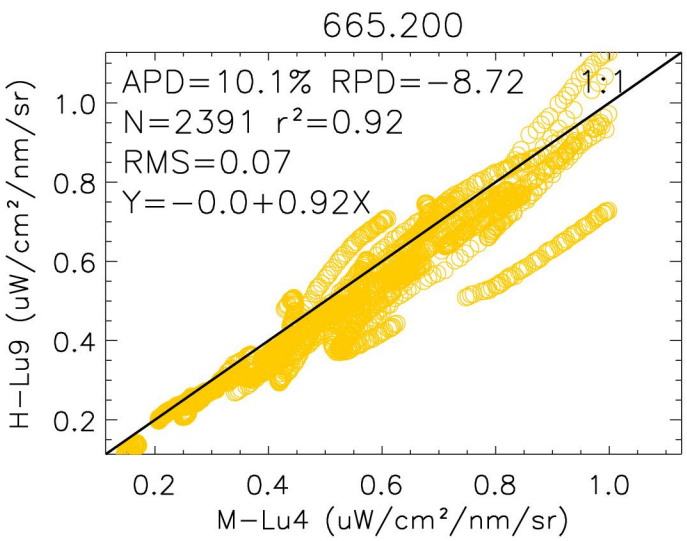

443.000
APD=3.41% RPD=−1.39 1:1
N=2923 r²=0.98
RMS=0.04
Y=−0.0+1.01X
H−Lu9 (uW/cm²/nm/sr)
M−Lu4 (uW/cm²/nm/sr)

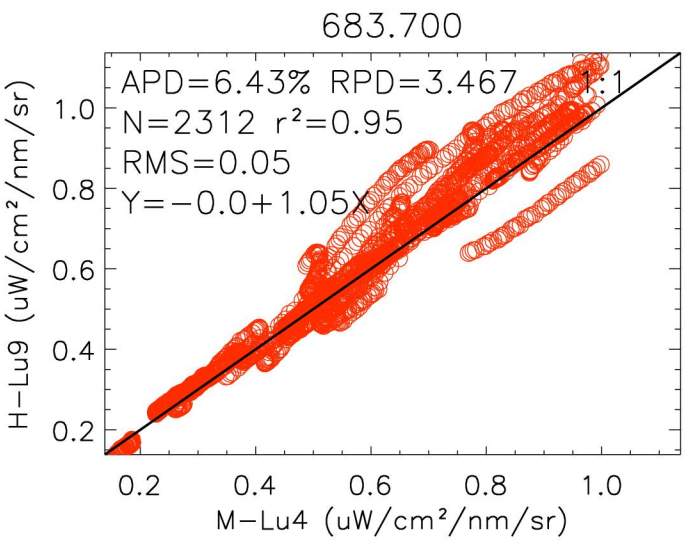

490.600
APD=5.00% RPD=−2.82 1:1
N=2974 r²=0.98
RMS=0.04
Y=−0.0+0.98X
H−Lu9 (uW/cm²/nm/sr)
M−Lu4 (uW/cm²/nm/sr)

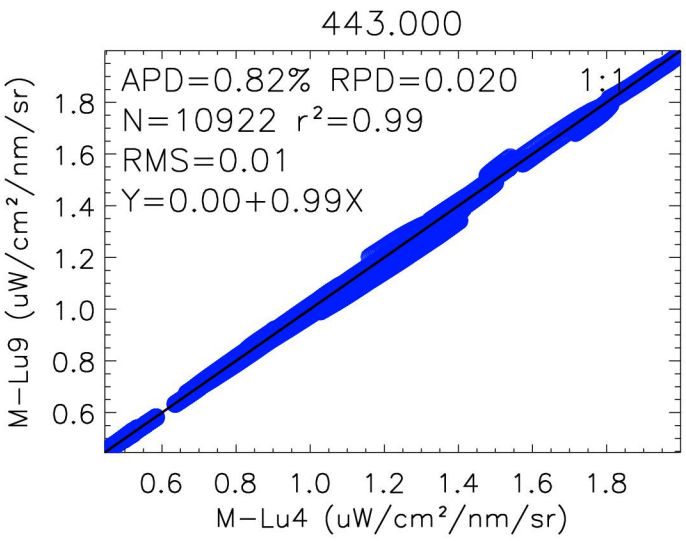

511.000
APD=4.22% RPD=−1.16 1:1
N=2957 r²=0.98
RMS=0.04
Y=−0.0+0.99X
H−Lu9 (uW/cm²/nm/sr)
M−Lu4 (uW/cm²/nm/sr)

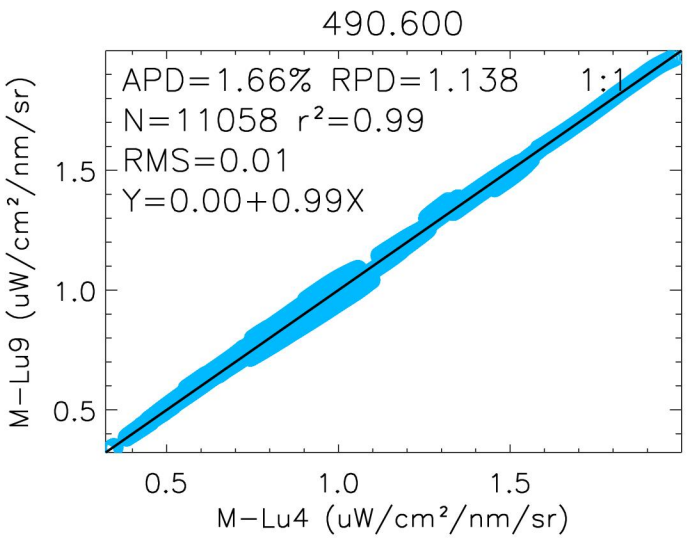

555.500
APD=4.80% RPD=0.317 1:1
N=2823 r²=0.97
RMS=0.06
Y=−0.0+1.00X
H−Lu9 (uW/cm²/nm/sr)
M−Lu4 (uW/cm²/nm/sr)

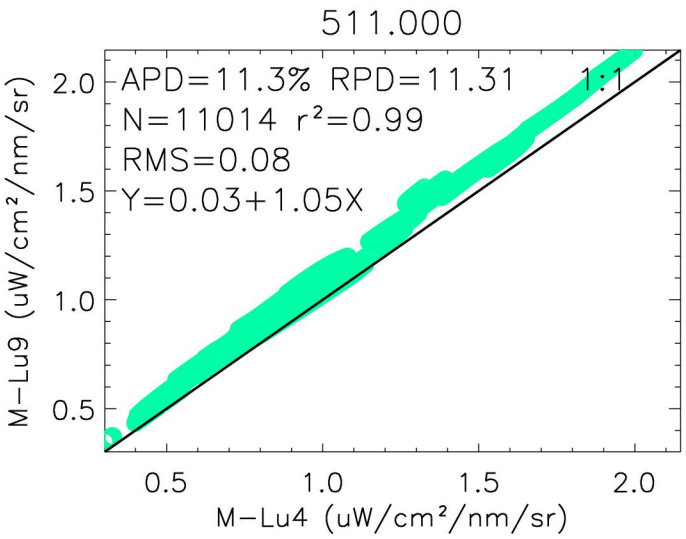

560.000
APD=5.13% RPD=2.846 1:1
N=2829 r²=0.97
