



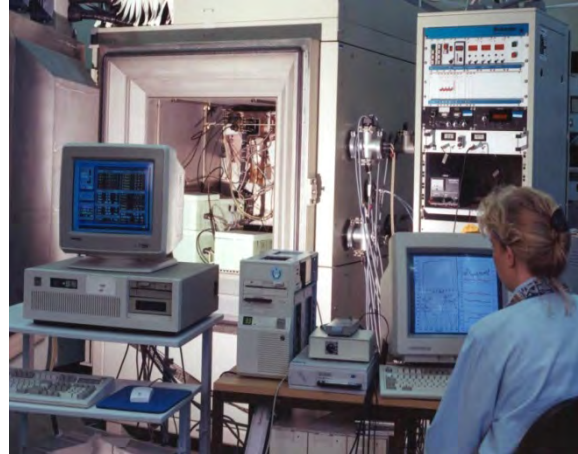
JOSIE 2017-SHADOZ at WCCOS:

Jülich Ozone Sonde Intercomparison Experiment

Herman G.J. Smit & Anne Thompson & JOSIE-SHADOZ Team



Quality Assurance (QA) of Ozone Sonde (O3S) Data



ASOPOS

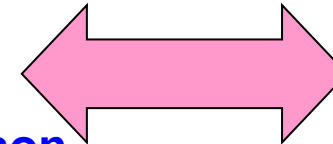
Assessment for
Standard
Operating
Procedures for
Ozone
Sondes



JOSIE

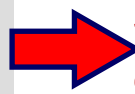
Jülich
Ozone
Sonde
Intercomparison
Experiment

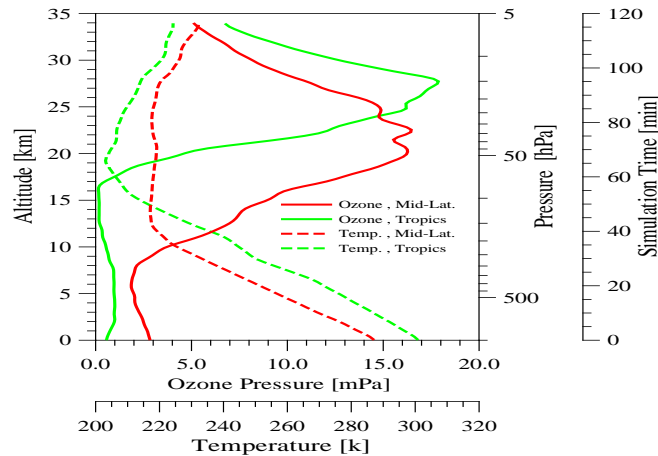
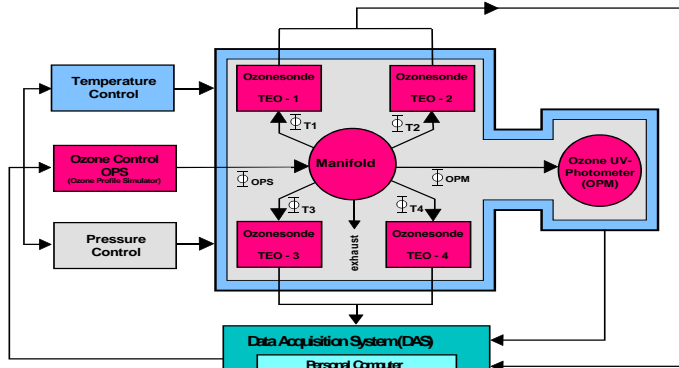
Since 1996



O3S-DQA

Ozone
Sonde
Data
Quality
Assurance

 **Standard operating procedures (SOP's) and Homogenisation of O3S data records can improve precision & uncertainty better $\pm 5\%$**



The facility enables control of pressure, temperature and ozone concentration and can simulate quasi realistic flight conditions of ozone soundings from surface to Z=35 km. A dual beam UV-photometer serves as a reference (uncertainty better than $\pm 5\%$).

