

Review ESSD-2019-156, atmospheric radioactivity dose rates over the North Pacific

Data download easily and cleanly from Zenodo link. Colletion of g01 to g14 folders each holding multiple .csv files. I believe one could find and re-assemble data to reproduce, e.g., one of the panels of Figure 14, but that effort would require significant time and work on the part of users. More seriously, as itemized below, this reviewer can not verify nor trust the author's descriptions in the text. I urge editors to reject and authors to revise and perhaps resubmit.

Reply. We are very grateful indeed to the reviewer for very detailed comments. Detailed replies to each comment are shown in the following.

Specific comments:

P2L4: FNPP disaster happened 11 March 2011, not 11 April 2011?

Reply. We have made correction to the date of the FNPP disaster. It was on 11 March 2011.

P4L49: Again, this date seems wrong? FNPP disaster happened 11 March 2011, not 11 April 2011?

Reply. We have corrected the date to 11 March 2011.

P5L62: "are openly and openly available"? You mean 'freely and openly available' or simply 'openly available'?

Reply. We have rephrased to "openly available".

P5L63,64: "data will aid the validation of atmospheric models for modeling atmospheric 64 dispersions of radioactive materials from the nuclear power plant". Confusing and redundant. I think you mean 'data will assist evaluation and validation of models of atmospheric dispersions of radioactive materials from the nuclear power plant'?

Reply. We have rephrased the description as suggested by the reviewer.

P5L81: These dates imply that monitoring started very soon after the earthquake, tsunami and disruption at FNPP1? E.g. 11 March 2011 or very soon thereafter. Thus earlier dates of earthquake occurring on 11 April 2011 cannot be correct? Table 1 confirms start dates of 03/2011.

Reply. We have corrected the date to 11 March 2011.

P6L85-89: Give us the manufacturer's specs for these sensors! Accuracy? Precision? Normal operating temperatures? Software version if any?

Reply. The sensors have an accuracy of  $\pm 3\%$  (please attached two pdf files for the original calibration certificates from the makers). Our calibrations of sensors (see Figure 1) show that the sensors have the precisions of 2% (50<sup>th</sup> percentile) and 5% (75<sup>th</sup> percentile) of deviations to the designated dose rates. The sensors have an operating temperature range of -20°C to 50°C (SAVER, 2016; RedEye B20, 2017). We have included above description in the end of the first paragraph of section 2.2.

P6L102: What does the parenthetical phrase “(1 July 1996)” indicate here? The dates of the most recent confirmation of 137-Cs concentrations/activities? This date occurs in neither Figure 1 nor Table 2? Please clarify?

Reply. This is the date of the 137-Cs source obtained in calibrating the sensors used in this work. We have added this description after the date.

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P7L110: “are consistently within 90designated dose rates”. What does this mean. Can the authors provide a standard uncertainty, e.g.  $\pm$  sd or  $\pm$  95%, or percentiles as used in the Figures?

Reply. We have followed reviewer’s suggestion to rephrase this description as: “are consistently at 1% (50<sup>th</sup> percentile) and 4% (75<sup>th</sup> percentile) of deviations to the designated dose rates”.

P7L113: “(within 5(packages G03, G05, G06, and G07).”? Something missing here? From Figure 1, data from sensor G09, also a G10 sensor, look as good as data from G03, G05, G06, and G07?

Reply. We are very grateful indeed to the reviewer for pointing out this incomplete description. The error was caused by a % symbol after 5% used in the original latex file, which was converted from a word file. We have fixed and rephrased this description following reviewer’s comment.

P7L127: “taken at three locations”. The G01 sensor moved small distances between port locations with time? Each time? Figure nor Table give the reader any information about how the authors sampled these three locations. Later, we learn 00UT and 06UT each day, but, again, sensor moved among three locations or locations changed with time? If the former, authors should have good error/uncertainty statistics. If the latter, readers needs to know exactly when the locations changed? Given data files and Figures 4, 5 and 6, it appears that all three locations were sampled each day. Authors need to clarify!

