



Recent Updates about the Absolute Cavity  
Pyradiometer (ACP), InfraRed Integrating Sphere (IRIS),  
and Atmospheric Emitted Radiance Interferometer  
(AERI) Comparisons

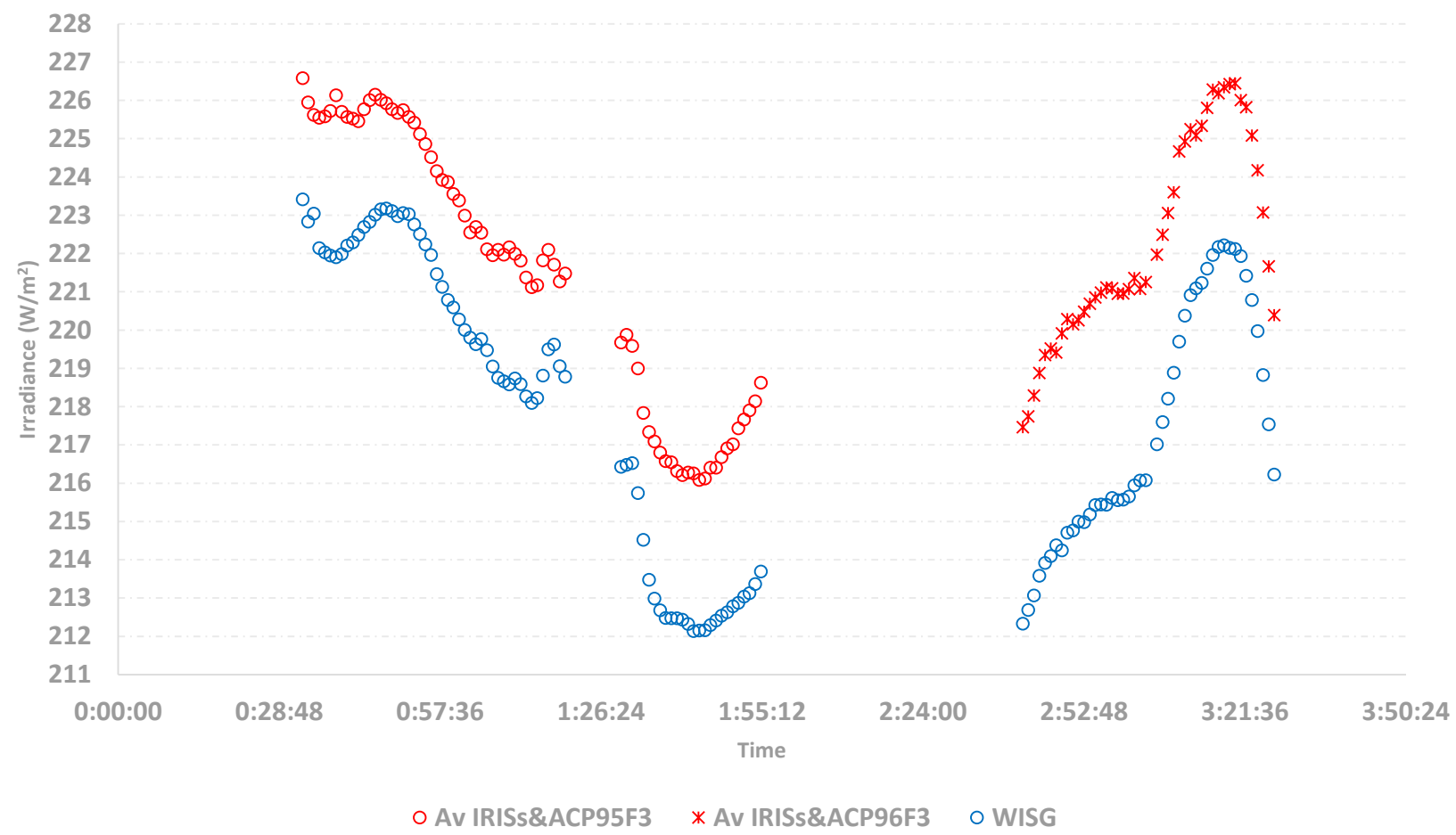
Ibrahim Reda, Julian Gröbner, and Dave Turner  
BSRN 2018 Workshop  
July 19, 2018

# Overview

- Results of five comparisons between ACPs and IRISs.
- Difference between the longwave irradiance measured by the ACPs and IRISs versus the irradiance measured by the WISG.
- The longwave irradiance measured by the ACPs, IRISs, and AERI versus the irradiance measured by the WISG.