- **JOSIE 1996: QA-Operation**
>> Small changes/differences of instruments or operating procedures can have significant impact on data quality!!!!
- **JOSIE 1998: QA-Manufacturers**
>> Differences between manufacturers
- **JOSIE 2000: QA-Procedures**
>> Differences between sensing solutions
- **ASOPOS 2001: Evaluation of JOSIE 2000**
>> Definition of provisional SOP's
- **BESOS 2004: Testing of provisional SOP's in the field**
- **ASOPOS 2004: Evaluation JOSIE & BESOS**
>> Unanimous agreement on SOP's
- **ASOPOS 2009: Approval SOP's by WMO**
>> GAW Report #201
- **JOSIE 2009-2011: QA-Manufacturers**
- **O3S-DQA Activity 2011-2017:**
>> Homogenisation long term O3S records
- **JOSIE 2017/SHADOZ:**
>> QA-Tropical profiling capabilities
- **ASOPOS 2.0 (2018-2019): Upgrade of SOP's**

Southern Hemisphere ADDitional OZonesondes



The **SHADOZ** project coordinated by Anne Thompson (NASA/GSFC) began in 1998 as a coordinated effort among NASA, NOAA and international partners to coordinate an operational network of tropical and remote ozone sounding sites. **To date, more than 7000 sets of ozone and P-T-U radiosonde measurements have been collected.**

JOSIE 2017 in collaboration with SHADOZ

Objectives:

- ✚ Tropical Profiling Capabilities
 - ✚ Critical instrumental issues: Background Current, Pump flow Corrections and Sensing Solution Type
 - ✚ Capacity building (support from UNEP-Vienna Convention Trust Fund (Montreal Protocol))
 - ✚ Testing to upgrade SOP's: ASOPOS 2.0 (Reload)
-
- Week 1: Present Status SHADOZ : Inhomogeneity in SOP's
 - Week 2: Future more homogeneity in SOP's
- Goal: Through better standardization of ground equipment and preparation procedures and instructions to achieve uncertainty better than 5%**

JOSIE 2017-SHADOZ: Participants

Session 1: 09-20 October 2017



VTCF-Funded Operators

Name	Affiliation	Country
Ernesto Corrales	University of Costa Rica	Costa Rica
Tshidi Machinini	South African Weather Service	South Africa
Nguyen Thi Hoang Anh	National Hydro-Meteorological Service of S.R. Vietnam	Vietnam
George Paiman	Meteorological Service of Suriname	Suriname
Françoise Posny	Université La Réunion, Météo-France, CNRS	France
Francisco R. da Silva	Brazilian Space Agency	Brazil
Kennedy Thiongo	Kenyan Meteorology Department	Nairobi
Zamuna Zainal	Malaysian Meteorological Department	Malaysia

Other Operator Participants

Name	Affiliation	Country
George Brothers	NASA/Wallops Flight Facility	USA
Katherine Wolff	NASA/Wallops Flight Facility	USA
Ryan Stauffer	NASA/Goddard Space Flight Center	USA

Coaches

Name	Affiliation	Country
Marc Allaart	Royal Netherlands Meteorological Institute	Netherlands
Patrick Cullis	NOAA/Global Monitoring Division	USA
Rigel Kivi	Finnish Meteorological Institute	Finland
Bryan Johnson	NOAA/Global Monitoring Division	USA
Gary Morris	St. Edward's University	USA
Anne Thompson	NASA/Goddard Space Flight Center	USA

Referees

Name	Affiliation	Country
Jonathan Davies	Environment and Climate Change Canada	Canada
Peter van der Gathen	Alfred Wegener Institute	Germany
Roeland van Malderen	Royal Meteorological Institute of Belgium	Belgium

Other Participants

Name	Affiliation	Country
Réné Stübi	Federal Office of Meteorology and Climatology MeteoSwiss	Switzerland
Gilbert Levrat		
Gonzague Romanens		
Greg Kok	ENSCI	USA
Nakano Tatsumi	Japan Meteorological Agency	Japan
Jacquelyn Witte	NASA/Goddard Space Flight Center	USA

Session 2: 23 October-03 November 2017



JOSIE 2017-SHADOZ: Session Schedule for 2 Weeks.

