ASOPOS-Webinar Series on the Implementation of the Recommendations Made by the ASOPOS 2.0 Panel

Ozonesonde Measurement Principles and Best Operational Practices

ASOPOS 2.0 (GAW Report No. 268) (Assessment of Standard Operating Procedures for Ozonesondes)

ASOPOS-Webinar No. 3 Standard Operating Procedures (SOPs) for Ozonesondes

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Outline

- Introduction
- First preparation (3 to 30 days prior to launch)
- Second preparation (0 to 1 day prior to launch)
- Issues to avoid & potential pitfalls
- Take away messages





Introduction

- from the JOSIE campaigns: operating and preparation procedures impact accuracy and precision from ozonesonde measurements
- Overall recommendation: DO NOT CHANGE! (i.e. don't switch to a different combination)
 - ✓ SPC-6A + SST1.0 + PFE: Komhyr 1986
 - ✓ En-Sci (2)Z + SST0.5 + PFE: Komhyr 1995
 - ✓ En-Sci (2)Z + SST0.1 + PFE: Johnson et al. 2002/Nakano & Morofuji 2022
- SOPs: only small, but important, changes proposed
- Reference to WMO GAW 201 (old) and WMO GAW 268 (new)





Introduction

- SOPs: only small (but important) changes proposed → WHY CHANGES?
 - \checkmark Keep SOPs as simple as possible.
 - ✓ Drop manipulations without proven added value (e.g. back pressure of pumps).
 - ✓ Avoid unnecessary manipulations with cells opened (e.g. refreshing solutions).
 - \checkmark Build in some quality checks/limiting values to avoid launch of bad ozonesondes.
 - ✓ Get ready for future reprocessing based on current knowledge (Vömel et al., 2020; Tarasick et al., 2021; Smit et al., in preparation): I_{B0} , I_{B1} , sensor response time.
- HOW/WHY doing the preparation steps:
 - ✓ video on Preparation of an ECC-Ozonesonde: <u>https://vimeo.com/niwanz/asoposprep</u>
 - ✓ GAW Report No. 268, particularly Chapter 4 (WHY) and Annex A (HOW)

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➔ Here: key messages + most important changes w.r.t. WMO GAW 201!



First preparation (3 to 30 days prior to launch)

PURPOSE:

- cleaning some parts of the ozonesonde
- first pre-check of overall performance of the ozonesonde
- charging the ozonesonde with sensing solutions for the first time

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GLOBAL ATMOSPHER





First preparation (3 to 30 days prior to launch) WMO GAW 201 (old)

OZONE SONDE CONDITIONING AND PRE-FLIGHT PREPARATIONS

3-7 Days Prior to Launch Date	_Ozone Unit Number	Initials	
Liti-1 Deven Comment			
Initial Pump Current	mA (~< 100 mA)		
Pump Head Pressure	psi (~>10 psi)		
Pump Suction	inches Hg (~< 20 in H	g)	
Condition with High Ozone for 30	min (tubing, pump, cathode chamber)		
Condition with Zero Ozone (filter)	Condition with Zero Ozone (filter) for 5 min		
Fill with Cathode Solution (3 ml). Wait 2 min			
Fill with Anode Solution (1.5 ml)			
Condition with Zero Ozone for 10 min			
Run on high ozone (5 µA) for 10 min			
Ozone free air for 10 min. Check that O3 decreases by 70-80% in 1 min			
Background current may be 0.2 - 0.5 µA at this time. It will decrease in the next days			
Add 3 ml to cathode. Short ECC-co	Add 3 ml to cathode. Short ECC-cell Leads. Replace in Plastic Storage Bag		



WMO GAW 268 (new)

ASOPOS 2.0 ECC Ozonesonde Blank Checklist Sheet A-9.2 Version June 2021

Pre-conditioning (prepared 3 to 30 days before flight)