RMS=0.07
Y=−0.0+1.04X
H−Lu9 (uW/cm²/nm/sr)
M−Lu4 (uW/cm²/nm/sr)

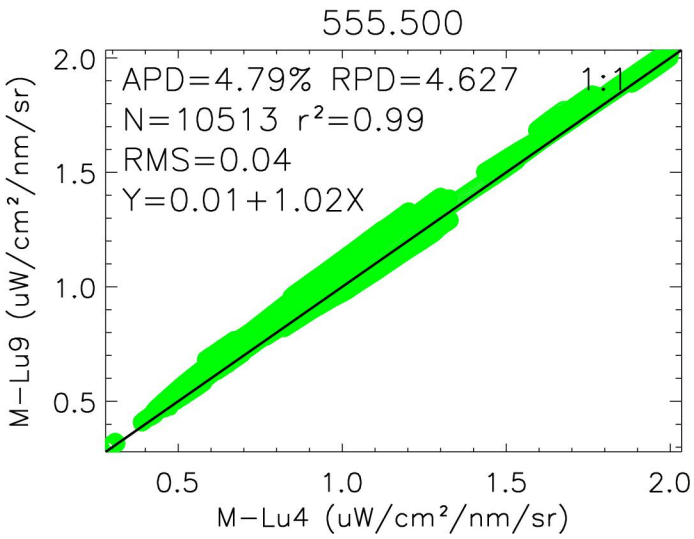

665.200
APD=10.1% RPD=−8.72 1:1
N=2391 r²=0.92
RMS=0.07
Y=−0.0+0.92X
H−Lu9 (uW/cm²/nm/sr)
M−Lu4 (uW/cm²/nm/sr)

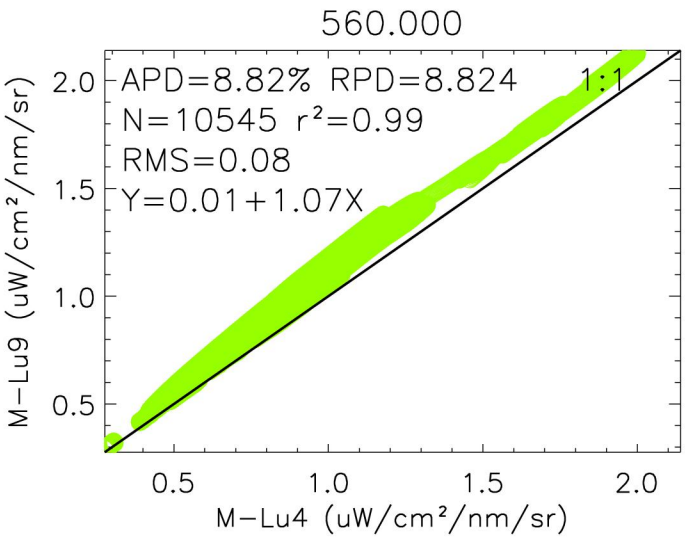

683.700
APD=6.43% RPD=3.467 1:1
N=2312 r²=0.95
RMS=0.05
Y=−0.0+1.05X
H−Lu9 (uW/cm²/nm/sr)
M−Lu4 (uW/cm²/nm/sr)

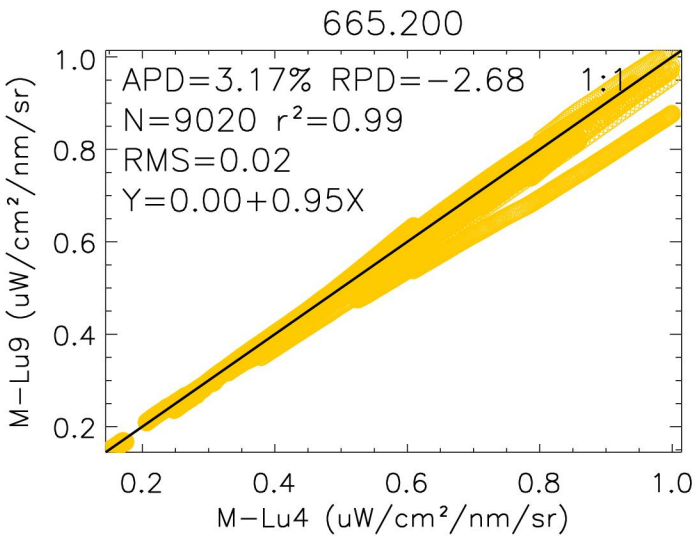

443.000
APD=0.82% RPD=0.020 1:1
N=10922 r²=0.99
RMS=0.01
Y=0.00+0.99X
M−Lu9 (uW/cm²/nm/sr)
M−Lu4 (uW/cm²/nm/sr)

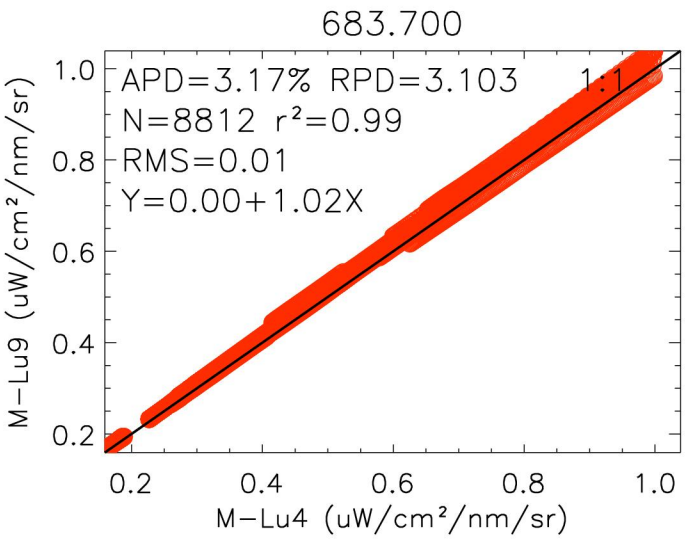

490.600
APD=1.66% RPD=1.138 1:1
N=11058 r²=0.99
RMS=0.01
Y=0.00+0.99X
M−Lu9 (uW/cm²/nm/sr)
M−Lu4 (uW/cm²/nm/sr)