Session 1: 9-20 Oct. Session 2: 23 Oct-3 Nov. 2017

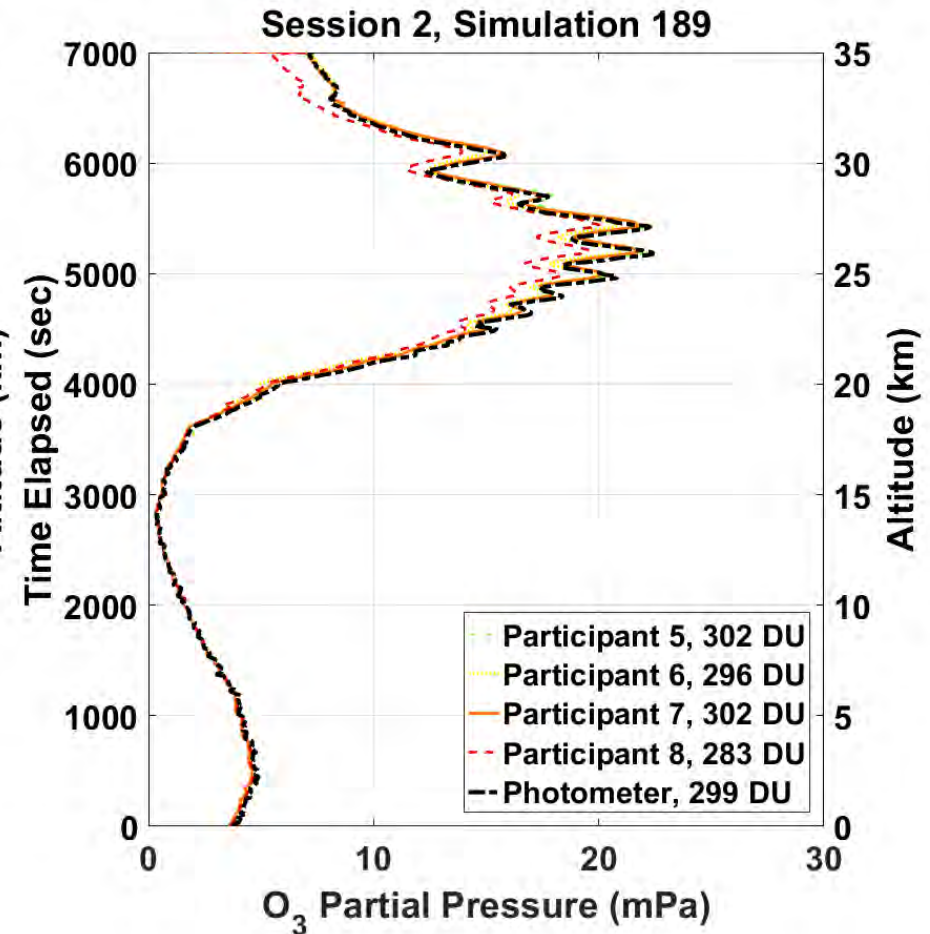
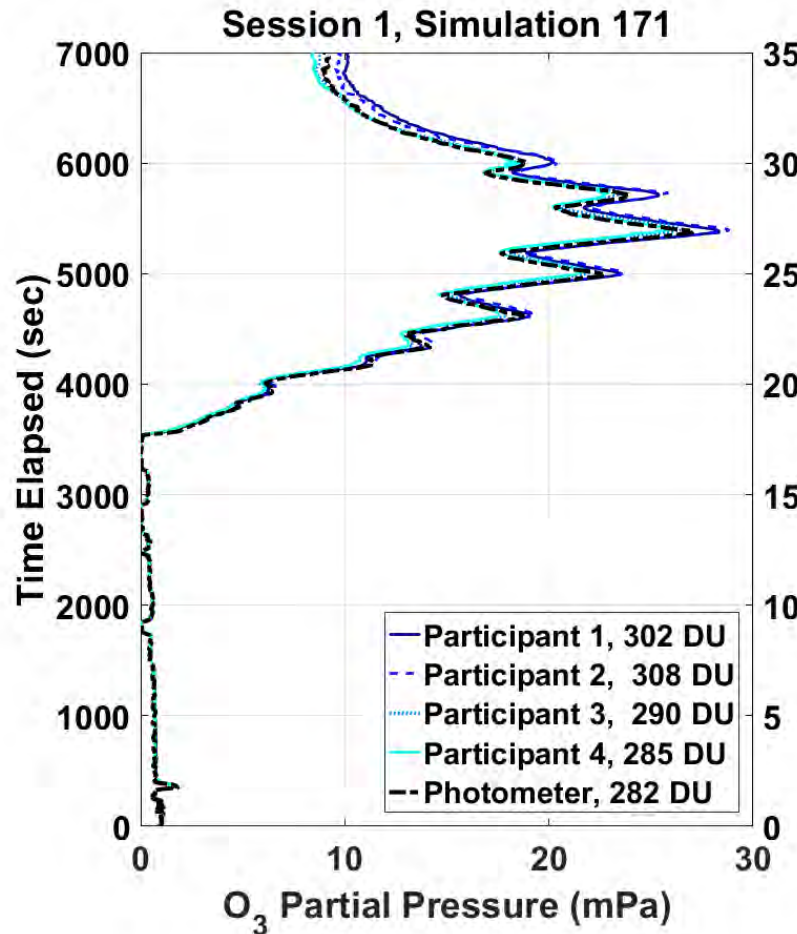
Day	Lecture	Tutorial	Activity
Sunday (Day#01)			Arrival
Monday (Day#02)	Principles of an ozone sounding		Installation Ground Equipment 3-5 days preparation of O3S
Tuesday (Day#03)	Standard Operating Procedures (SOPs)	Preparation of an ozone sonde in practice	Test of O3S-simulation run
Wednesday (Day#04)	Post-flight data processing	Post-flight data processing in practice	First O3S simulation run Evaluation of first results
Thursday (Day#05)	Chemistry of O3+KI		Two O3S simulation runs
Friday (Day#06)	Pumpflow efficiency		Two O3S simulation runs
Saturday (Day#07)	Uncertainty analysis	Uncertainty analysis in practice	
Sunday (Day#08)			Sight seeing
Monday (Day#09)	Radiosonde-PTU & GPS/Wind/Altitude		Mid-term evaluation meeting on the results of O3S
Tuesday (Day#10)	Background current		Two O3S simulation runs
Wednesday (Day#11)	Total ozone column/normalisation		Two O3S simulation runs
Thursday (Day#12)	QA/QC-evaluation	QA/QC-evaluation in practice	Last O3S simulation run
Friday (Day#13)			Final evaluation meeting Packing
Saturday (Day#14)			Departure