- Date of pre-conditioning (YYYYMMDD): ____ 1.
- Operator Initials: ____ 2.
- Station ID: ___ 3.
- ECC serial number: ____ 4.
- Manufacture Date (YYYYMMDD): ____ 5.
- Manufacturer pump voltage (V): ____ 6.
- Manufacturer pump current (mA): ____ 7.
- Manufacturer flowrate (s/100ml): ____ 8.
- 9. Sensing Solution/Buffer: ____
- Sensing Solution Identifier: ___ 10.
- 11. Run 10 min of NO-Ozone air: ___
- Bypass Cathode chamber: Yes No
- 13. Run 30 min on High Ozone: ____
- 14. Run 5 min on NO-Ozone air:
- Add 3.0 cm³ Cathode solution (wait 2 min):
- Add 1.5 cm³ Anode solution:
- Run on no-Ozone air until the current drops below 0.3µA: _____
- 18. Run 10 min at 5 µA Ozone: ____
- 19. Switch to no-Ozone air and record time to drop from 4 to 1.5 µA (s): ___
- 20. Run 10 min on NO-Ozone air: ____ Record Ozone Current (μA): ___
- Short cell leads: ____
- 22. Store in sonde box, with tissue under the cells: ____





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OZONE SONDE CONDITIONING AND PRE-FLIGHT PREPARATIONS

Date	Ozone Unit NumberInitials	
Initial Pump Current	mA (~< 100 mA)	
Pump Head Pressure	psi (~>10 psi)	
Pump Suction	inches Hg (~< 20 in Hg)	
Condition with High Ozone for 30	min (tubing, pump, cathode chamber)	[
Condition with Zero Ozone (filter) for 5 min		
Fill with Cathode Solution (3 ml). Wait 2 min		
Fill with Anode Solution (1.5 ml)		Ì
Condition with Zero Ozone for 10	min	j
Run on high ozone (5 uA) for 10 n	nin	Ì
Ozone free air for 10 min. Check t	hat O ₂ decreases by 70-80% in 1 min	í
Background current may	be 0.2 - 0.5 uA at this time. It will decrease in the next	davs .
Add 3 ml to cathode. Short ECC-c	ell Leads. Replace in Plastic Storage Bag	

1. First preparation period extended

➔ no need to refresh solutions after 1 week

Pre	conditioning (prepared 3 to 30 days before flight)
1.	Date of pre-conditioning (YYYYMMDD):
2.	Operator Initials:
3.	Station ID:
4.	ECC serial number:
5.	Manufacture Date (YYYYMMDD):
6.	Manufacturer pump voltage (V):
7.	Manufacturer pump current (mA):
8.	Manufacturer flowrate (s/100ml):
9.	Sensing Solution/Buffer:
10.	Sensing Solution Identifier:
11.	Run 10 min of NO-Ozone air:
12.	Bypass Cathode chamber: Yes No
13.	Run 30 min on High Ozone:
14.	Run 5 min on NO-Ozone air:
15.	Add 3.0 cm ³ Cathode solution (wait 2 min):
16.	Add 1.5 cm ³ Anode solution:
17.	Run on no-Ozone air until the current drops below 0.3 μ A:
18.	Run 10 min at 5 µA Ozone:
19.	Switch to no-Ozone air and record time to drop from 4 to 1.5 μA (s):
20.	Run 10 min on NO-Ozone air: Record Ozone Current (µA):
21.	Short cell leads:
22.	Store in sonde box, with tissue under the cells:



OZONE SONDE CONDITIONING AND PRE-FLIGHT PREPARATIONS

3-7 Days Prior to Launch	Ozona Unit Number	Initials
Date	Ozone Unit Number	Initials
Initial Pump Current	mA (~< 100 mA	.)
Pump Head Pressure	psi (~>10 psi)	,
Pump Suction	inches Hg (~< 20	0 in Hg)
Condition with High Ozone for 30	min (tubing, pump, cathode cha	mber) [
Condition with Zero Ozone (filter)	for 5 min	Ĵ
Fill with Cathode Solution (3 ml).	Wait 2 min	Ĵ
Fill with Anode Solution (1.5 ml)		Ī
Condition with Zero Ozone for 10	min	Ĵ
Run on high ozone (5 µA) for 10 n	nin	Ĩ
Ozone free air for 10 min. Check t	hat O ₁ decreases by 70-80% in 1	min [
Background current may	be $0.2 - 0.5 \mu A$ at this time. It will	ll decrease in the next days
Add 3 ml to cathode. Short ECC-co	ll Leads. Replace in Plastic Stor	rage Bag [

2. Pump Head Pressure/Suction no longer needed

- ✓ note manufacturer measurements
- ✓ measured pump current < 120mA!