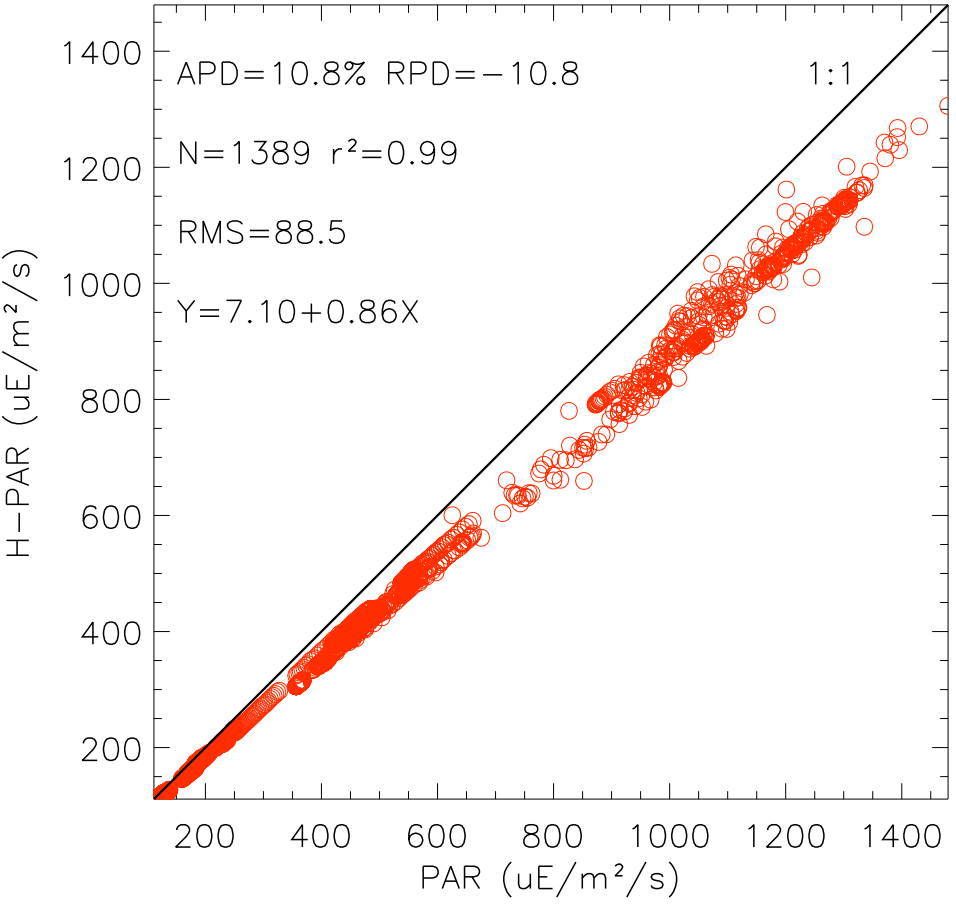

511.000
APD=11.3% RPD=11.31 1:1
N=11014 r²=0.99
RMS=0.08
Y=0.03+1.05X
M−Lu9 (uW/cm²/nm/sr)
M−Lu4 (uW/cm²/nm/sr)

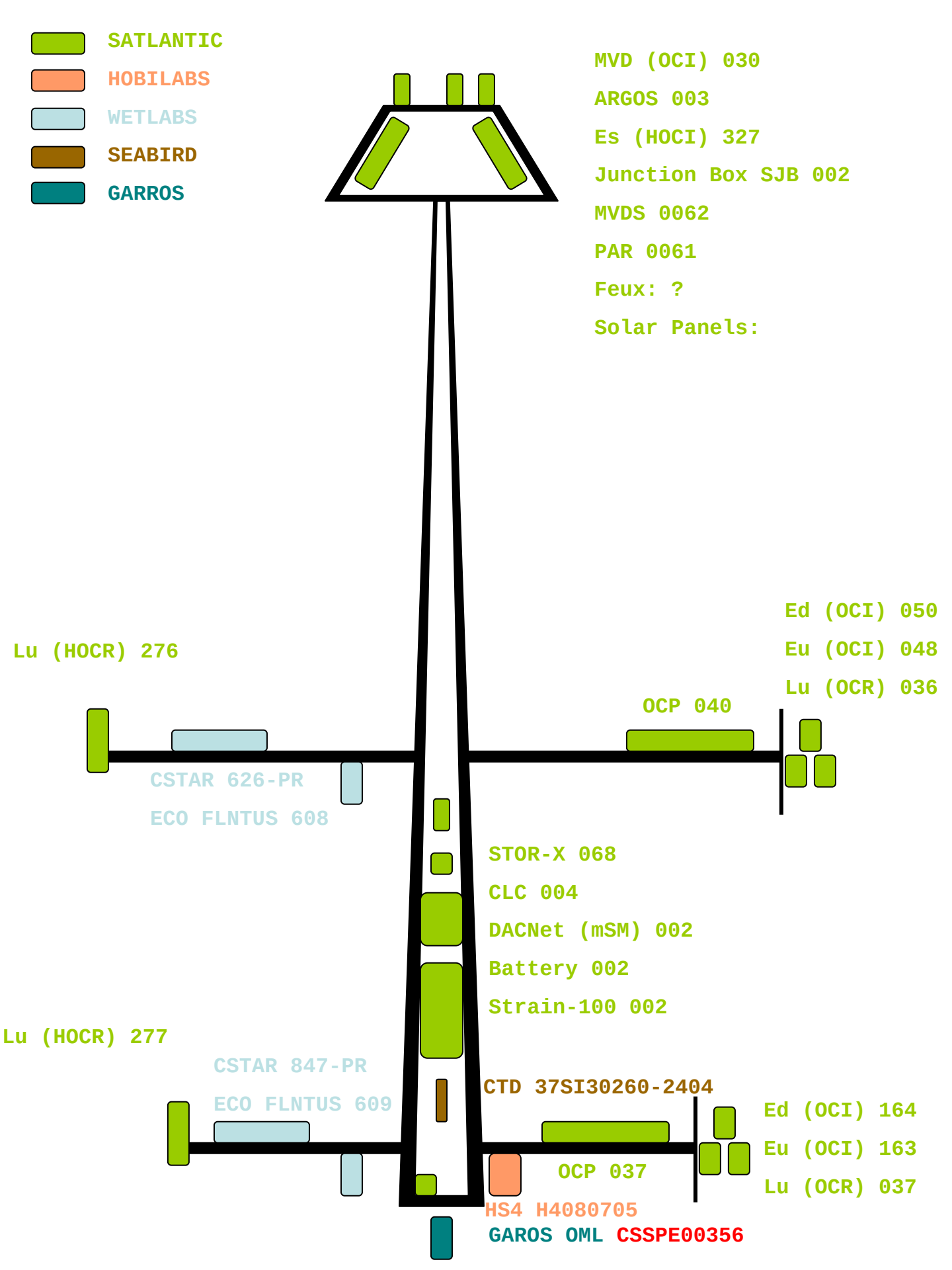

555.500
APD=4.79% RPD=4.627 1:1
N=10513 r²=0.99
RMS=0.04
Y=0.01+1.02X
M−Lu9 (uW/cm²/nm/sr)
M−Lu4 (uW/cm²/nm/sr)

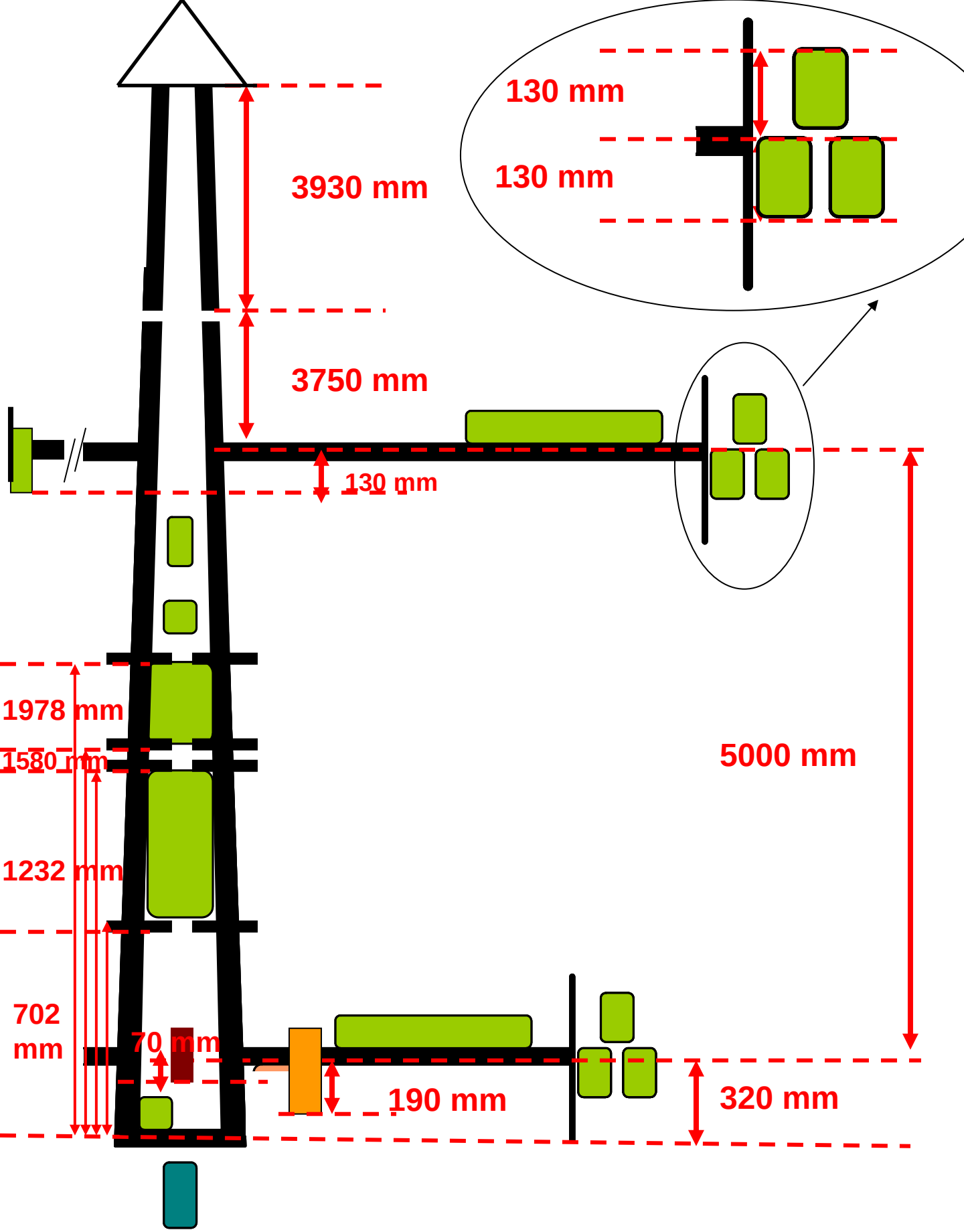

560.000
APD=8.82% RPD=8.824 1:1
N=10545 r²=0.99
RMS=0.08
Y=0.01+1.07X
M−Lu9 (uW/cm²/nm/sr)
M−Lu4 (uW/cm²/nm/sr)

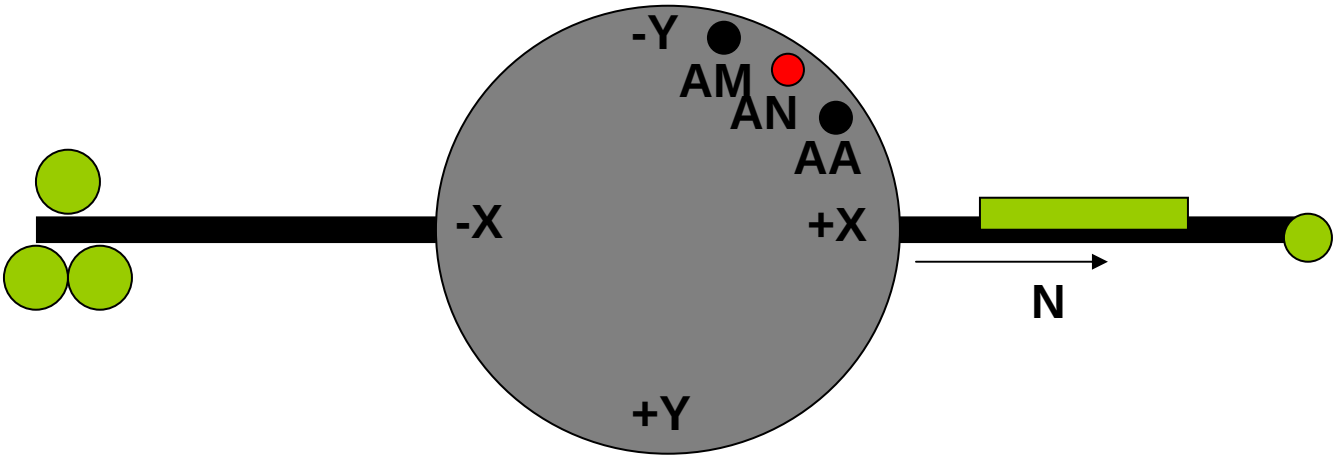

665.200
APD=3.17% RPD=−2.68 1:1
N=9020 r²=0.99
RMS=0.02
Y=0.00+0.95X
M−Lu9 (uW/cm²/nm/sr)
M−Lu4 (uW/cm²/nm/sr)

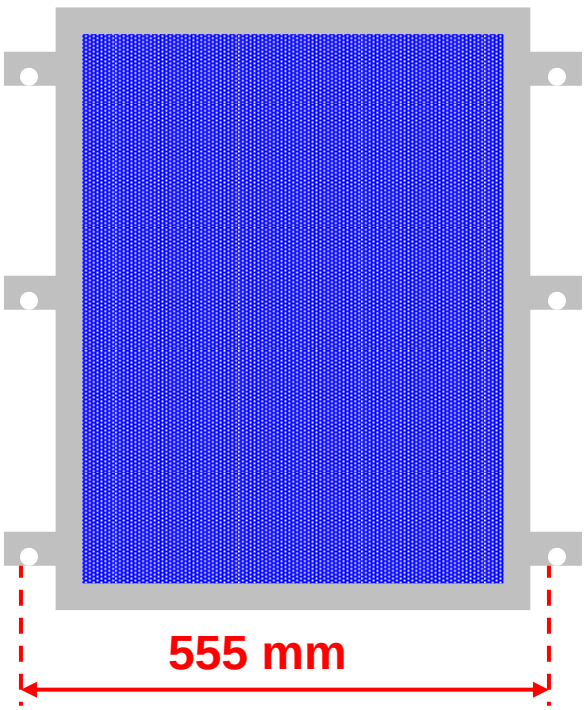

683.700
APD=3.17% RPD=3.103 1:1
N=8812 r²=0.99
RMS=0.01