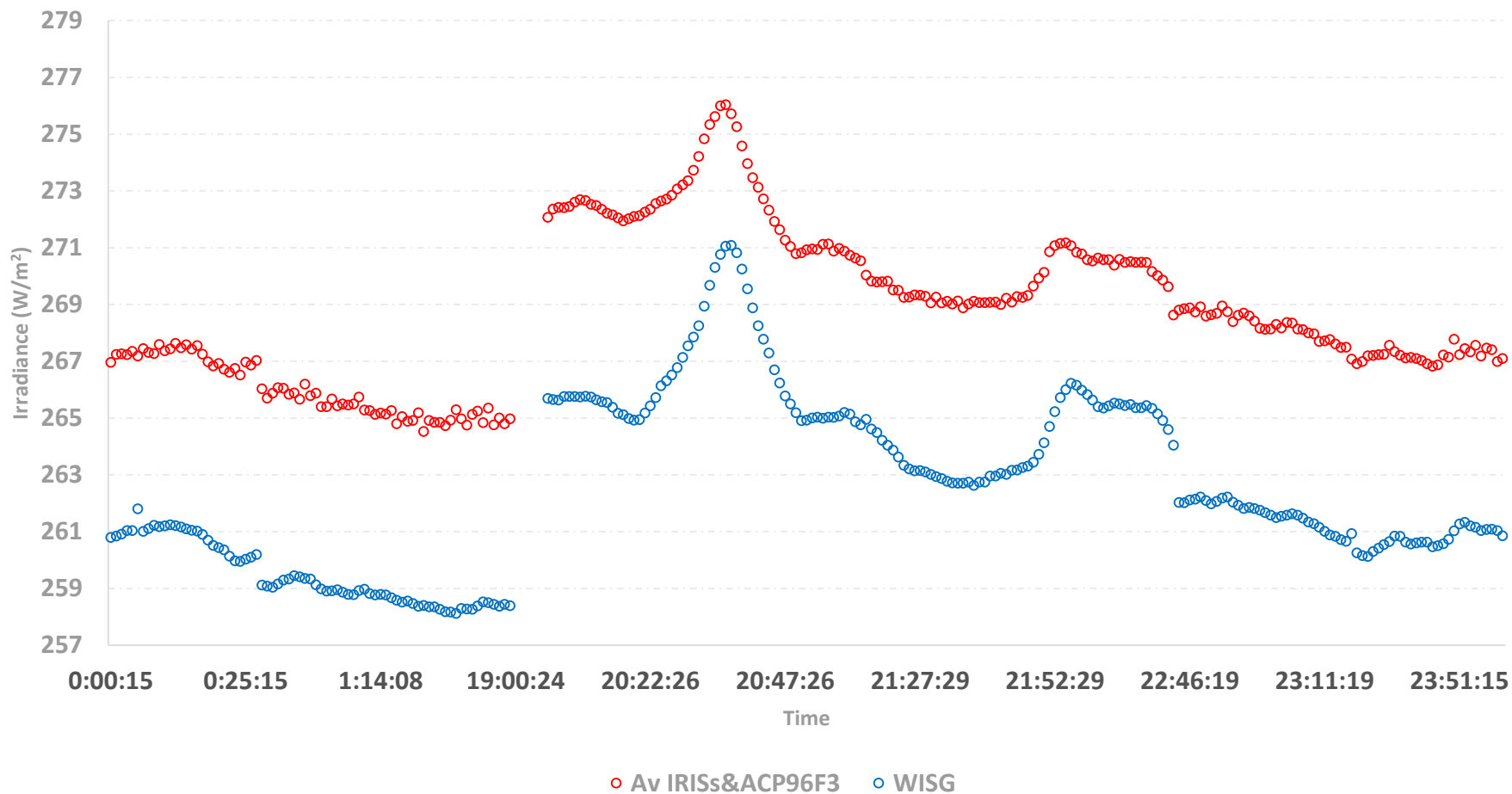
# Results of First Comparison between ACPs and IRISs-Davos

## Average Irradiance of Two IRISs&ACP95F3 or 96F3 versus the WISG Average Irradiance at night on Feb. 5, 2013 (~8 mm H<sub>2</sub>O vapor column)



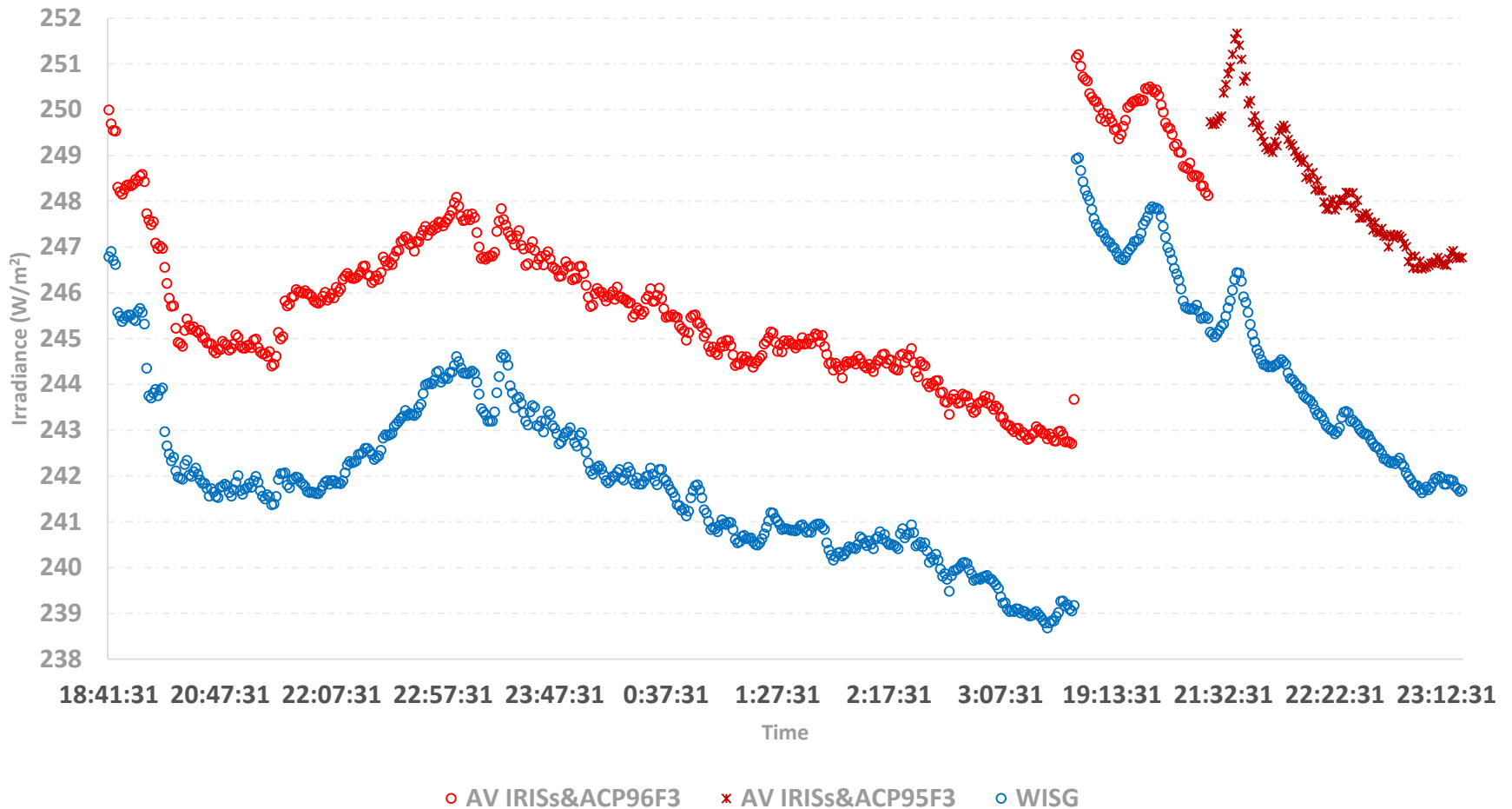
# Results of Second Comparison between ACPs and IRISs-Davos