Reply. Yes, all three locations were sampled each day by the same G01 sensor. We have included this description in the revised manuscript.

P8L141: “50 cm and 10 cm above the ground at the attic”. 50 cm and 10 cm not very high. Confusion here? These measurements taken each day? G01 data folder shows three files: a4, outdoor and vessel. A4 = Gate? Outdoor = ATTIC? Vessel = over the water at the port? Only \_outdoor file shows obs related to height above ground? No height-related differences?

Reply. We have included following description to increase the clarity of the data:

“In the raw data files (Wang et al., 2019) and calibrated data files (Wang, 2019), there are three files in the G01 data folder: a4, outdoor and vessel. A4 represents measurements made at gate. Outdoor represents measurements at office attic. Vessel represents measurements over the the water at the port. Only the outdoor file shows measurements related to height about the ground. The height-related measurements are shown in the last three columns of data (DOWN, 50 cm, and 10 cm) of the outdoor files.”

P8L149 and following: I can not find or confirm these data. First, the authors mean the highest individual data (from twice daily measurements), not the “highest monthly radioactive dose”. Second, in the \_outdoor data file, I find maximum values of 0.50 and 0.49 microSv/h. Nothing to show how the authors got 0.40 or 0.45. I find no values of 0.45 in that entire table?

Reply. We have revised the description as suggested by the reviewer:

“In the first two months after 11 March 2011, the highest individual radioactive dose rates measured at Tokyo Port office is at 0.40  $\mu\text{Sv/h}$  (at 0600 UT on 23 Mar 2011 of 20110322\_20150902\_tokyo\_outdoor.txt; Wang et al., 2019). In the following discussions, the highest individual radioactive dose rates measured twice daily in a month is referred to as the highest monthly dose rates. The highest monthly dose rates gradually drop with time.”

The calibrated data measured at 0600 UT on 23 Mar 2011 is 0.42  $\mu\text{Sv/h}$  in the 20110322\_20150902\_tokyo\_outdoor.csv (Wang, 2019).

We get no information of how the authors processed or filtered these data. Did they average all directional measurements, e.g. N, E, W, S, together? Did they add UP and DOWN measurements, to take an average of 6 separate data points? Did they give preference to 50 cm vs 10 cm? Did they even analyze 50 cm vs 10 cm or UP vs DOWN? All the data files hold this basic structure (time, N, E, W, S, UP, DOWN), with additional lat lon data from the ships, but reader gets no idea about averaging, filtering, etc.

Reply. We have rephrased following description in the beginning of section 3.1:

“Fig. 4 shows time-series measurements of radioactive dose rates at the attic of Tokyo Port office from March 2011 to September 2015. The green dots show all measurement data (from all six directions and at two heights of 10 cm and 50 cm above the ground).”

No averaging and filtering processes were used in this work. We presented all measurement data.

P8L151 and following: “0.18 Sv/h in March 2012” I can not find nor reproduce that value. I calculate an average of 0.12 for March 2012 with a max of 0.14 (22 data points). What gives? “0.15 Sv/h in March 2013”? I can not find nor reproduce that value (I calculate average 0.10, max 0.12, for 20 data points), nor any of the following values listed in this paragraph.

Reply. The dose rate of 0.18  $\mu\text{Sv/h}$  appear in raw data (Wang et al., 2019). We have rephrased the description as following:

“It was 0.18  $\mu\text{Sv/h}$  in March 2012 (at 2330 UT on 13 March 2012, in raw data of Wang et al. (2019)), one year after the disaster.”

Figure 4: vertical blue lines indicate years after FNPP accident?

Reply. We have rephrased the figure caption for Figure 4 as following:

“The vertical red line indicates the maximum and minimum air dose rates measured in a month. Vertical blue lines indicate 11 March of 2011, 2012, 2013, 2014, and 2015, respectively.”