WMO GAW 268 (new)			
A-9.2 ASOPOS 2.0 ECC Ozonesonde Blank Checklist Sheet			
Pre	Pre-conditioning (prepared 3 to 30 days before flight)		
1.	Date of pre-conditioning (YYYYMMDD):		
2.	Operator Initials:		
3.	Station ID:	There should be	
4.	ECC serial number:		
5.	Manufacture Date (YYYYMMDD):	also measured !	
6	Manufacturer pump voltage (V):		
7.	Manufacturer pump current (mA):		
8.	Manufacturer flowrate (s/100ml):		
9.	Sensing Solution/Buffer:		
10.	Sensing Solution Identifier:		
11.	Run 10 min of NO-Ozone air:		
12.	Bypass Cathode chamber: Yes No		
13.	Run 30 min on High Ozone:		
14.	Run 5 min on NO-Ozone air:		
15.	Add 3.0 cm^3 Cathode solution (wait 2 min):		
16.	Add 1.5 cm ³ Anode solution:		
17.	Run on no-Ozone air until the current drops be	elow 0.3µA:	
18.	Run 10 min at 5 µA Ozone:		
19.	Switch to no-Ozone air and record time to dro	p from 4 to 1.5 μA (s):	
20.	Run 10 min on NO-Ozone air: Record Ozo	ne Current (μΑ):	
21.	Short cell leads:		
22.	Store in sonde box, with tissue under the cells	-	
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OZONE SONDE CONDITIONING AND PRE-FLIGHT PREPARATIONS



2. Pump Head Pressure/Suction no longer needed

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- ✓ note manufacturer measurements
- ✓ measured pump current < 120mA!</p>



First preparation (3 to 30 days prior to launch) WMO GAW 201 (old)

OZONE SONDE CONDITIONING AND PRE-FLIGHT PREPARATIONS

3-7 Days Prior to Launch		
Date	_Ozone Unit Number	Initials
Initial Pump Current	mA (~< 100 mA	A)
Pump Head Pressure	psi (~>10 psi)	
Pump Suction	inches Hg (< 2	20 in Hg)
Condition with High Ozone for 30	min (tubing, pump, cathode cha	amber) [
Condition with Zero Ozone (filter)	for 5 min]
Fill with Cathode Solution (3 ml).	Wait 2 min]
Fill with Anode Solution (1.5 ml)]
Condition with Zero Ozone for 10	min]
Run on high ozone (5 µA) for 10 n	nin]
Ozone free air for 10 min. Check t	hat O3 decreases by 70-80% in 1	min [
Background current may	be 0.2 - 0.5 µA at this time. It wi	ill decrease in the next days
Add 3 ml to cathode. Short ECC-c	ell Leads. Replace in Plastic Sto	rage Bag [

- 3. Conditioning with high ozone amounts
 - ✓ NEW sondes: tubing, pump & cathode chamber (i.e. **NO** BYPASS)
 - ✓ RE-USED sondes: tubing, pump & <u>only</u> cathode chamber <u>cap</u> (i.e. **<u>BYPASS</u>** cathode chamber)

WMO GAW 268 (new) A-9.2 ASOPOS 2.0 ECC Ozonesonde Blank Checklist Sheet Version June 2021 Pre-conditioning (prepared 3 to 30 days before flight) Date of pre-conditioning (YYYYMMDD): ____ 1. Operator Initials: ____ 2. 3. Station ID: ____ ECC serial number: ____ 4. Manufacture Date (YYYYMMDD): ____ 5. Manufacturer pump voltage (V): ____ 6. Manufacturer pump current (mA): ____ 7. Manufacturer flowrate (s/100ml): ____ 8. Sensing Solution/Buffer: ____ 9. Sensing Solution Identifier: __ 10. Run 10 min of NO-Ozone air: _____ Bypass Cathode chamber: Yes Run 30 min on High Ozone: 14. Run 5 min on NO-Ozone air: Add 3.0 cm³ Cathode solution (wait 2 min): 15. Add 1.5 cm³ Anode solution: 16. Run on no-Ozone air until the current drops below 0.3µA: _____ Run 10 min at 5 µA Ozone: ___ 18. Switch to no-Ozone air and record time to drop from 4 to $1.5 \,\mu A$ (s): ___ Run 10 min on NO-Ozone air: ____ Record Ozone Current (µA): ___ 20. Short cell leads: ____ 22. Store in sonde box, with tissue under the cells:













First preparation (3 to 30 days prior to launch) WMO GAW 201 (old)

OZONE SONDE CONDITIONING AND PRE-FLIGHT PREPARATIONS

3-7 Days Prior to Launch		
Date	Ozone Unit Number	Initials
Initial Pump Current	mA (~< 100 mA)
Pump Head Pressure	psi (~>10 psi)	*
Pump Suction	inches Hg (< 2)	0 in Hg)
Condition with High Ozone for 30	min (tubing, pump, cathode cha	mber) [
Condition with Zero Ozone (filter)	for 5 min]
Fill with Cathode Solution (3 ml).	Wait 2 min]
Fill with Anode Solution (1.5 ml)]
Condition with Zero Ozone for 10	min]
Run on high ozone (5 µA) for 10 n	nin]
Ozone free air for 10 min. Check t	hat O3 decreases by 70-80% in 1	min [
Background current may	be 0.2 - 0.5 µA at this time. It wil	l decrease in the next days
Add 3 ml to cathode. Short ECC-co	ell Leads. Replace in Plastic Stor	age Bag [

- 3. Conditioning with high ozone amounts
 - ✓ NEW sondes: tubing, pump & cathode chamber (i.e. **NO** BYPASS)
 - RE-USED sondes: tubing, pump & <u>only</u> cathode chamber <u>cap</u> (i.e. **<u>BYPASS</u>** cathode chamber)

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WMO GAW 268 (new)

ASOPOS 2.0 ECC Ozonesonde Blank Checklist Sheet A-9.2 Version June 2021

Pre-conditioning (prepared 3 to 30 days before flight)

- Date of pre-conditioning (YYYYMMDD): ____ 1.
- Operator Initials: ____ 2.
- Station ID: 3.
- ECC serial number: 4.
- Manufacture Date (YYYYMMDD): 5.
- Manufacturer pump voltage (V): ____ 6.
- Manufacturer pump current (mA): ____ 7.
- Manufacturer flowrate (s/100ml): ____ 8.
- 9. Sensing Solution/Buffer:
- Sensing Solution Identifier: 10.



OZONE SONDE CONDITIONING AND PRE-FLIGHT PREPARATIONS

3-7 Days Prior to Launch		
Date	Ozone Unit Number	Initials
Initial Pump Current	mA (~< 100 mA)	
Pump Head Pressure	psi (~>10 psi)	
Pump Suction	inches Hg (~< 20 in H	g)
Condition with High Ozone for 30	min (tubing, pump, cathode chamber)] [
Condition with Zero Ozone (filter)	for 5 min	[
Fill with Cathode Solution (3 ml).	Wait 2 min	Ι
Fill with Anode Solution (1.5 ml)		[
Condition with Zero Ozone for 10	min	I
Run on high ozone (5 µA) for 10 n	lin	[
Ozone free air for 10 min. Check t	hat O3 decreases by 70-80% in 1 min	Ī
Background current may b	be 0.2 - 0.5 µA at this time. It will decr	ease in the next days
Add 3 ml to cathode. Short ECC-co	ell Leads. Replace in Plastic Storage B	ag [

- 4. When first charged with solutions, run zero ozone air through the cells for a longer time (< 30 min)
 - There should be a reaction (high ozone currents) first!
 - ✓ Ozone current should then drop below
 0.3 µA within 30 min.
 (longer for En-Sci than SPC)