Y=0.00+1.02X
M−Lu9 (uW/cm²/nm/sr)
M−Lu4 (uW/cm²/nm/sr)

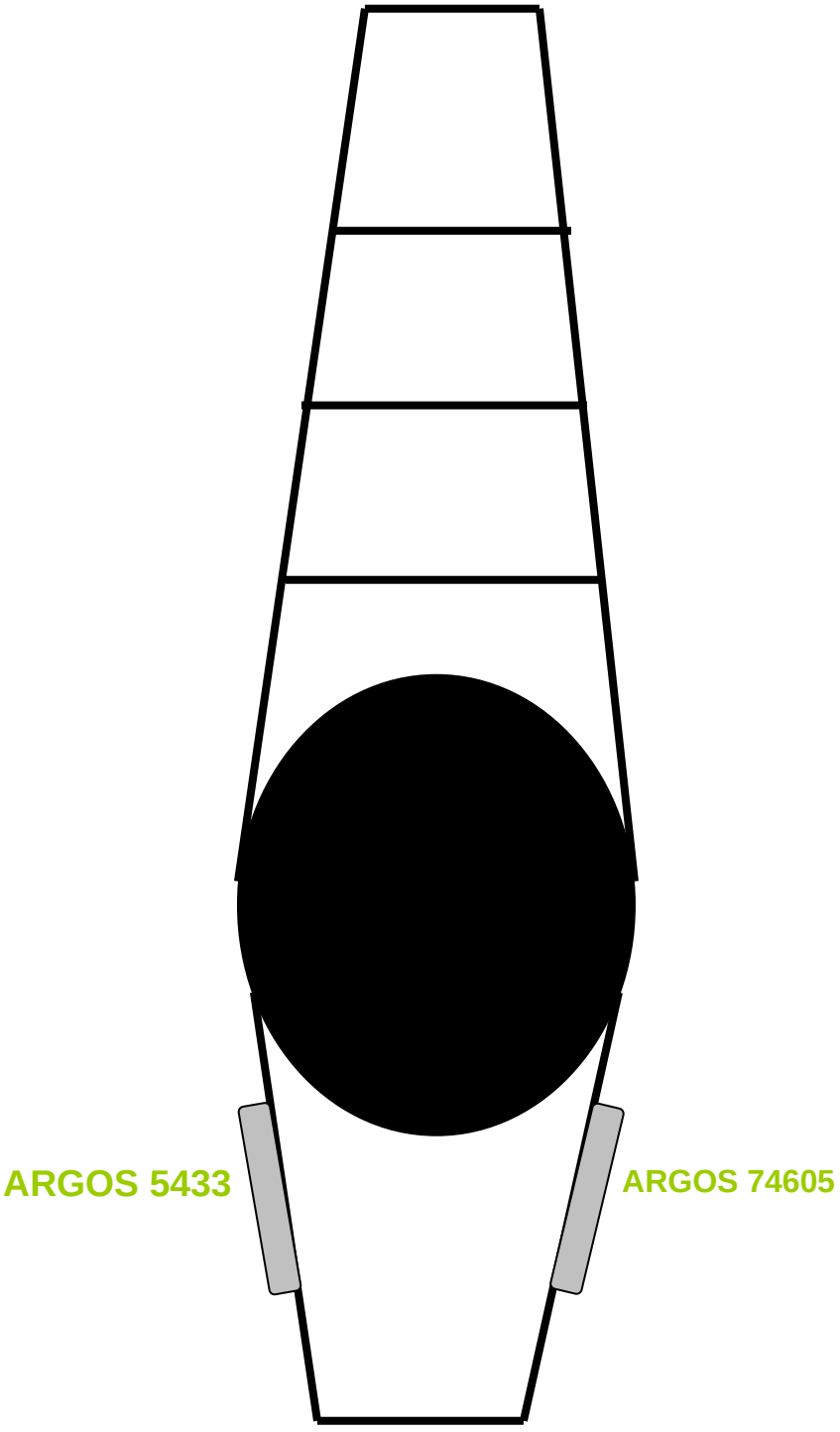

APD=10.8% RPD=−10.8
1:1
N=1389 r²=0.99
RMS=88.5
Y=7.10+0.86X
H−PAR (uE/m²/s)
PAR (uE/m²/s)
200
400
600
800
1000
1200
1400

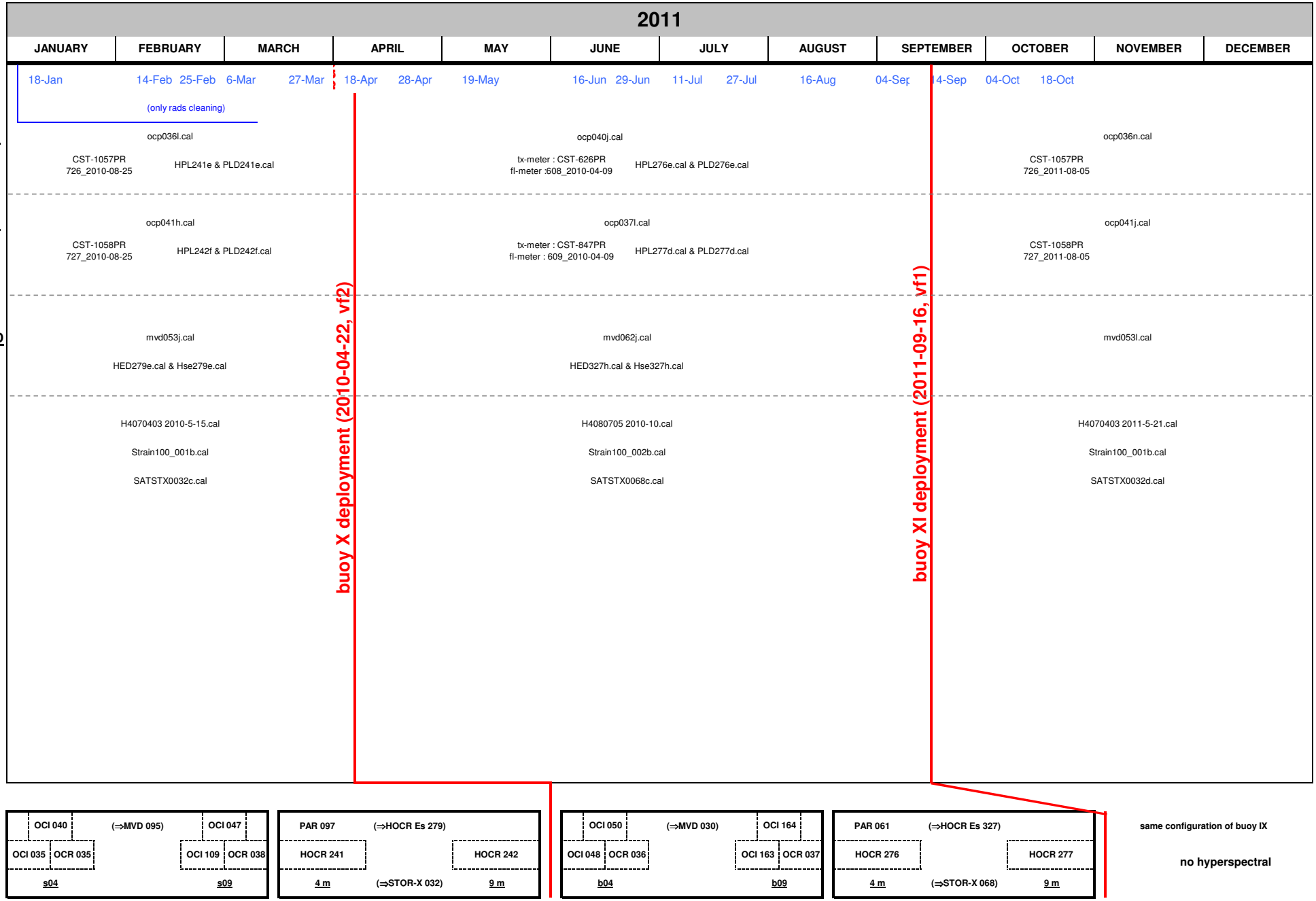

SATLANTIC
HOBILABS
WETLABS
SEABIRD
GARROS
MVD (OCI) 030
ARGOS 003
Es (HOCI) 327
Junction Box SJB 002
MVDS 0062
PAR 0061
Feux: ?
Solar Panels:
Ed (OCI) 050
Eu (OCI) 048
Lu (OCR) 036
Lu (HOCR) 276
OCP 040
CSTAR 626-PR
ECO FLNTUS 608
STOR-X 068
CLC 004
DACNet (mSM) 002
Battery 002
Strain-100 002
Lu (HOCR) 277
CSTAR 847-PR
ECO FLNTUS 609
CTD 37SI30260-2404
Ed (OCI) 164
Eu (OCI) 163
Lu (OCR) 037
OCP 037
HS4 H4080705
GAROS OML CSSPE00356