Average Irradiance of Two IRISs&ACP96F3 versus the WISG Average  
Irradiance on Oct. 2&3, 2013  
(~15 mm H<sub>2</sub>O vapor column)



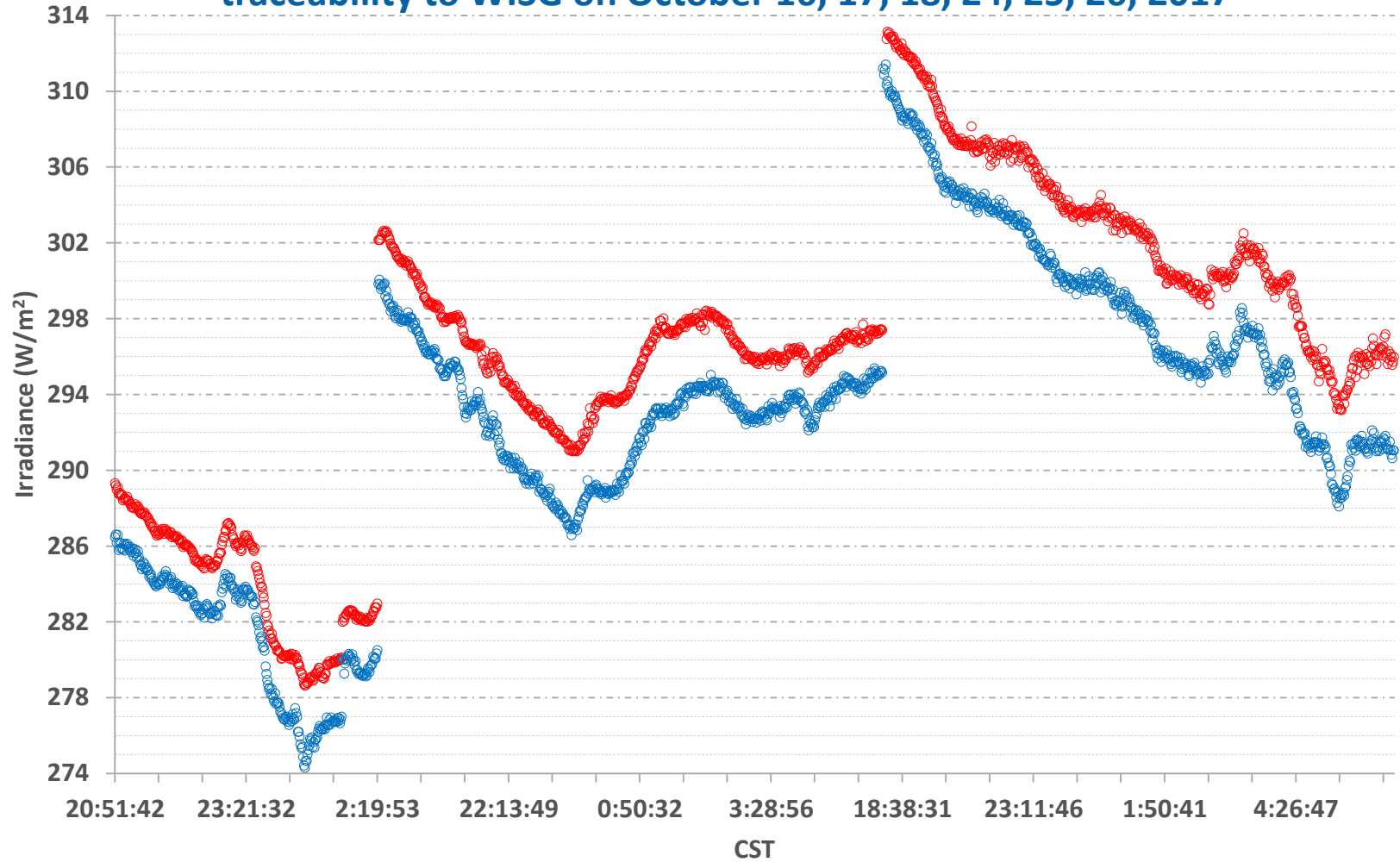
# Results of Third Comparison between ACPs and IRISs-Davos

Average Irradiance of Four IRISs&ACP95F3 or ACP96F3 versus the WISG  
Average From September 28 to October 16, 2015  
(~10 mm H<sub>2</sub>O vapor column)