WMO GAW 268 (new) ASOPOS 2.0 ECC Ozonesonde Blank Checklist Sheet A-9.2 Version June 2021 Pre-conditioning (prepared 3 to 30 days before flight) Date of pre-conditioning (YYYYMMDD): ____ 1. Operator Initials: ____ 2. 3. Station ID: ___ ECC serial number: ____ 4. Manufacture Date (YYYYMMDD): ____ 5. Manufacturer pump voltage (V): ____ 6. Manufacturer pump current (mA): ____ 7. Manufacturer flowrate (s/100ml): ____ 8. Sensing Solution/Buffer: ____ 9. Sensing Solution Identifier: __ 10. 11. Run 10 min of NO-Ozone air: ____ Bypass Cathode chamber: Yes No 13. Run 30 min on High Ozone: ___ 14. Run 5 min on NO-Ozone air: ____ Add 3.0 cm³ Cathode solution (wait 2 min): 15. Add 1.5 cm³ Anode solution: Run on no-Ozone air until the current drops below 0.3µA: 18. Run 10 min at 5 µA Ozone: ____ 19. Switch to no-Ozone air and record time to drop from 4 to 1.5 μA (s): ___ Run 10 min on NO-Ozone air: _ Record Ozone Current (µA): __ 20. Short cell leads: ____ 22. Store in sonde box, with tissue under the cells:



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OZONE SONDE CONDITIONING AND PRE-FLIGHT PREPARATIONS

Date Ozone Unit Number Initials
Initial Pump Current mA (~< 100 mA)
Pump Head Pressure psi (~>10 psi)
Pump Suction inches Hg (~< 20 in Hg)
Condition with High Ozone for 30 min (tubing, pump, cathode chamber)
Condition with Zero Ozone (filter) for 5 min
Fill with Cathode Solution (3 ml). Wait 2 min
Fill with Anode Solution (1.5 ml)
Condition with Zero Ozone for 10 min
Run on high ozone (5 µA) for 10 min
Ozone free air for 10 min. Check that O ₃ decreases by 70-80% in 1 min
Background current may be 0.2 - 0.5 uA at this time. It will decrease in the next days
Add 3 ml to cathode. Short ECC-cell Leads. Replace in Plastic Storage Bag

- 5. Store prepared ozonesonde in Styrofoam box, with tissue under the cells
- ➔ leaking of cells can then be checked after storage (brown stains from KI)!

WMO GAW 268 (new)		
A-9.2 ASOPOS 2.0 ECC Ozonesonde Blank Checklist Sheet Version June 2021		
Pre	-conditioning (prepared 3 to 30 days before flight)	
1.	Date of pre-conditioning (YYYYMMDD):	
2.	Operator Initials:	
3.	Station ID:	
4.	ECC serial number:	
5.	Manufacture Date (YYYYMMDD):	
6.	Manufacturer pump voltage (V):	
7.	Manufacturer pump current (mA):	
8.	Manufacturer flowrate (s/100ml):	
9.	Sensing Solution/Buffer:	
10.	Sensing Solution Identifier:	
11.	Run 10 min of NO-Ozone air:	
12.	Bypass Cathode chamber: Yes No	
13.	Run 30 min on High Ozone:	
14.	Run 5 min on NO-Ozone air:	
15.	Add 3.0 cm ³ Cathode solution (wait 2 min):	
16.	Add 1.5 cm ³ Anode solution:	
17.	Run on no-Ozone air until the current drops below 0.3 μ A:	
18.	Run 10 min at 5 µA Ozone:	
19.	Switch to no-Ozone air and record time to drop from 4 to 1.5 μA (s):	
20.	Run 10 min on NO-Ozone air: Record Ozone Current (μ A):	
21.	Short cell leads:	
22.	Store in sonde box, with tissue under the cells:	
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Second preparation (0 to 1 day prior to launch) – "day of flight"

PURPOSE:

- final check of overall performance of the ozonesonde
- measure the variables that enter in the basic equation of the ozonesonde measurement:



• measure variables that *(might)* enter *(in the future)* in the ozonesonde data processing code (lab conditions at flow rate measurement, background current I_{B0} , fast response time)



1 - 24 hours prior to flight (multiple columns/rows allow for multiple tests of same ozonesonde)