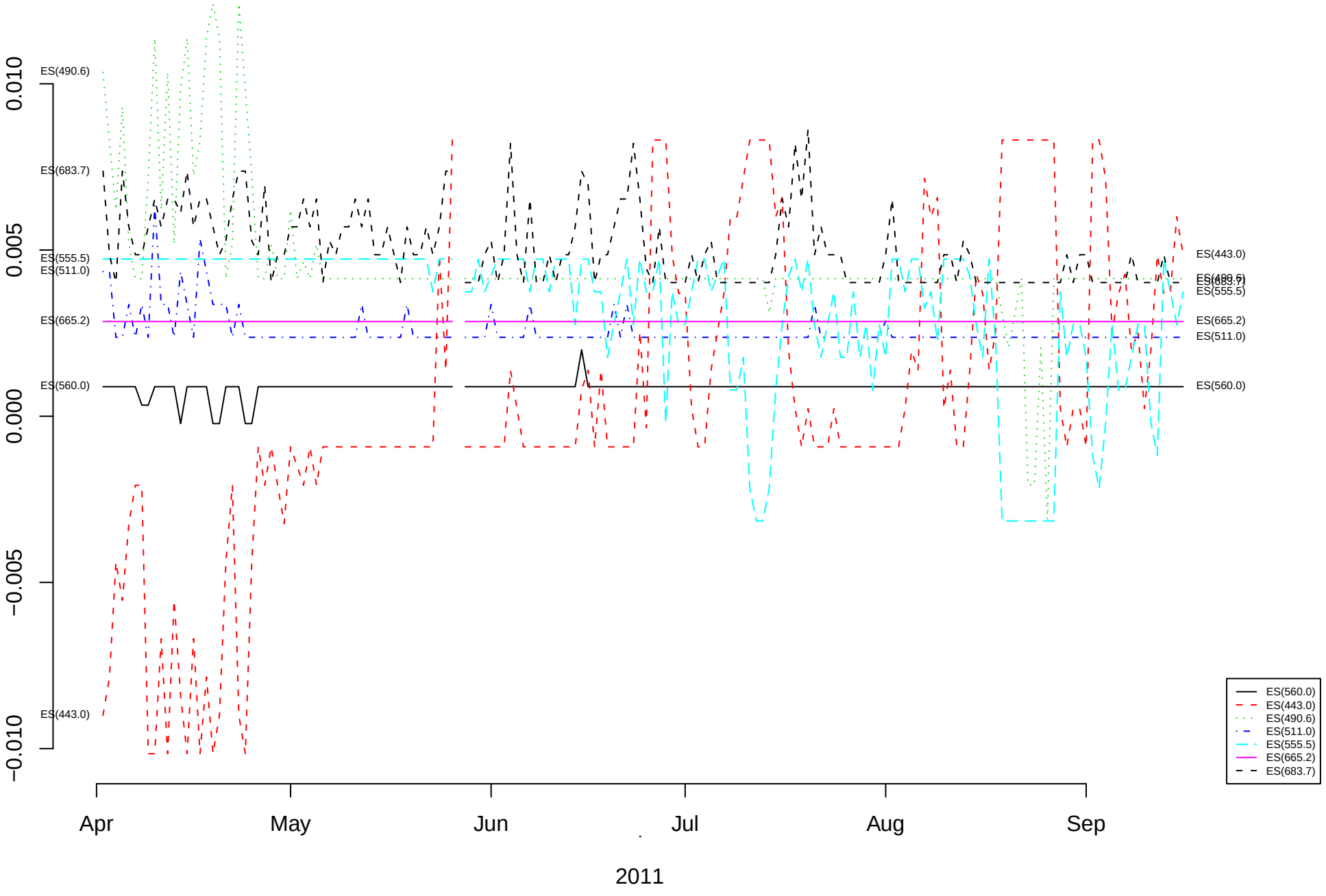

130 mm
130 mm
3930 mm
3750 mm
130 mm
1978 mm
1580 mm
1232 mm
5000 mm
702 mm
70 mm
190 mm
320 mm