# Results of Fourth Comparison between ACPs and IRISs-SGP-Phase 1

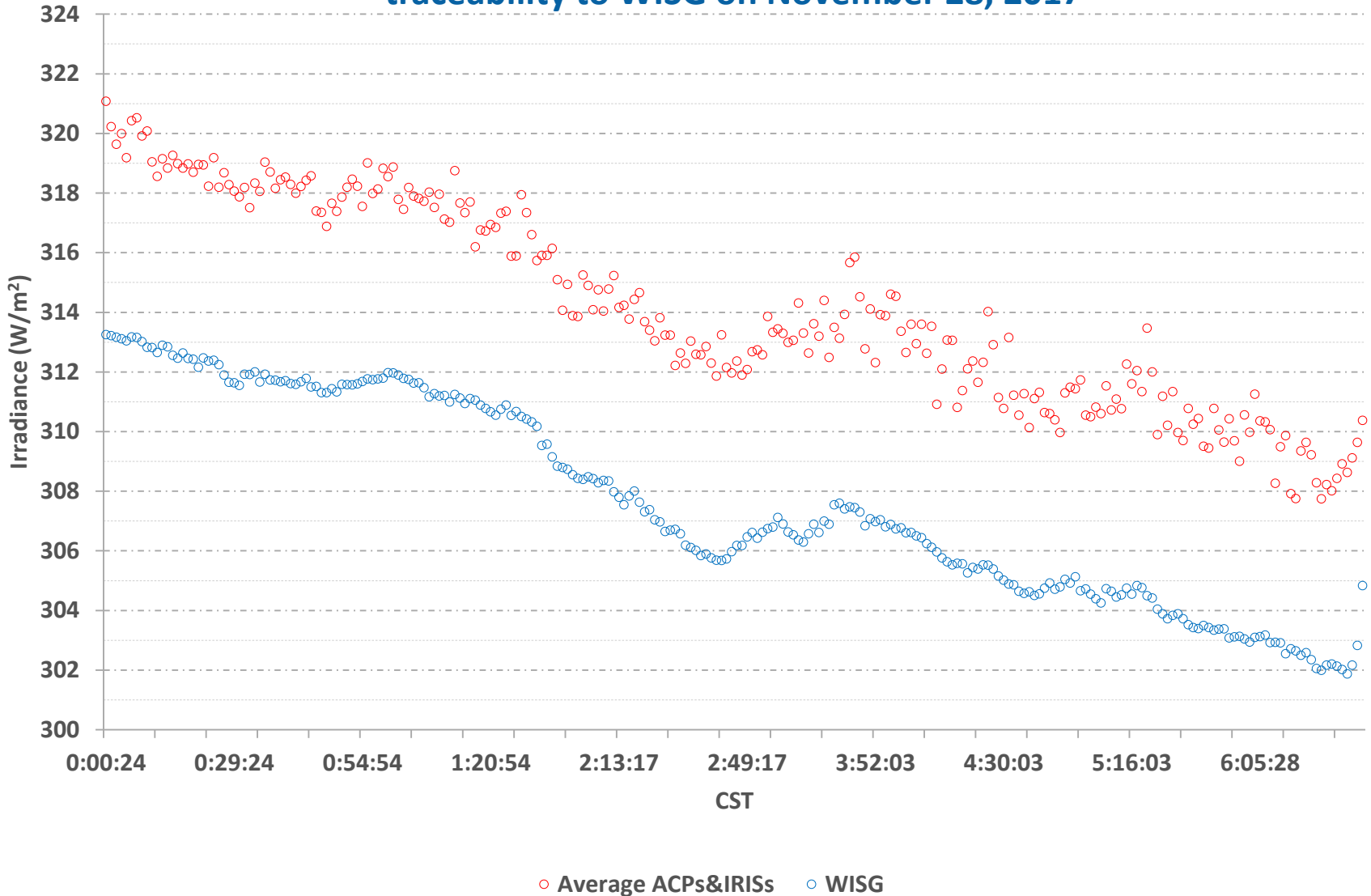
## Average of Three IRISs & Two ACPs Versus PIR-31197F3 with traceability to WISG on October 16, 17, 18, 24, 25, 26, 2017