Present Status:
Inhomogeneity in SOP's



Future Status: More
homogeneity in SOP's

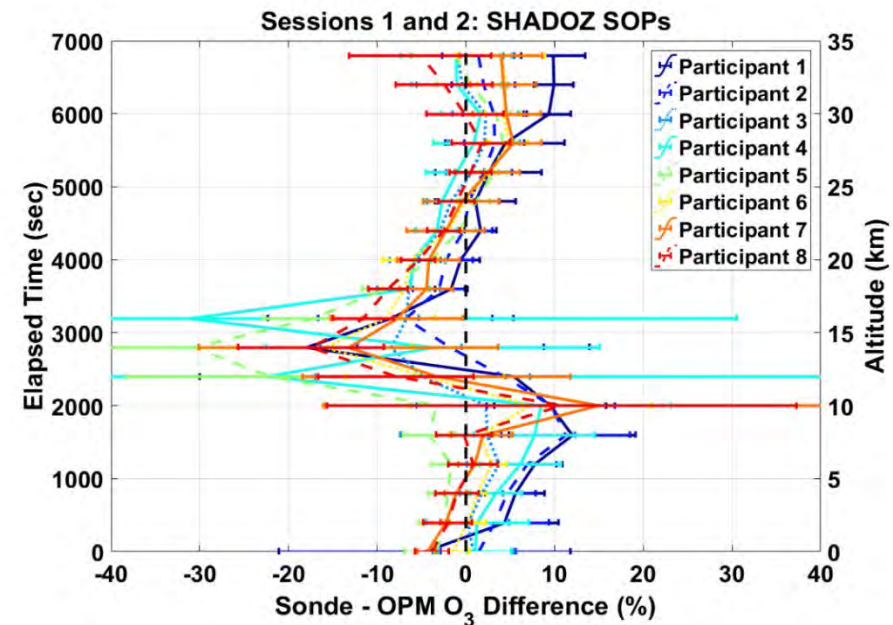
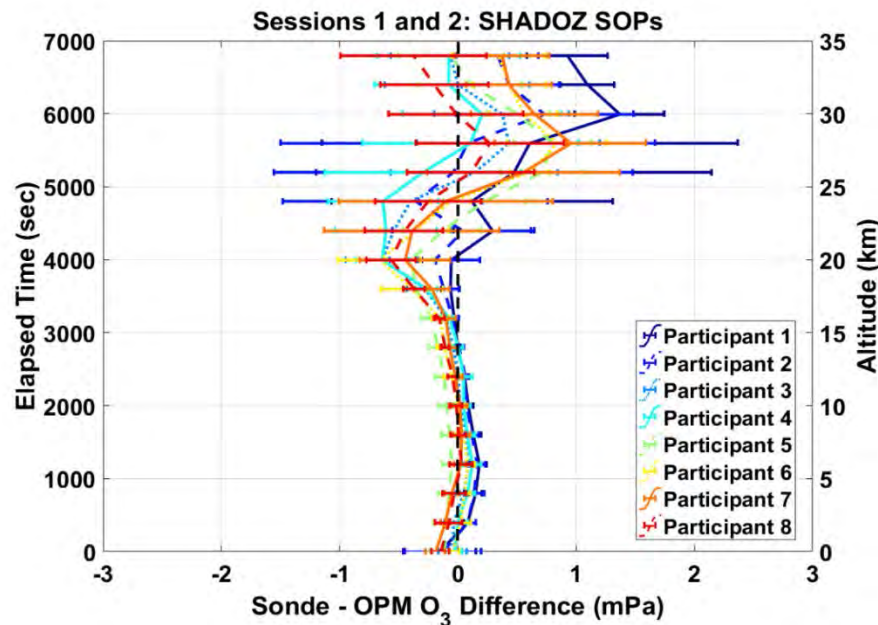
JOSIE 2017-SHADOZ: First Results of 2 Simulation Flights