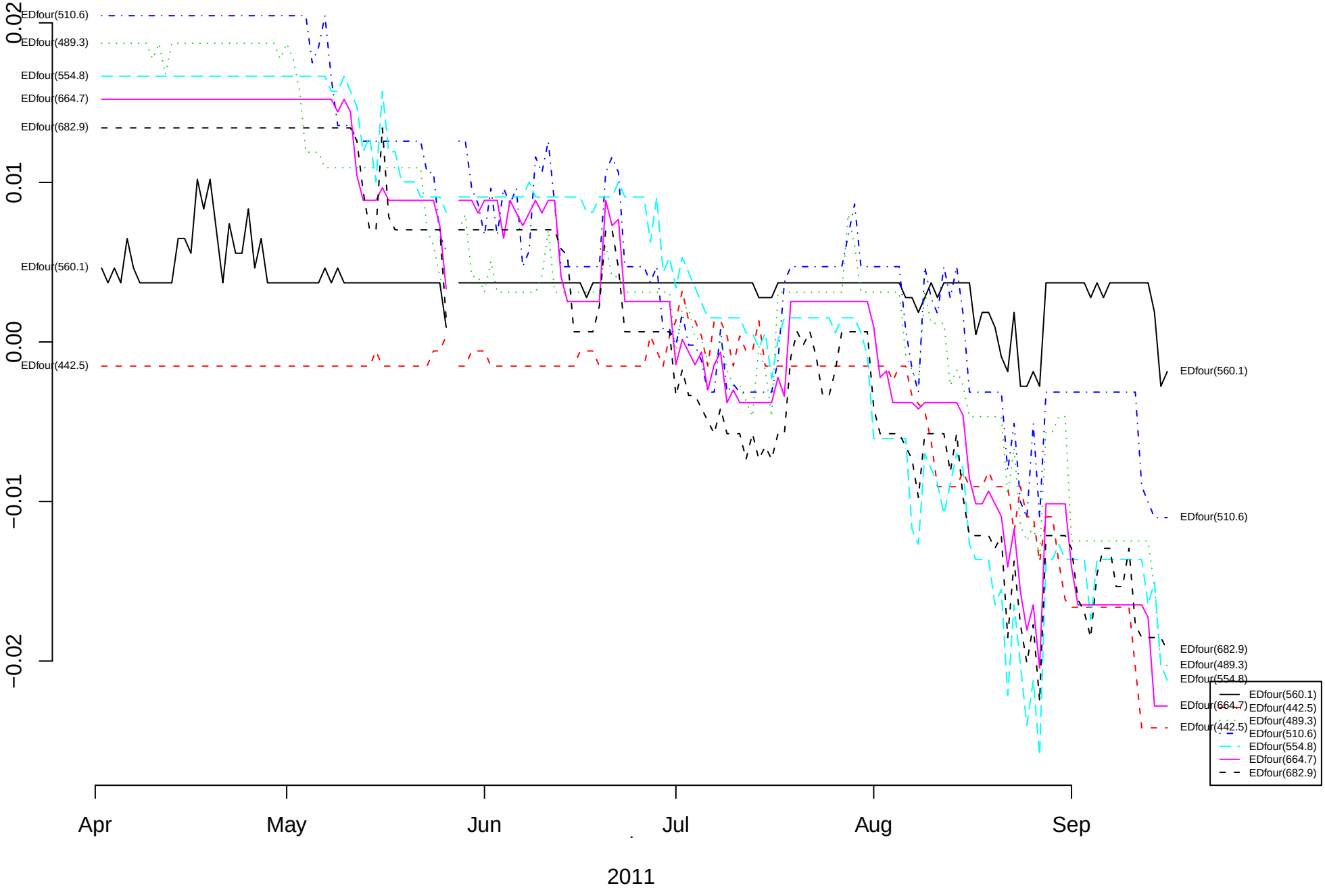

-Y
AM
AN
AA
-X
+X
N
+Y

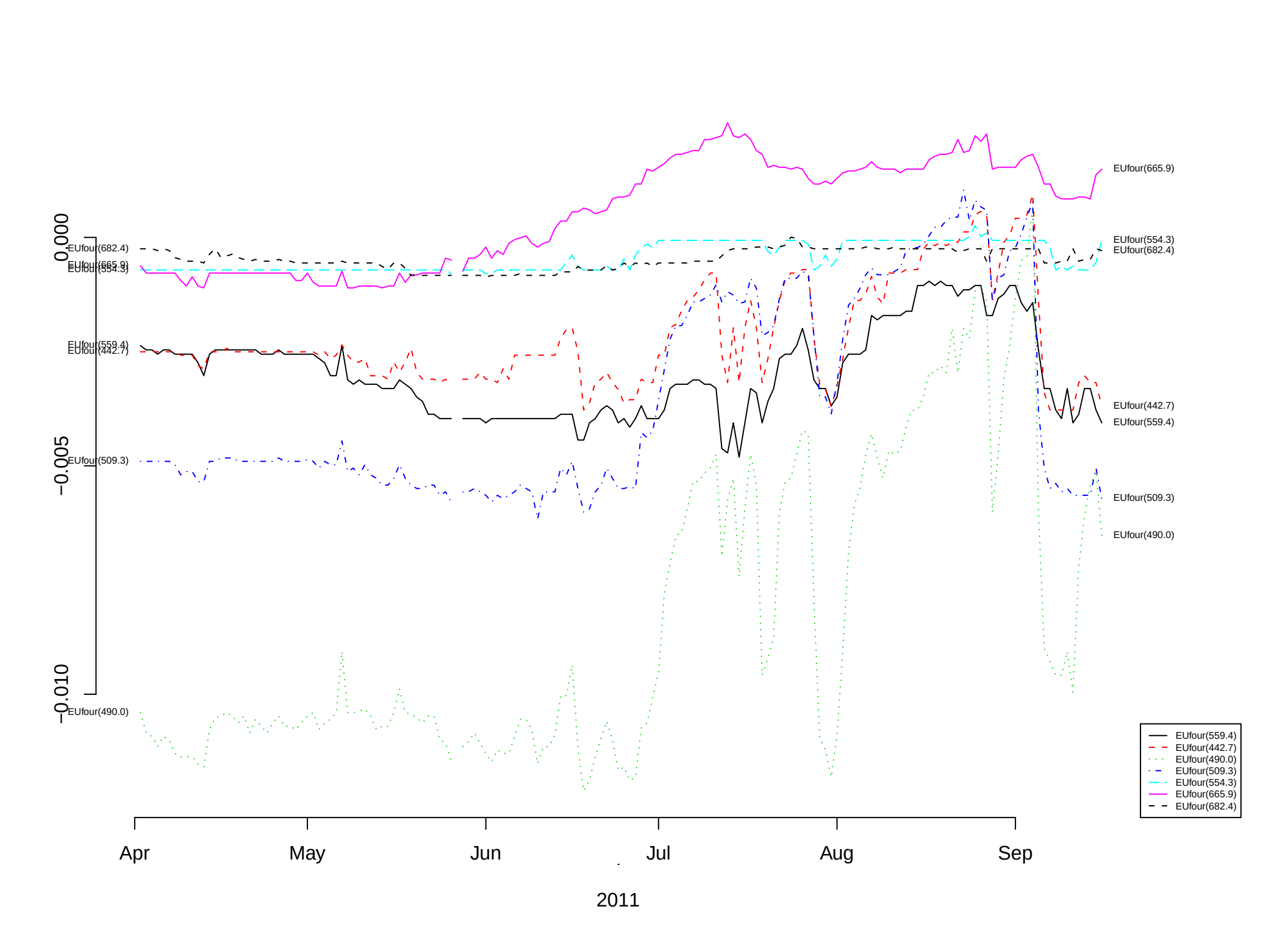

555 mm

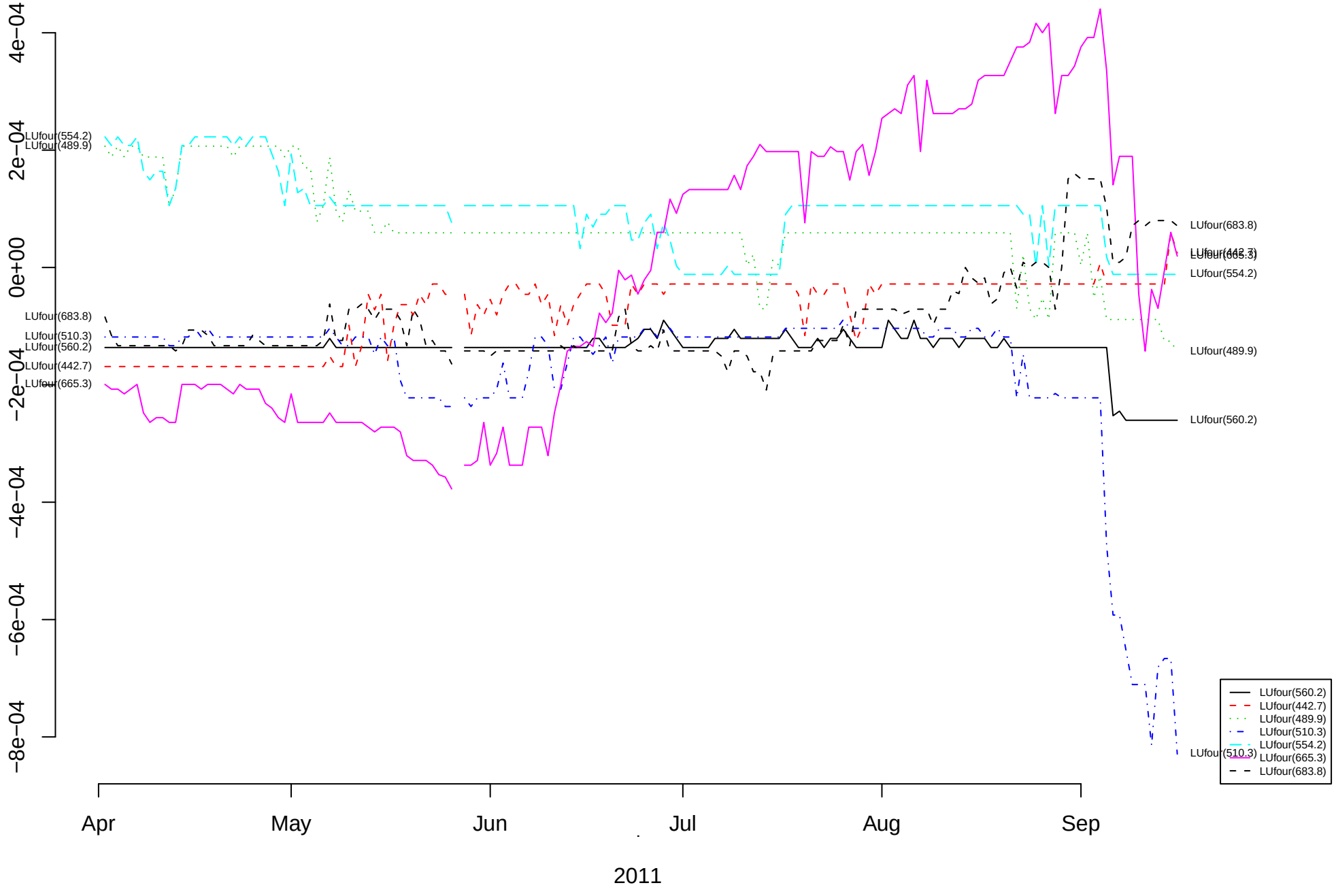

ARGOS 5433
ARGOS 74605


2011
JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER
18-Jan
14-Feb
25-Feb
6-Mar
27-Mar
18-Apr
28-Apr
19-May
16-Jun
29-Jun
11-Jul
27-Jul
16-Aug
04-Sep
14-Sep
04-Oct
18-Oct
(only rads cleaning)
4 m
ocp036l.cal
CST-1057PR
726_2010-08-25
HPL241e & PLD241e.cal
ocp040j.cal
tx-meter : CST-626PR
fl-meter :608_2010-04-09
HPL276e.cal & PLD276e.cal
ocp036n.cal
CST-1057PR
726_2011-08-05
9 m
ocp041h.cal
CST-1058PR
727_2010-08-25
HPL242f & PLD242f.cal
ocp037l.cal
tx-meter : CST-847PR
fl-meter : 609_2010-04-09
HPL277d.cal & PLD277d.cal
ocp041j.cal
CST-1058PR
727_2011-08-05
MVD
mvd053j.cal
HED279e.cal & Hse279e.cal
mvd062j.cal
HED327h.cal & Hse327h.cal
mvd053l.cal
H4070403 2010-5-15.cal
Strain100_001b.cal
SATSTX0032c.cal
H4080705 2010-10.cal
Strain100_002b.cal
SATSTX0068c.cal
H4070403 2011-5-21.cal
Strain100_001b.cal
SATSTX0032d.cal
buoy X deployment (2010-04-22, vf2)
buoy XI deployment (2011-09-16, vf1)
OCI 040
(⇒MVD 095)
OCI 047
OCI 035
OCR 035
OCI 109
OCR 038
s04
s09
PAR 097
(⇒HOCR Es 279)
HOCR 241
HOCR 242
4 m
(⇒STOR-X 032)
9 m
OCI 050
(⇒MVD 030)
OCI 164
OCI 048
OCR 036
OCI 163
OCR 037
b04
b09
PAR 061
(⇒HOCR Es 327)
HOCR 276
HOCR 277
4 m
(⇒STOR-X 068)
9 m
same configuration of buoy IX
no hyperspectral


0.010
0.005
0.000
−0.005
−0.010
ES(490.6)
ES(683.7)
ES(555.5)
ES(511.0)
ES(665.2)
ES(560.0)
ES(443.0)
ES(443.0)
ES(490.6)
ES(683.7)
ES(555.5)
ES(665.2)
ES(511.0)
ES(560.0)
Apr
May
Jun
Jul
Aug
Sep
2011
ES(560.0)
ES(443.0)
ES(490.6)
ES(511.0)
ES(555.5)
ES(665.2)
ES(683.7)


EDfour(510.6)
EDfour(489.3)
EDfour(554.8)
EDfour(664.7)
EDfour(682.9)
EDfour(560.1)
EDfour(442.5)
0.02
0.01
0.00
−0.01
−0.02
Apr
May
Jun
Jul
Aug
Sep
2011
EDfour(560.1)
EDfour(510.6)
EDfour(682.9)
EDfour(489.3)
EDfour(554.8)
EDfour(664.7)
EDfour(442.5)
EDfour(560.1)
EDfour(442.5)
EDfour(489.3)
EDfour(510.6)
EDfour(554.8)
EDfour(664.7)
EDfour(682.9)