Date					
Initials					
Rinse Catho	de and Anode ce	lls []	[]	[]
Replace Cat	hode (3 ml)]]	[]	[]
Replace And	ode (1.5 ml)]]	[]	[]
Attach cell le	eads to ozone go	enerator [1	[]	[]
Ozone free a	air on pump intal	ce [1	[]	[]
Pump motor	current (~<100	mA)			mA
Background	/~time to bkg				μΑ
Replace solu	itions if backgro	und is ~≥0.10 μA	(~0.35 mPa).		
-	-				
Moderate oz	one (~5 μA) for	10 minutes []	[]	[]
Switch to o	zone free air an	nd record (µA) a	t:		
0.0	0.5	1	3	5	10 min
		_	_		(1)
					(2)
					(3)
Flow rate (m	11 min ⁻¹⁾				
Record P/T/I	RH				
Ozone Backs	ground in lab:				hex/mPa
Background	before release:				hex/mPa
Surface ozor	ne before release:				hex/mPa
Ozone pump	temp:				°C
			GAW Report No. 201		

uality Assurance and Quality Control fo conecorde Measurements in GAW

WMO GAW 268 (new) Final conditioning for 0-1 day prior to launch Date (YYYYMMDD): _____ 1. Operator Initials: 2. Check tissue under the cells for any leakage: ____ 3. Remove original Cathode and Anode solution: 4 Add 3.0 cm³ cathode solution (wait minimum 2 min): 5. Add 1.5 cm³ anode solution: 6. Run 10 min of no-Ozone air: 7. 8. Record Ozone current (IBO) (µA): ____ Run 10 min at 5 µA Ozone: ____ 9. 10. Switch to NO-Ozone air and record time to drop from 4 to 1.5 µA (s): Run on NO-Ozone air: _____ Record 5 times t100 inverse flow rates (s/100ml): 12. 01

01.	
02.	
03.	

04.	
05.	

- 13. Average t100 time (s/100ml) inverse flowrate:
- Lab Temperature TLab (°C): _____
- 15. Lab Relative Humidity RHLab (%): _____
- 16. Lab Pressure PLab (hPa): _____
- 17. After 10 min on NO-Ozone air, record Ozone Current (IB1) (µA):_____
- Pump Motor Current (mA): _____
- 19. End time of preparation (UTC): HH:MM

If the sonde package is not flown during final conditioning procedures:

20. Short cell leads: ____





Ozonesonde Measurement Principles and

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Best Operational Practices

August 202

28.03.24







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1 - 24 hours prior to flight (multiple columns/rows allow for multiple tests of same ozonesonde)

Date					
Initials					
Rinse Cathoo	de and Anode co	ells]	[]	[]
Replace Cath	node (3 ml)	ĺ	1	[]	[]
Replace Ano	de (1.5 ml)	ĺ]	[]	[]
Attach cell le	eads to ozone g	enerator]	ĒĴ	[]
Ozone free a	ir on pump inta	ke [1	ĒĴ	Î Î
Pump motor	current (~<100	mA)			mA
Background	/~time to bkg				μΑ
Replace solu	tions if backgro	und is ~≥0.10 μA	(~0.35 mPa).		
Moderate oz	one (~5 µA) for	10 minutes	1	[]	[]
Switch to or	zone free air a	nd record (uA)	at:		
0.0	0.5	1	3	5	10 min
					(1)
					(2)
					(3)
Flow rate (m	1 min ⁻¹⁾				
Record P/T/F	RH				
Ozone Backg	round in lab:				hex/mPa
Background	before release:				hex/mPa
Surface ozen	e before release				hex/mPa
Ozone pump	temp:				°C

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- 1. background current measurements
 - \checkmark $I_{B0} < 0.03 \,\mu\text{A}$ + actions
 - \checkmark $I_{B1} < 0.07 \ \mu\text{A} + \text{timing}$
 - ✓ **No** I_{B2} (at launch site)!