○ AV IRISs&ACPs   ○ WISG

# Results of Fifth Comparison between ACPs and IRISs-SGP-Phase 2

## Average of Three IRISs and Two ACPs Versus PIR-30475F3 with traceability to WISG on November 28, 2017

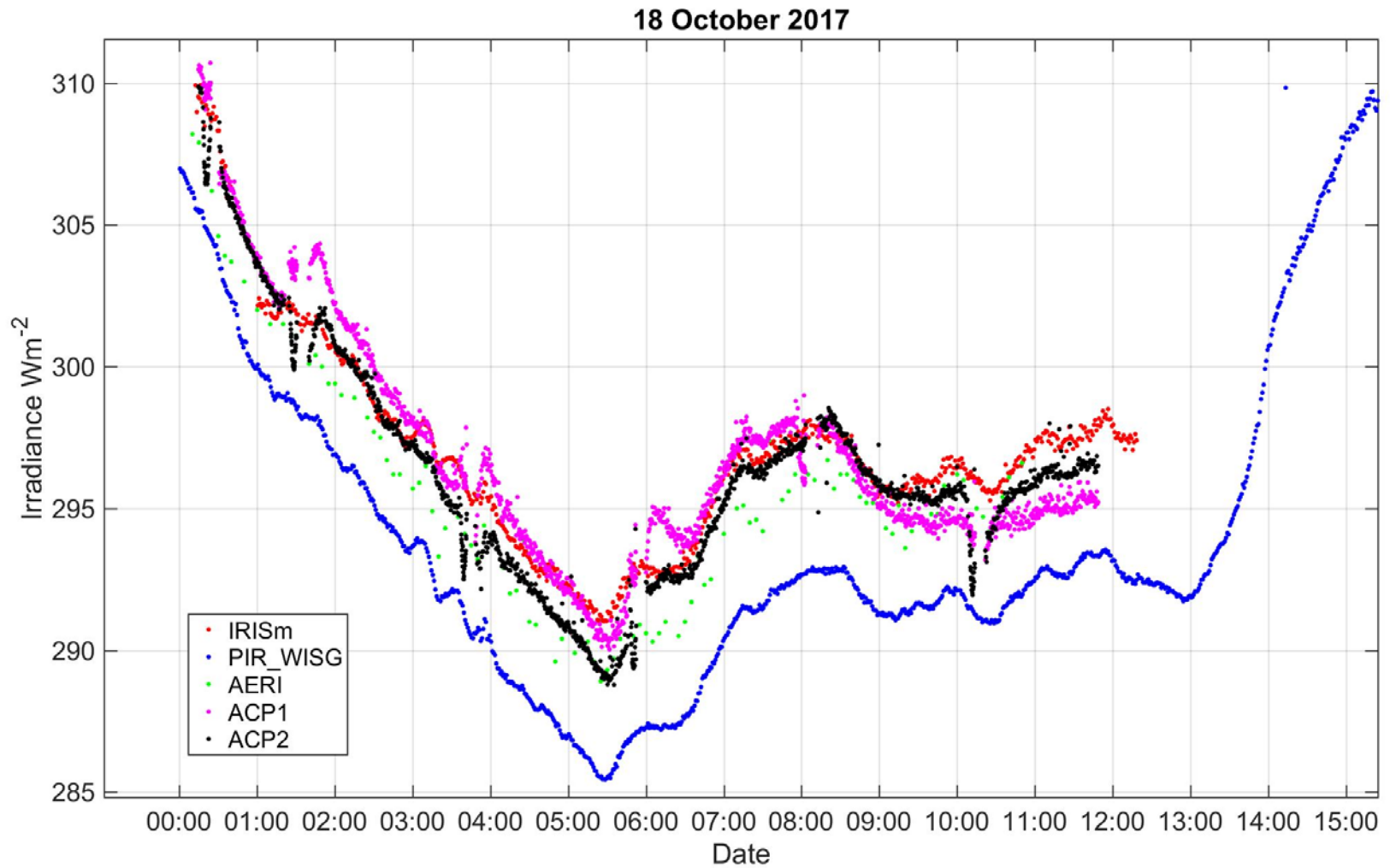


# Summary of the Five comparisons

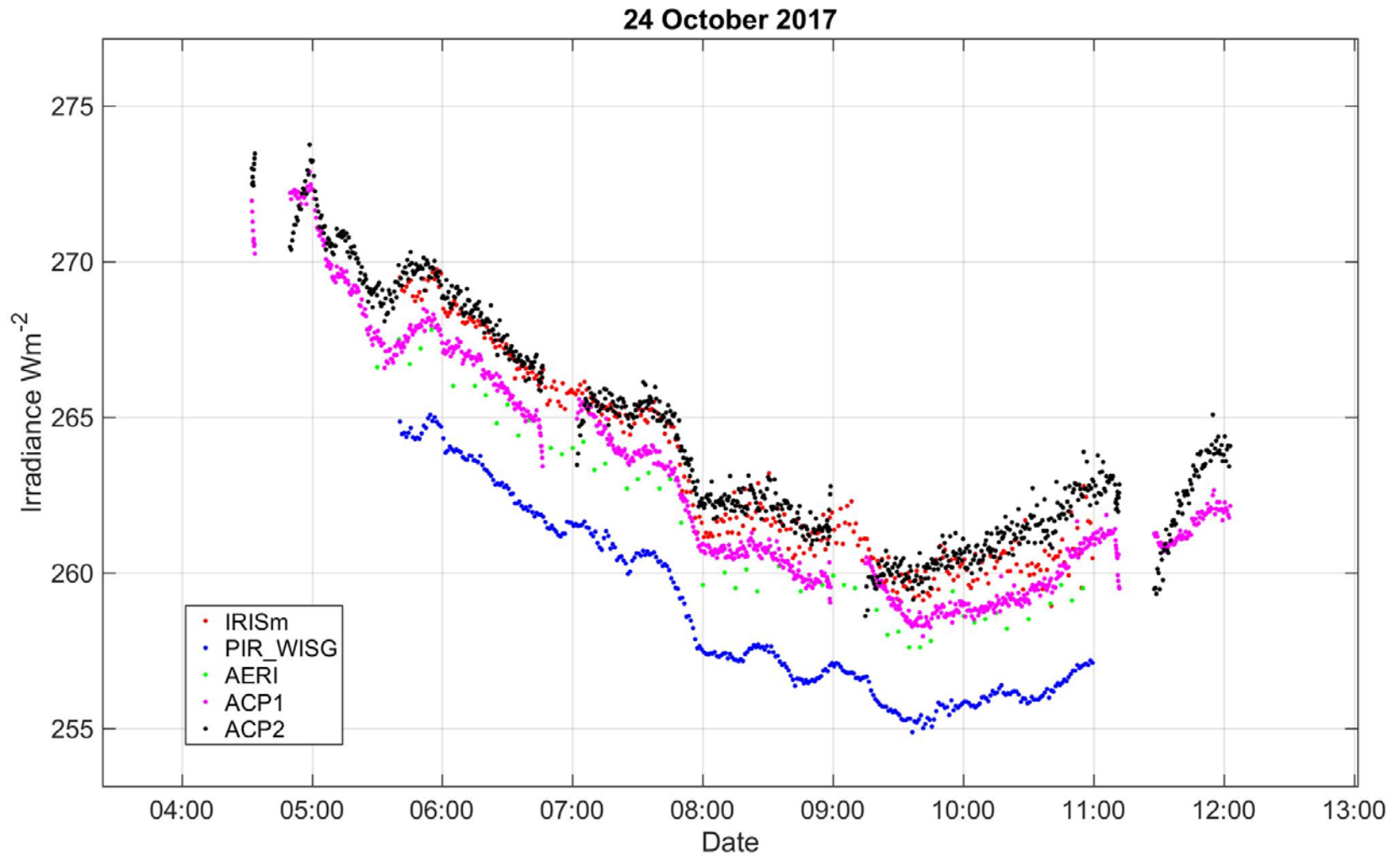
<b>W/m<sup>2</sup></b>	<b>First</b>	<b>Second</b>	<b>Third</b>	<b>Fourth</b>	<b>Fifth</b>
<b>Average difference between ACPs&amp;IRISs</b>	0.10	0.31	-1.17	-1.58	-1.77
<b>StDev of Difference</b>	0.08	0.65	0.70	1.15	0.88
<b>Difference within 95%</b>	0.19	1.34	1.82	2.79	2.50
<b>Average of ACPs&amp;IRISs - WISG</b>	3.93	6.14	3.82	3.50	6.50
<b>StDev of Difference</b>	0.97	0.76	0.67	0.81	0.66
<b>Difference within 95%</b>	4.38	6.33	4.05	3.86	6.63