JOSIE 2017-SHADOZ:

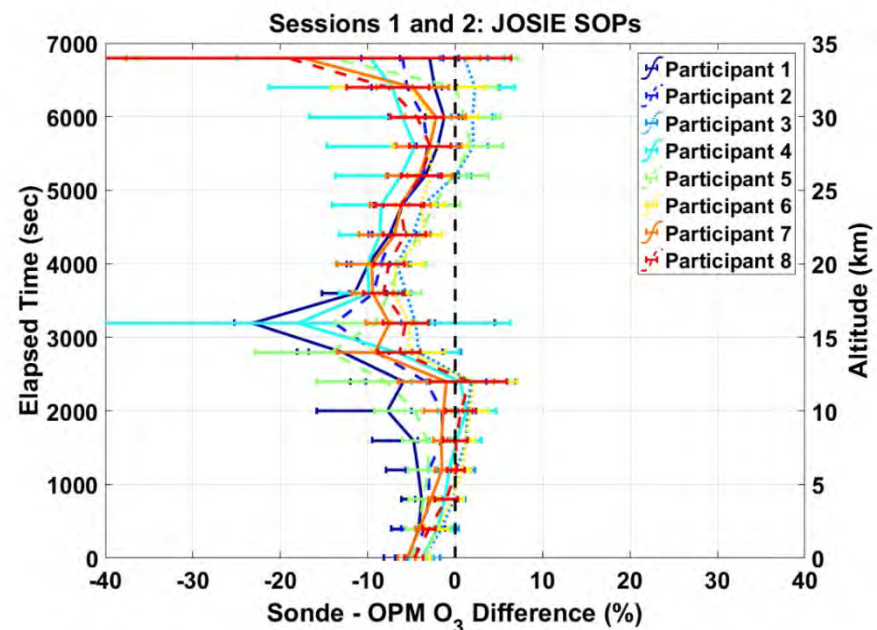
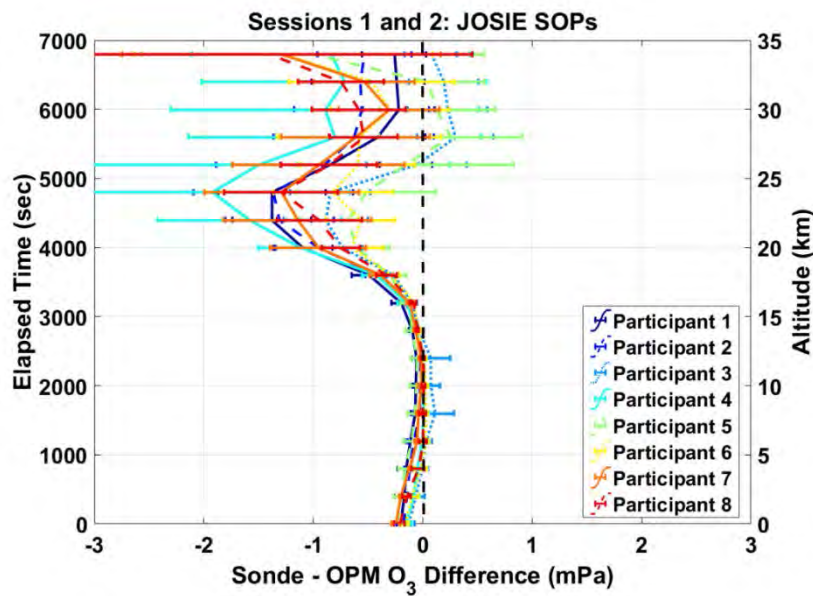
Comparison Sondes to UV-Photometer (OPM) using SHADOZ-SOP's