0.000
−0.005
−0.010
EUfour(682.4)
EUfour(665.9)
EUfour(554.3)
EUfour(559.4)
EUfour(442.7)
EUfour(509.3)
EUfour(490.0)
EUfour(665.9)
EUfour(554.3)
EUfour(682.4)
EUfour(442.7)
EUfour(559.4)
EUfour(509.3)
EUfour(490.0)
Apr
May
Jun
Jul
Aug
Sep
2011
EUfour(559.4)
EUfour(442.7)
EUfour(490.0)
EUfour(509.3)
EUfour(554.3)
EUfour(665.9)
EUfour(682.4)


4e−04
2e−04
0e+00
−2e−04
−4e−04
−6e−04
−8e−04
LUfour(554.2)
LUfour(489.9)
LUfour(683.8)
LUfour(510.3)
LUfour(560.2)
LUfour(442.7)
LUfour(665.3)
LUfour(683.8)
LUfour(554.2)
LUfour(489.9)
LUfour(560.2)
LUfour(510.3)
LUfour(560.2)
LUfour(442.7)
LUfour(489.9)
LUfour(510.3)
LUfour(554.2)
LUfour(665.3)
LUfour(683.8)
Apr
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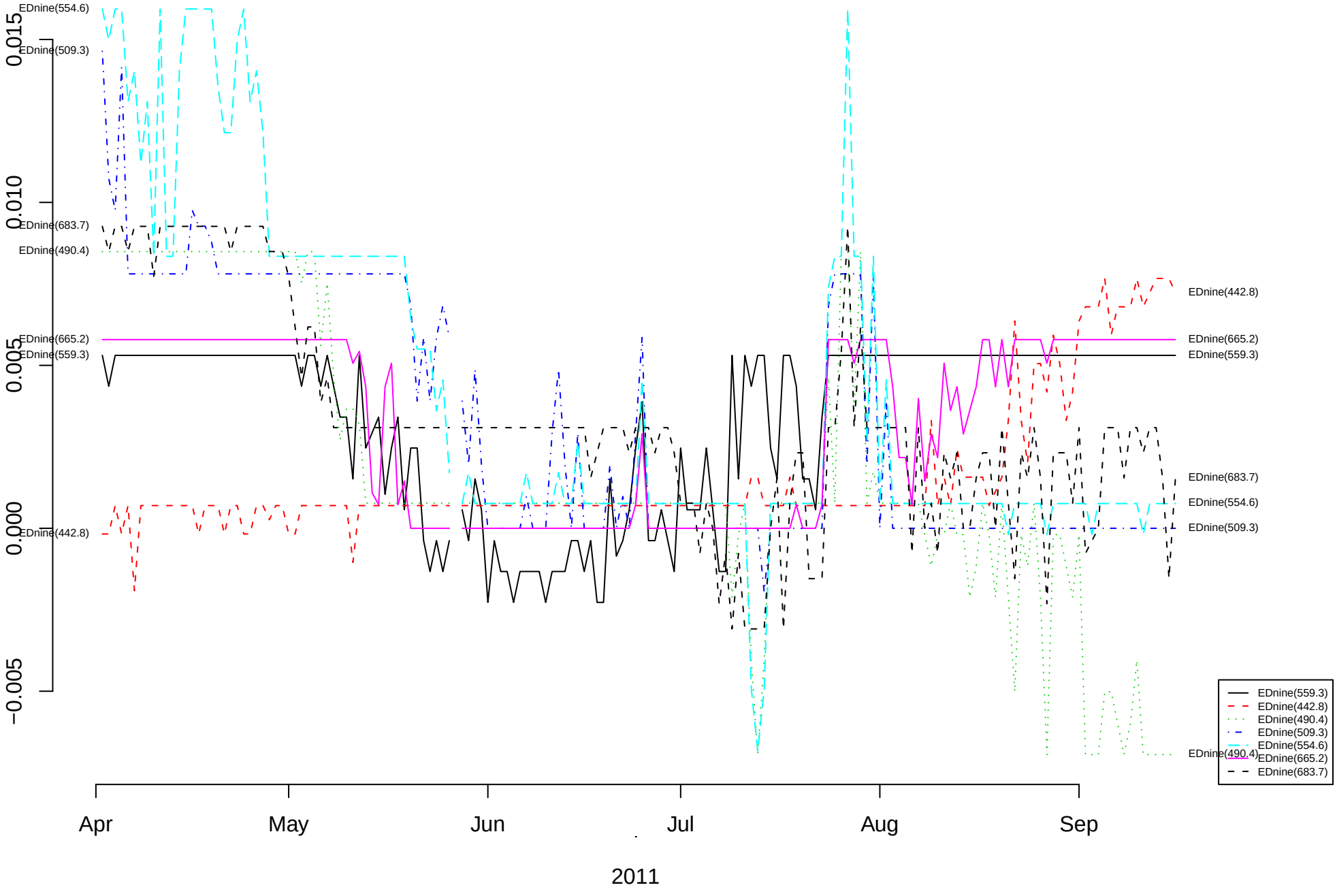
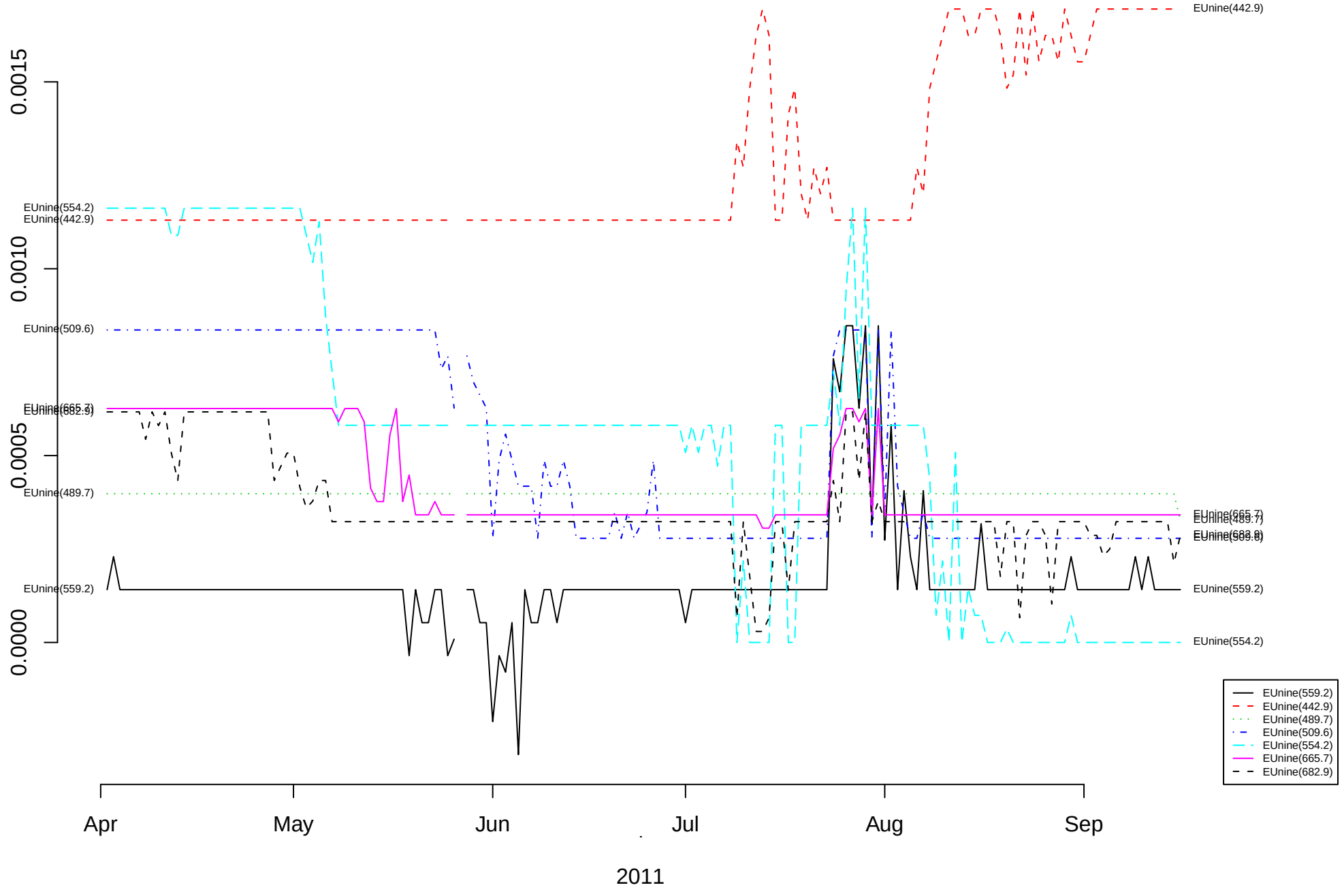
Sep
2011


EDnine(554.6)
EDnine(509.3)
EDnine(683.7)
EDnine(490.4)
EDnine(665.2)
EDnine(559.3)
EDnine(442.8)
0.015
0.010
0.005
0.000
−0.005
Apr
May
Jun
Jul
Aug
Sep
2011
EDnine(442.8)
EDnine(665.2)
EDnine(559.3)
EDnine(683.7)
EDnine(554.6)
EDnine(509.3)
EDnine(490.4)
EDnine(559.3)
EDnine(442.8)
EDnine(490.4)
EDnine(509.3)
EDnine(554.6)
EDnine(665.2)
EDnine(683.7)