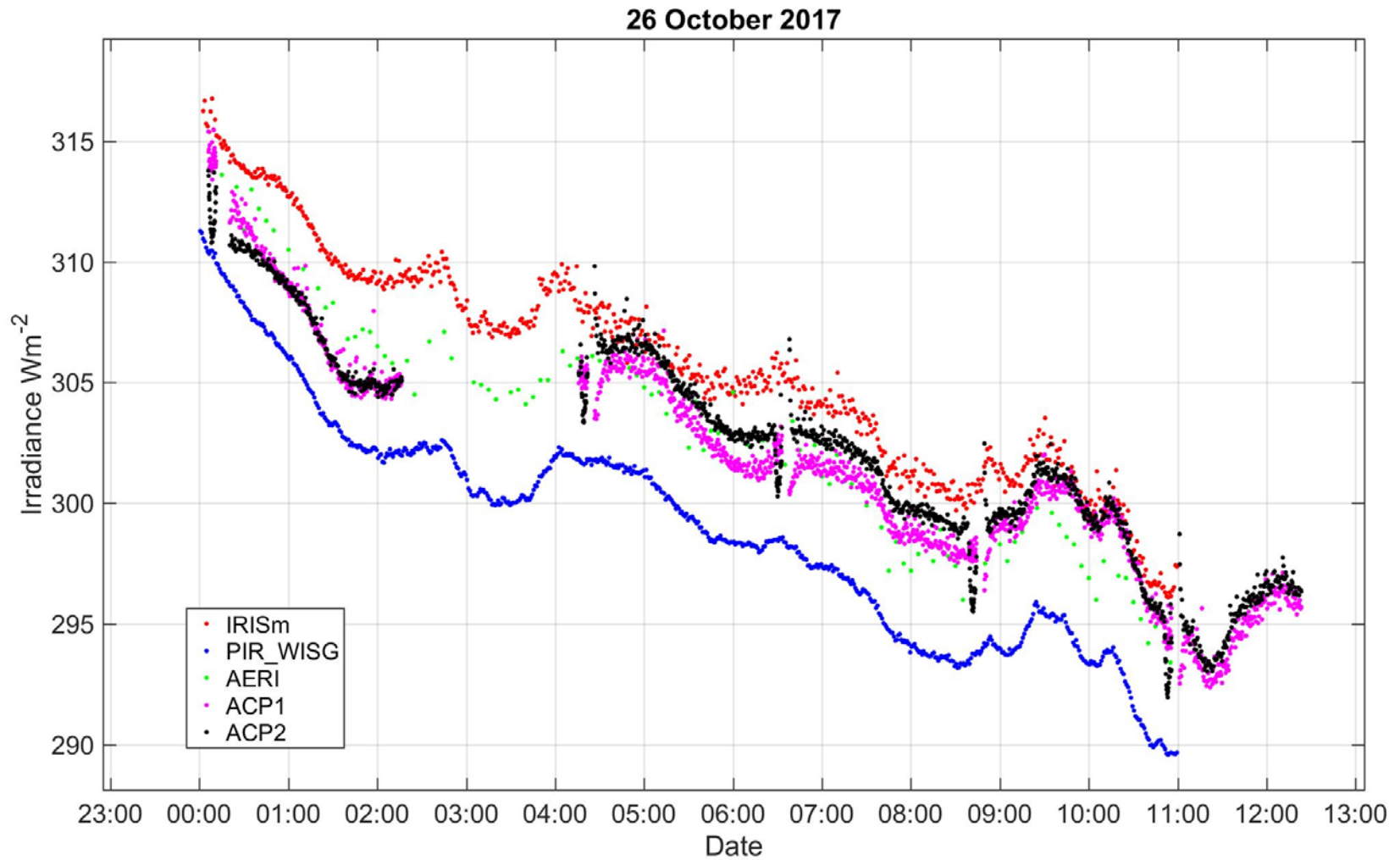
# Results of Comparison between ACPs, IRISs, and AERI at SGP