Figure 5 (and many other figures): The dose meter data in all these figures shows discrete rather than continuous values. One might suspect bit noise but we get no information about data resolution. We do see the impact of the start-to-end calibration because these discrete values clearly decline in magnitude over time while still retaining their discrete distributions?

Reply. As indicated in a previous reply, the precisions of the sensors are within 2% (50<sup>th</sup> percentile) and 5% (75<sup>th</sup> percentile) of the deviations from the 4 designated dose rates. Hence, the sensors are quite accurate and all the raw data (Wang et al., 2019) were calibrated and presented in this work (Wang, 2019). The gradual decline in magnitude of dose rates over time are consistent with the decline of radioactivity with time over the source region and land area, as shown in Figures 4 and 11.

At this point I gave up. Until the text matches data, or data matches the text, or the authors give better clearer instructions to reviewers and potential users, I see no point in proceeding.

Reply. We are very grateful to the reviewer for the very insightful comments. The raw data (Wang et al., 2019) and the calibrated data in csv format (Wang, 2019) were uploaded. It was the original raw data values that were referred in the text of the submitted manuscript.

**Prüfling / Test piece :****RadEye G-10**

Seriennummer / Serial number :

**2113**

Software Version / Software version :

**E1.52**

Messbereich / Measurement range :

**10 nSv/h - 100 mSv/h****Kalibrierparameter / Calibration Parameters**

Umgebungsäquivalentdosisleistung / Ambient equivalent :

**H\*(10)**

Kalibrierdatum / Date of calibration :

**24. November 2010 / November 24, 2010****Kalibrierparameter / Calibration parameters**

Kalibrierfaktor / Calibration factor [(µSv/h)/cps] :

**6,0253E-01**

Totzeit R1 / Dead time R1 [µs] :

**6,0000E+01**

Totzeit TTP / Dead time TTP [µs] :

**1,5000E+01****Überprüfung der Messgenauigkeit mit Strahler Cs-137 :****Verification of the measurement accuracy Cs-137 :**

Die angegebenen Sollwerte der Dosisleistung haben eine Unsicherheit von weniger als ± 3%.

The indicated nominal values have an uncertainty of less than ± 3%

Sollwert [mSv/h] Nominal [mSv/h]	Messwert [mSv/h] Actual [mSv/h]	Abweichung [%] Deviation [%]	Messzeit [s] Measuring time [s]	Zulässige Abweichung [%] Tolerance limit [%]
0,080	0,080	-0,6	55	10
0,80	0,78	-2,9	25	10
8,0	8,3	3,7	25	10
80	83	3,3	25	10

Abweichungen innerhalb zulässiger Toleranz / Deviation within the tolerance : **Ja / Yes**

Überstrahlung in Ordnung / Overrange OK :

**Ja / Yes**

Alarmeintrag im Logbuch / Alarm entry in logbook :

**Ja / Yes**

Prüfung gemäß Prüfanweisung für RadEye G-10 / Test according to test instruction RadEye G-10.

Kalibrierung gespeichert in Datei / Calibration is saved in File :

Kalibrieranlage PC1\C:\Programme\Thermo\CalRadEyeMulti\Calib\42506-76 RadEye G-10.cal

Unser Qualitätsmanagementsystem ist zertifiziert nach ISO 9001.

Our quality management system has been certified according to ISO 9001.

Die Kalibrierung ist rückführbar auf die nationalen Normale der PTB und NIST (über MRA-Statement für Kalibrierzertifikate).

The calibration is traceable to the national standards of the PTB and NIST (via MRA statement for Calibration Certificates).