0.0015
0.0010
0.0005
0.0000
EUnine(554.2)
EUnine(442.9)
EUnine(509.6)
EUnine(665.7)
EUnine(682.9)
EUnine(489.7)
EUnine(559.2)
EUnine(442.9)
EUnine(665.7)
EUnine(489.7)
EUnine(682.9)
EUnine(509.6)
EUnine(559.2)
EUnine(554.2)
EUnine(559.2)
EUnine(442.9)
EUnine(489.7)
EUnine(509.6)
EUnine(554.2)
EUnine(665.7)
EUnine(682.9)
Apr
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Jun
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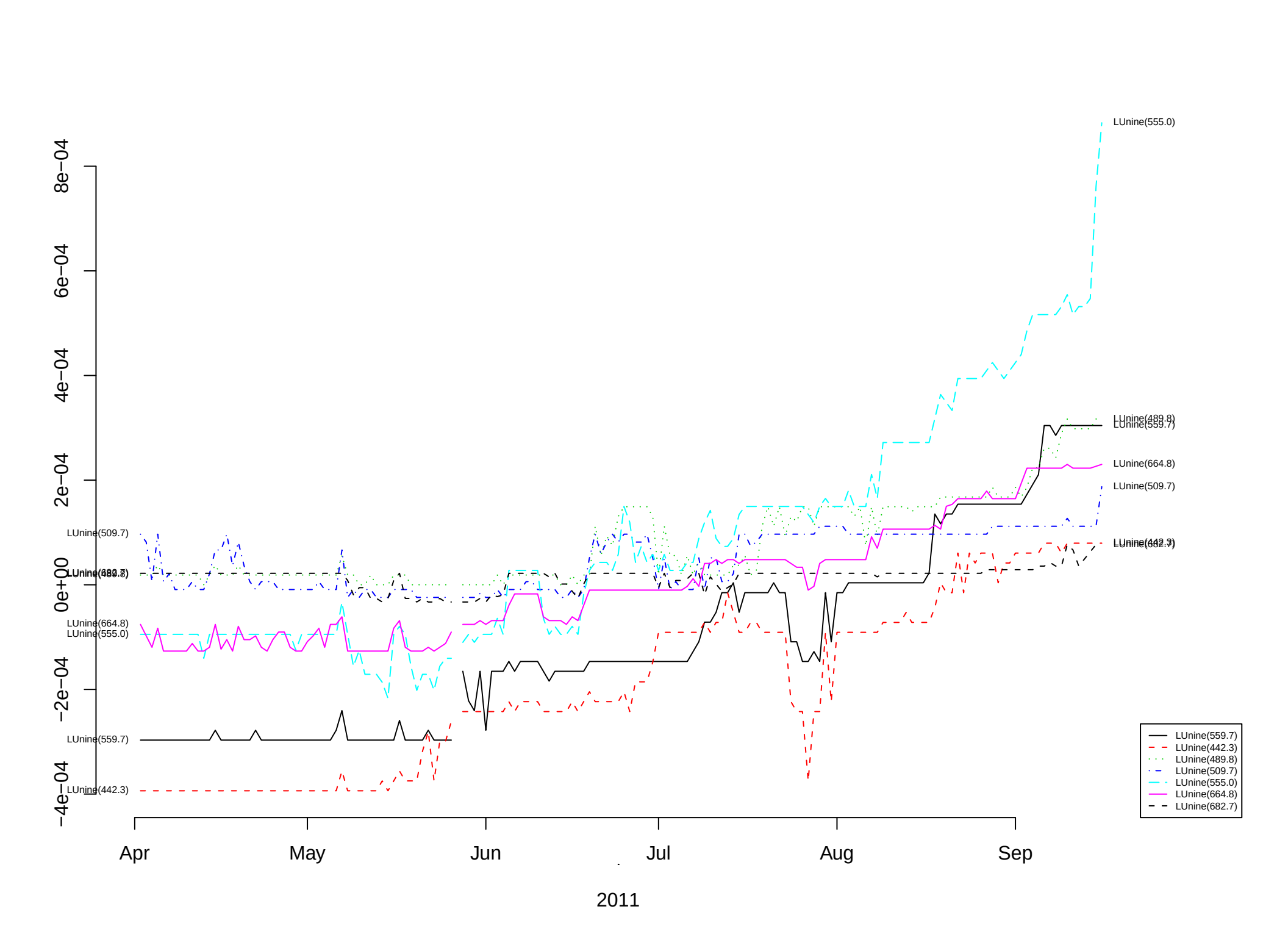
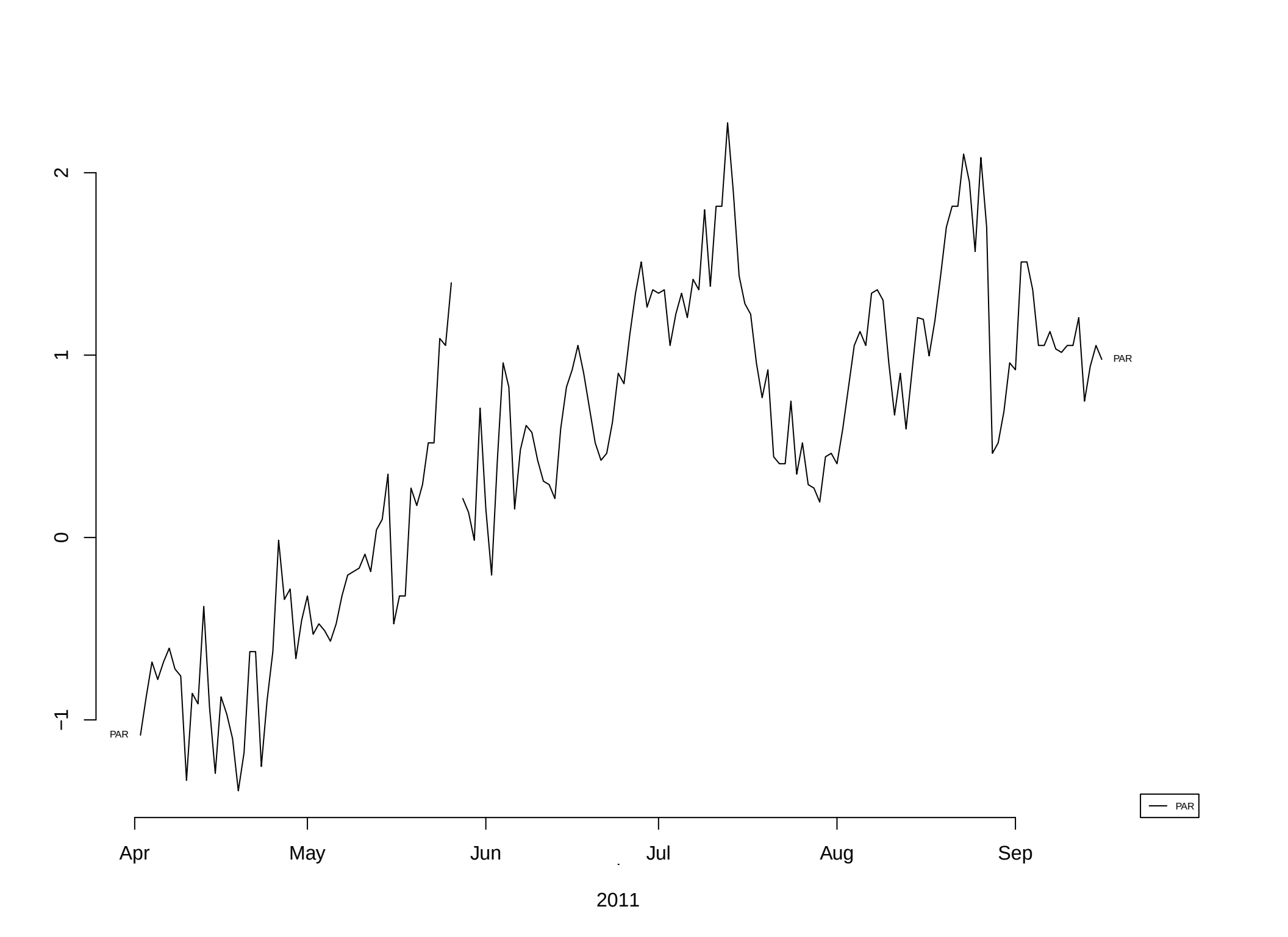
Sep
2011


8e−04
6e−04
4e−04
2e−04
0e+00
−2e−04
−4e−04
Apr
May
Jun
Jul
Aug
Sep
2011
LUnine(555.0)
LUnine(489.8)
LUnine(559.7)
LUnine(664.8)
LUnine(509.7)
LUnine(442.3)
LUnine(682.7)
LUnine(509.7)
LUnine(664.8)
LUnine(555.0)
LUnine(559.7)
LUnine(442.3)
LUnine(559.7)
LUnine(442.3)
LUnine(489.8)
LUnine(509.7)
LUnine(555.0)
LUnine(664.8)
LUnine(682.7)


2
1
0
−1
PAR
PAR
PAR
Apr
May
Jun
Jul
Aug
Sep
2011