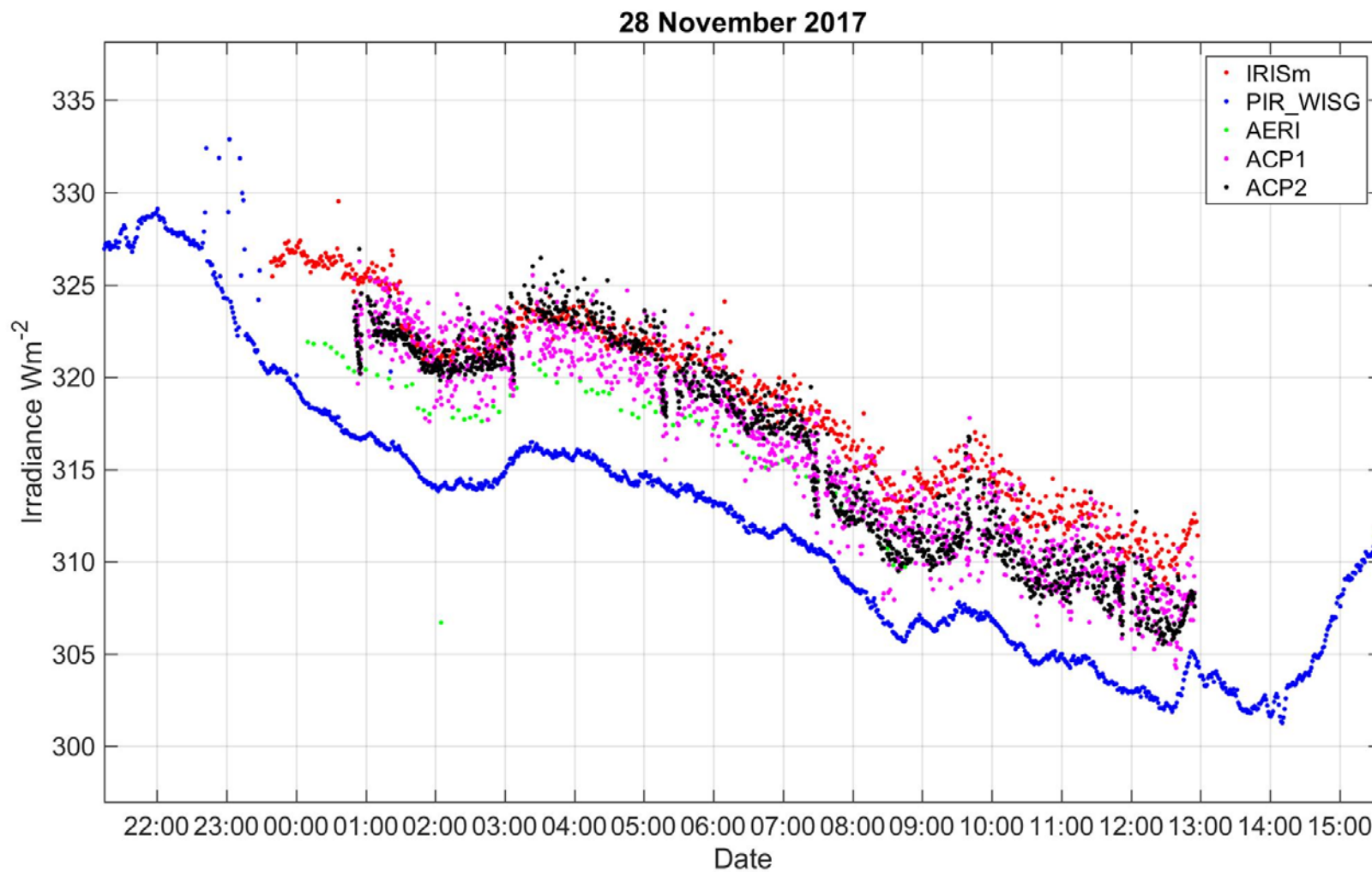
# Results of Comparison between ACPs, IRISs, and AERI at SGP



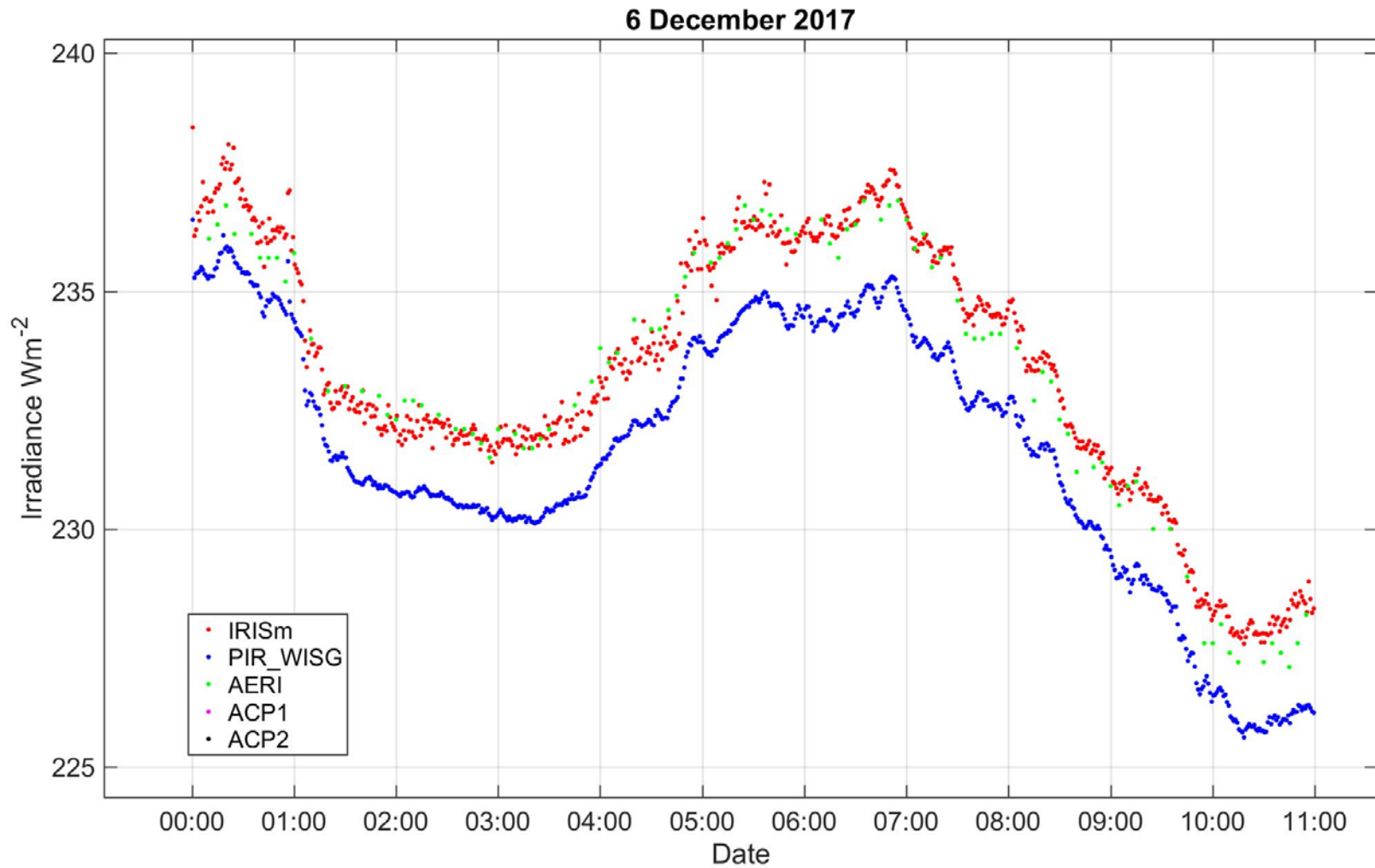
# Results of Comparison between ACPs, IRISs, and AERI at SGP