Protokolldatum / Protocol date:

Erlangen, 24. Nov. 10 / Nov. 24, 10

Unterschrift des Prüfers / Signature :

*V. Asmus*

V. Asmus



**Prüfling / Test piece :**
**RadEye G-10**

Seriennummer / Serial number :

**2113**

Software Version / Software version :

E1.52

Messbereich / Measurement range :

10 nSv/h - 100 mSv/h

**Werkseinstellungen / Factory settings (7601)**
**Allgemein / Generals**

Typ / Type :	Export / Export
Anzeigeeinheit / Unit :	Sievert / Sievert
Energiebewertung nach / Measured quantity :	H*(10)
Grundanzeige / Default display :	Dosisleistung / Dose Rate [
Tastaturpieps / Beep when key pressed :	An / On
History Zeitintervall / History timer interval :	120 s
Akustische Anzeige / Acoustic Indication :	Einzelimpuls / Single Pulse
Temperaturanzeige / Display temperature :	Celsius / Celsius
Obere Taste zeigt Dosis / Upper key display dose :	An / On
Autosend / Autosend :	Aus / Off
Sprache / Language :	Englisch / English
Batterietyp / Type of battery :	Batterie (Alkaline) / Battery (Alkaline)
Anzeige umdrehbar / Display upside down :	Aus / Off

**Text / Text**

Textinfo 1 / Text Info 1 :  
 Textinfo 2 / Text Info 2 :  
 Textinfo 3 / Text Info 3 :  
 Textinfo 4 / Text Info 4 :  
 Textfeld / Text Field :

**Alarme / Alarms**

Dosisleistung / Dose Rate :	Alarm 1 / Alarm 1	Alarm 2 / Alarm 2
Dosis / Dose	5,000E-01 µSv/h	2,500E+01 µSv/h
	6,911E+05 µSv	6,911E+05 µSv
Alarm nicht änderbar / Alarm read only :	Nein / No	

**Alarmgeber / Alarm indicator**

Schallgeber / Beeper :	An / On
LED / LED :	An / On
Vibrator / Vibrator :	An / On
Alarmhaltezeit / Alarm latching time :	Aus / Off

**Aktive Funktionen / Active Functions**

Gerät aus / Instrument off	Dauerlicht ein / aus / Backlight on / off
Alarm Schallgeber ein / aus / Alarm beeper on / off	Alarmliste anzeigen / Show alarm
Alarm LED aus / ein / Alarm LED on / off	Einstellungen / Settings
Alarm Vibrator an / aus / Alarm Vibrator on / off	Text Info / Text Info
Alarm Dosisleist. setzen / Set Alarm Dose Rate	
Alarm Dosis setzen / Set Alarm Dose	
Automatisches senden / Autosend on / off	
Dosis löschen / Clear Dose	
Chirper an / aus / Finder on / off	
Einzelimpuls ein / aus / Single Pulse on / off	

**Prüfling / Test piece :****RadEye B20**

Seriennummer / Serial number :

**1059**

Software Version / Software version :

**E2.05****Kalibrierparameter / Calibration Parameters**

Umgebungsäquivalentdosisleistung / Ambient equivalent :

**H\*(10)**

Kalibrierdatum / Date of calibration :

**23. März 2011 / March 23, 2011****Kalibrierparameter / Calibration parameters**Kalibrierfaktor / Calibration factor [( $\mu$ Sv/h)/cps] :**1,7777E-01**Totzeit R1 / Dead time R1 [ $\mu$ s] :**1,2000E+02****Vergleichsmessungen / Check measurements**

Überprüfung der Messgenauigkeit mit Strahler Cs-137 :

Verification of the measurement accuracy Cs-137 :

Die angegebenen Sollwerte der Dosisleistung haben eine Unsicherheit von weniger als  $\pm 3\%$ .The indicated nominal values have an uncertainty of less than  $\pm 3\%$ 

Sollwert [mSv/h] Nominal [mSv/h]	Messwert [mSv/h] Actual [mSv/h]	Abweichung [%] Deviation [%]	Messzeit [s] Measuring time [s]	Zulässige Abweichung [%] Tolerance limit [%]
0,0800	0,0787	-1,6	60	10
0,800	0,813	1,6	30	10

  