Record PTU in lab

GLOBAL

pump flow

rates & average

1 - 24 hours prior to flight (multiple columns/rows allow for multiple tests of same ozonesonde)

Date				
Initials				
Rinse Cathode and Anode cel	ls	1	[]	[]
Replace Cathode (3 ml)	Í	1	i i	Ĩ Ĩ
Replace Anode (1.5 ml)	i	1	i i	î î
Attach cell leads to ozone ge	nerator	1	Ì Ì	î î
Ozone free air on pump intak	e I	1	i i	i i
Pump motor current (~<100 n	nA)			m
Background /~time to bkg	·			μΑ
Replace solutions if backgrou	nd is ~≥0.10 μA	(~0.35 mPa).		
1 0		``´´		
Moderate ozone (~5 µA) for	10 minutes]	[]	[]
Switch to ozone free air an	d record (uA)	at:		
0.0 0.5	1	3	5	10 min
				(1)
				(2)
				(3)
Flow rate (ml min ⁻¹⁾				
Record P/T/RH				
Ozone Background in lab:				hex/mPa
Background before release:				hex/mPa
Surface ozone before release:				hex/mPa
Ozone pump temp:				°C

2. sensor (fast) response test

→ response time of the drop from 4.0 to 1.5 μ A to be preferred, as it corresponds to direct measurement of the exp. decrease 1/e ≈ 0.368 ≈ 1.5/4.0

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		WMO GAW 268 (new)	
	Fina	l conditioning for 0–1 day prior to launch	
	1.	Date (YYYYMMDD):	
	2.	Operator Initials:	
	3.	Check tissue under the cells for any leakage:	
	4.	Remove original Cathode and Anode solution:	
	5.	Add 3.0 cm ³ cathode solution (wait minimum 2 min):	
	6.	Add 1.5 cm ³ anode solution:	
	7.	Run 10 min of no-Ozone air:	
	8.	Record Ozone current (Iso) (µA):	
	9.	Run 10 min at 5 µA Ozone:	
<	10.	Switch to NO-Ozone air and record time to drop from 4 to 1.5 µA (s):	>
	11.	Run on NO-Ozone air:	
	12.	Record 5 times t100 inverse flow rates (s/100ml):	
	01.		
	02.		
	03.		
	04.		
	05.		
	13.	Average t 100 time (s/100ml) inverse flowrate:	
	14.	Lab Temperature <i>TLab</i> (°C):	
	15.	Lab Relative Humidity RH Lab (%):	
	16.	Lab Pressure PLab (hPa):	
	17.	After 10 min on NO-Ozone air, record Ozone Current (<i>I</i> _{B1}) (µA):	
	18.	Pump Motor Current (mA):	
	19.	End time of preparation (UTC): HH:MM	
	If th	e sonde package is not flown during final conditioning procedures:	
	20.	Short cell leads:	
	21.	Store in sonde box:	
IO C		GLOBAL ATMOSPHERE WATCH	

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1 - 24 hours prior to flight (multiple columns/rows allow for multiple tests of same ozonesonde)

Date	-					
Initials						
Rinse Cathode and A	node cells	[]		[]		[]
Replace Cathode (3 n	nl)	í í		i i		í í
Replace Anode (1.5 r	nĺ)	î î		i i		i i
Attach cell leads to c	ozone generator	i i 🕐		i i		Ì Ì
Ozone free air on pur	np intake	î î		Ì Ì		Γĺ
Pump motor current (~<100 mA)					m/
Background /~time to	bkg .					μA
Replace solutions if h	background is ~	≥0.10 µA (~0.	35 mPa).			
Moderate ozone (~5)	uA) for 10 min	utes []		Г 1		L J
Switch to ozono fro	a air and room	ed (uA) et:		L 1		L J
Switch to ozone fre	e air and reco	ru (μΑ) at:	2	5		0
0.0 0.5		1	3	5	1	0 min
						(1)
						(2)
						(3)
Flow rate (ml min-1)						
Record P/T/RH						
Ozone Background in	lab:					hex/mPa
Background before re	lease:					hex/mPa
Surface ozone before	release:					hex/mPa
Ozone pump temp:						°C

 When performing pump flow rate measurements (→ "Hardware webinar"), accurately record PTU lab conditions for humidification correction (i.e., "dry flow rate" correction)