Individual mean deviations to OPM in partial pressure (mPa) (left) and relative (%) (right) for SHADOZ SOP's for both sessions. Based on 5 runs of each station



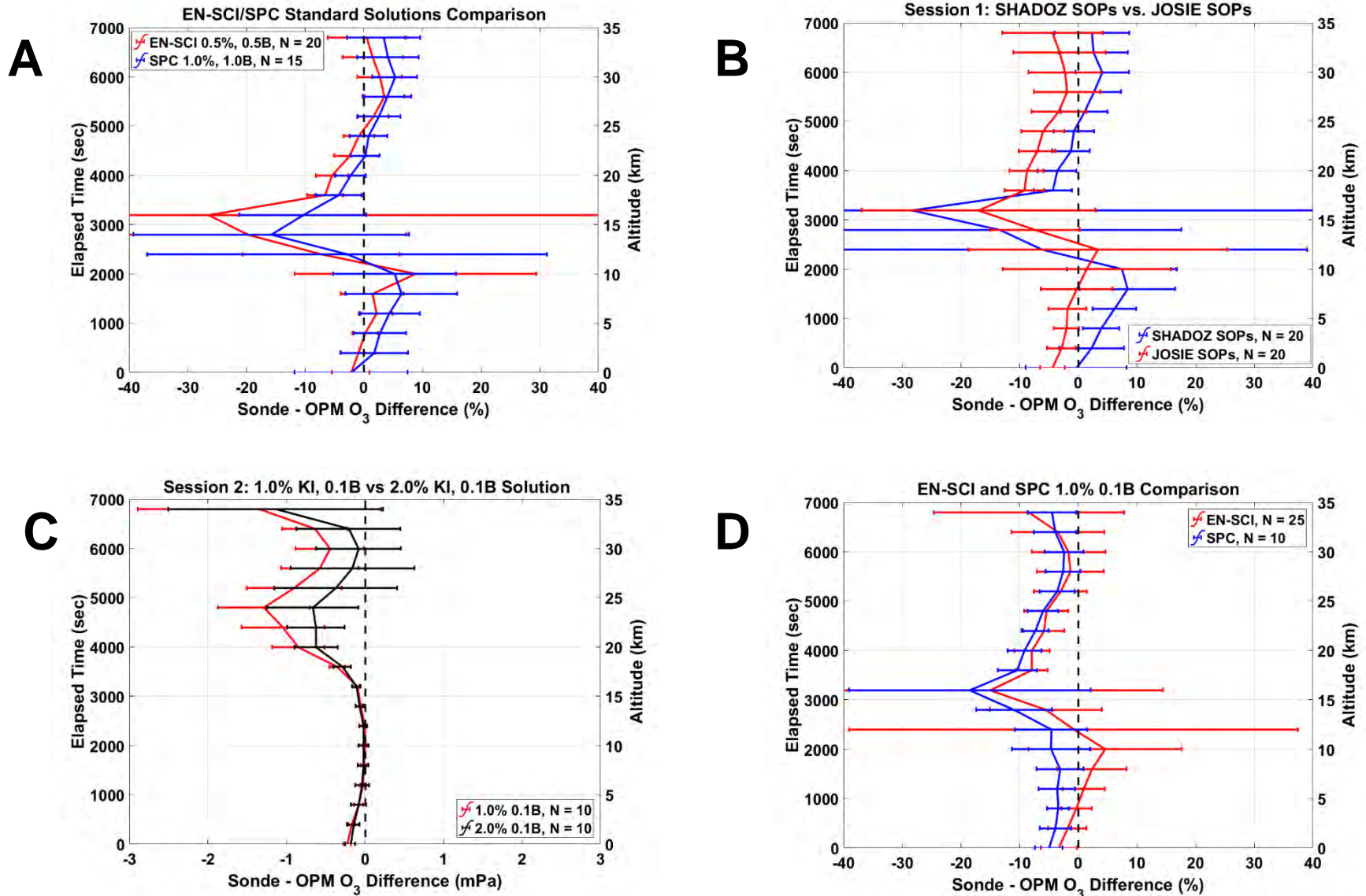
Comparison Sondes to UV-Photometer (OPM) using JOSIE-SOP's (Slightly Revised WMO/GAW SOP's)