				Efficiency [cps/Bq]				
	Nuklid Nuclide	Präparat Source	Aktivität [Bq] Aktivity [Bq]	Sollwert Nominal	Messwert Actual	Abweich. Deviation	Messzeit [s] Meas. time [s]	Zul. Abweich.[%] Tol. limit [%]
Alpha:	Am-241	XR6	990	0,130	0,119	-8,3	20	20
Beta:	Sr-90	XR7	1.234	0,240	0,244	1,5	20	20

Nulleffekt [s-] / Background [cps]

Messwert / Value: 0,42

Minimum / Minimum : 0,30

Maximum / Maximum : 0,80

Abweichungen innerhalb zulässiger Toleranz / Deviation within the tolerance : **Ja / Yes**Überstrahlung in Ordnung / Overrange OK : **Ja / Yes**Alarmeintrag im Logbuch / Alarm entry in logbook : **Ja / Yes**

Prüfung gemäß Prüfanweisung für RadEye B20 / Test according to test instruction RadEye B20.

Kalibrierung gespeichert in Datei / Calibration is saved in File :

Kalibrieranlage PC1\C:\Programme\Thermo\CalRadEyeMulti\Calib\42506-85 RadEye B20.cal

Unser Qualitätsmanagementsystem ist zertifiziert nach ISO 9001.

Our quality management system has been certified according to ISO 9001.

Die Kalibrierung ist rückführbar auf die nationalen Normale der PTB und NIST (über MRA-Statement für Kalibrierzertifikate).

The calibration is traceable to the national standards of the PTB and NIST (via MRA statement for Calibration Certificates).

Protokolldatum / Protocol date:

Erlangen, 23. März 11 / Mar. 23, 11

Unterschrift des Prüfers / Signature :

  
G. Weber

**Prüfling / Test piece :****RadEye B20**

Seriennummer / Serial number :

**1059**

Software Version / Software version :

**E2.05****Werkseinstellungen / Factory settings (8503)****Generals**

Type :	Export
Typ of Filter :	Without
Beep when key pressed :	On
History timer interval :	120 s
Language :	English
Type of battery :	Battery (Alkaline)
Acoustic Indication :	Single Pulse
Display temperature :	None
Upper key display dose :	On
Display upside down :	On
Autosend :	Off

**Text**

Text Info 1 :  
Text Info 2 :  
Text Info 3 :  
Text Info 4 :  
Text Field :

**Mode**

Operation Mode :	Ratemeter
Unit :	cps

**Scaler**

Auto restart :	Off
Background subtraction :	Off
Scaler mode :	Time
Preset time :	60 s
Preset counts :	100 counts

**Ratemeter**

Background subtraction :	Off
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**Background**

Current Background :	0,00 cps
Preset time :	60 s
Preset counts :	100 counts



**Prüfling / Test piece :**
**RadEye B20**

Seriennummer / Serial number :

**1059**

Software Version / Software version :

**E2.05**
**Nuclide**

Number of Nuclides :

6

Active Nuclide :

3

#	Nuclide	%Efficiency (relate to activity)	
		Without Filter	With Alpha Blocker
1	C-14	7,1	1,1
2	Co-60	12,5	6,7
<b>3</b>	<b>Tl-204</b>	<b>21,5</b>	<b>11,5</b>
4	Cs-137	21,1	16,3
5	Cl-36	20,4	15,5
6	Sr/Y90	22,9	17,6

**Alarms**

Contamination :

Alarm 1

Alarm 2

Count Rate :

8,00 Bq

80,00 Bq

Dose Rate :

1,00 cps

10,00 cps

Dose

0,50 µSv/h

25,00 µSv/h

9999999,00 µSv

9999999,00 µSv

Alarm read only :

No

**Alarm indicator**

Beeper :

On

LED :

On

Vibrator :

On

Alarm latching time :

Off

**Active Functions**

Instrument off

Alarm Contamination

Background

Alarm Dose

Backlight on / off

Clear Dose

Measuring units

Settings

Operation mode

Alarm indication

Scaler Parameter

Show alarm

Nuclide Table

Text Info

Alarm Count Rate

Bluetooth

Alarm Dose Rate