METEOROLOGICA

	WMO GAW 268 (new)
Fi	nal conditioning for 0–1 day prior to launch
1.	Date (YYYYMMDD):
2.	Operator Initials:
3.	Check tissue under the cells for any leakage:
4.	Remove original Cathode and Anode solution:
5.	Add 3.0 cm ³ cathode solution (wait minimum 2 min):
6.	Add 1.5 cm ³ anode solution:
7.	Run 10 min of no-Ozone air:
8.	Record Ozone current (<i>IBO</i>) (µA):
9.	Run 10 min at 5 µA Ozone:
10). Switch to NO-Ozone air and record time to drop from 4 to 1.5 μA (s):
1	L. Run on NO-Ozone air:
1	 Record 5 times t₁₀₀ inverse flow rates (s/100ml):
0:	
0	2
03	3
04	4
0	5
1	. Average t 100 time (s/100ml) inverse flowrate:
14	4. Lab Temperature <i>TLab</i> (°C):
1	5. Lab Relative Humidity RH_{Lab} (%):
1	o. Lab Pressure PLab (hPa):
17	7. After 10 min on NO Ozene zir, record Ozone Current (I_{B1}) (μ A):
10	3. Pump Motor Current (mA):
19	End time of preparation (UTC): HH:MM
If	the sonde package is not flown during final conditioning procedures:
20). Short cell leads:
	L. Store in sonde box:

Issues to avoid & potential pitfalls

- We are maintaining a Google Spaces chat/blog group for ozonesonde station operators and technicians. Contact <u>Gary.Morris@noaa.gov</u> to join the space.
- Some important pitfalls or guidelines:
 - \checkmark do not spill any of the anode into the cathode!
 - ✓ check pump temperature (through interface) just before launch
 - ✓ avoid evaporation (T_P >20°C) or freezing (T_P < 10°C for En-Sci, < 5°C for SPC) of solutions at lower pressures (P_{Air} < 50 hPa) → "Hardware" Webinar (#2)
 - \checkmark maintain and check the hardware used for the preparation \rightarrow "Hardware" Webinar (#2)
 - \checkmark carefully archive all the metadata gathered during the preparation \rightarrow "Metadata" Webinar (#6)
 - \checkmark follow guidelines for data processing \rightarrow "Processing" Webinar (#4)



Take away messages

- NOT treated here: SOPs for cleaning recovered sondes, new data format. Please see the report + more news from data archives in near future.
- MOST IMPORTANT TAKE HOME MESSAGE: Do <u>NOT</u> change your SOPs, unless seriously deviating from the SOPs in the report AND after discussing with an ASOPOS member.
- Most important proposed changes w.r.t. previous report:
 - \checkmark use I_{B1} for background current subtraction, do not measure I_{B2} anymore
 - ✓ I_{B0} < 0.03 µA and I_{B1} < 0.07 µA should be feasible with good zero ozone air sources
 - \checkmark (fast) time response measurement between 4 and 1.5 μA drop
 - During high ozone conditioning: distinction between new (no bypass) and recovered (bypass) ozonesondes



Closing Remarks

- □ This webinar no. 3 is part of a series of ASOPOS Webinars:
 - 1. Introduction to ASOPOS 2.0: An Overview (Anne Thompson & Herman Smit)
 - 2. Hardware (Herman Smit & Roeland Van Malderen)
 - 3. SOP: Standard Operating Procedures (Roeland Van Malderen, Peter von der Gathen, Gary Morris & Bryan Johnson)
 - 4. Data Processing (Herman Smit & David Tarasick)
 - 5. Data Quality Indicators (DQI) (Ryan Stauffer & Holger Vömel)
 - 6. Meta Data and Software (Ryan Stauffer & Roeland Van Malderen)
- The webinars do not replace the Report or associated video clips, but only highlight the most important topics and updates from the previous ASOPOS 1.0 report (WMO/GAW Report No. 201).
- □ Whenever you have questions or need advice, consult the authors of this webinar or any of the ASOPOS Team members listed above !!!

Thank you for your attention. We look forward to future collaborations!!!