Individual mean deviations to OPM in partial pressure (mPa) (left) and relative (%) (right) for SHADOZ SOP's for both sessions. Based on 5 runs of each station



JOSIE 2017-SHADOZ:

SHADOZ SOP's versus JOSIE-SOP'



JOSIE 2017-SHADOZ:

Achievements

- 2 x 2-Weeks-sessions with 2x4 SHADOZ stations
- 2 x 10-Simulation experiments of tropical profiles
- 2 x 40-Ozonesonde-profiles versus UV-Photometer for further investigations!
- Requirement for more standardization of ground equipment and preparational procedures
- Capacity building: Intensive training of station operators plus lectures by coaches and referees

JOSIE 2017-SHADOZ: Preliminary Findings

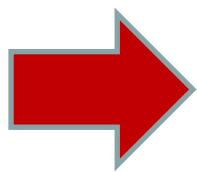
- The SPC / ENSCI offsets seen in JOSIE-2000 (Smit et al., 2007) & BESOS-2004 (Deshler et al., 2008) are confirmed in JOSIE-2017.
- With uniform preparation procedures, SHADOZ profiles agree within 5% with the UV photometer.
- Reducing the buffer in the sensing solution improves O₃ accuracy near the tropopause
- *Results Under Investigations*.....

JOSIE 2017-SHADOZ: Outlook

- “The JOSIE-SHADOZ Experience”: BAMS-Paper
- Evaluation of JOSIE 2017 results
- Evaluation existing SOP's:

>>> Start of ASOPOS 2.0 Reload

[Assessment of Standard Operating Procedures for Ozone Sondes]



JOSIE-SHADOZ & ASOPOS Workshop 17-19 Sept.
2018 in Switzerland (Geneva area) after the NDACC-
Annual SSC Meeting

Outcome of ASOPOS 2.0 Reload in 2019/2020 :

- 1. More strict SOP's**
- 2. Standardization of ground equipment for preparation of O3-sondes**

- JOSIE-SHADOZ support comes from **FZ-Jülich, NASA and NOAA** with special travel support from the **UNEP Vienna Convention Trust Fund**.
- Ozone sondes (more than 100) were supplied by **NOAA, NASA, Environmental Canada, FMI, Meteo Suisse, KMI, KNMI, NIWA**
- Participating organizations:



- Last but not least now **4 minutes of 4 weeks of JOSIE 2017/SHADOZ** campaign: <https://vimeo.com/240986625> by Patrick Cullis (NOAA, Boulder)

O3S-DQA: Last, but Not Least.....

Very important QA/QC factor to achieve the best data quality starts at the launch site:

- (1) Good quality of preparation equipment, which is well maintained**
- (2) Well trained and motivated sonde operator & scientist**
- (3) Good & regular communication between scientist & sonde operator**

COST-Action on Vertical Ozone Profiling???

- Presently elaborating the feasibility to submit a proposal for a EU-COST action on the harmonisation of ozone profiling data from different ground based platforms.....
- Ozone sondes , Lidars, In Service-Aircraft and others.....
- Focus on Troposphere + Tropopause region until Z= 20 km
- EU-COST action is a networking activity.....
- Funded by the European Commission for 4 years.....
- Majorly covering the costs of meetings, trainings, summer schools, short scientific missions (< 1-2 weeks).....
- Call for proposals in Fall 2018.....
- Oversigned by factor 5-10.....
- Several administrative thresholds/obstacles to be taken.....
-Realism: Limited chances of success.....

■ **JOSIE-Fun: <https://vimeo.com/240986625>** by Patrick Cullis (NOAA, Boulder)