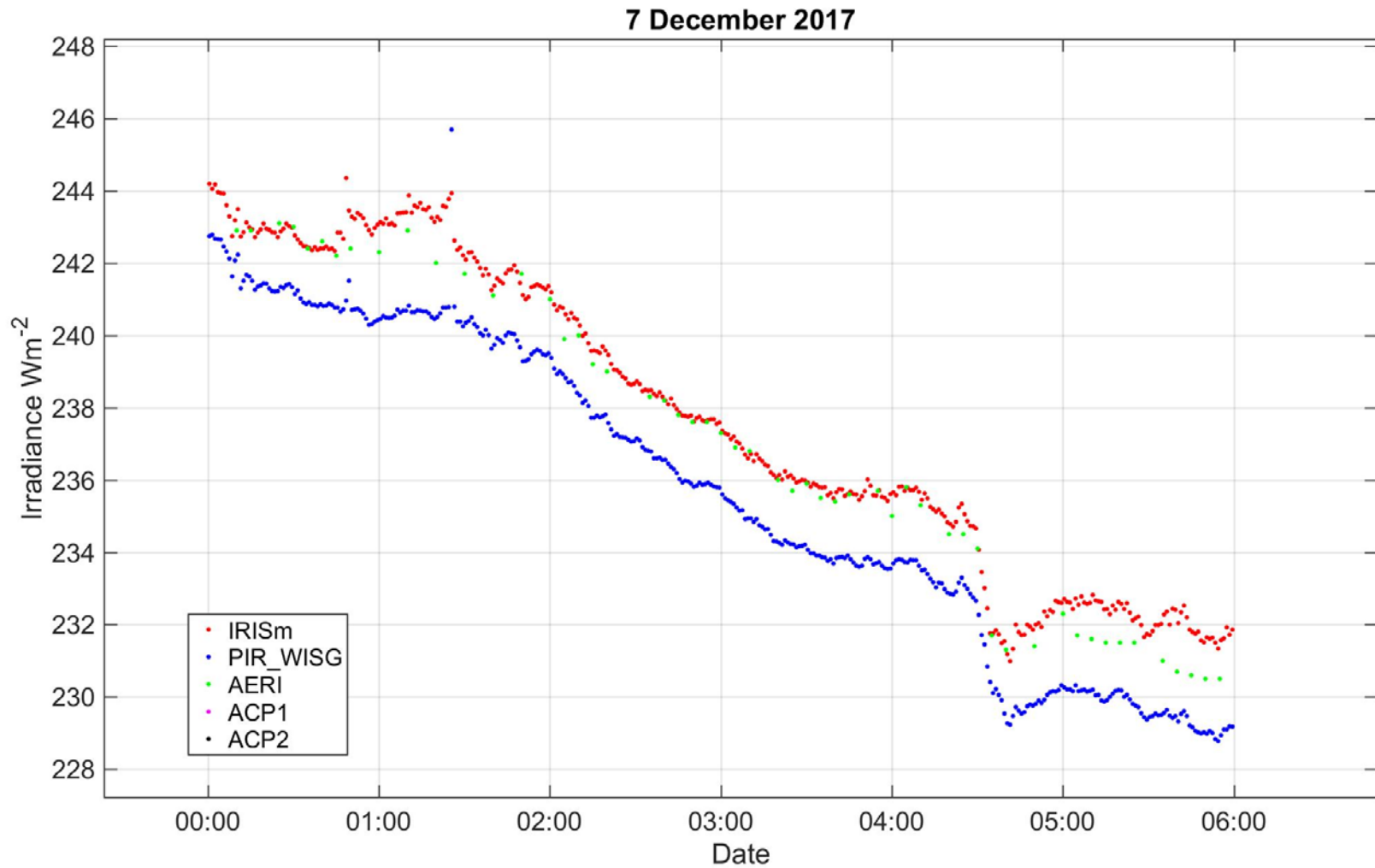
# Results of Comparison between ACPs, IRISs, and AERI at SGP



# Results of Comparison between ACPs, IRISs, and AERI at SGP

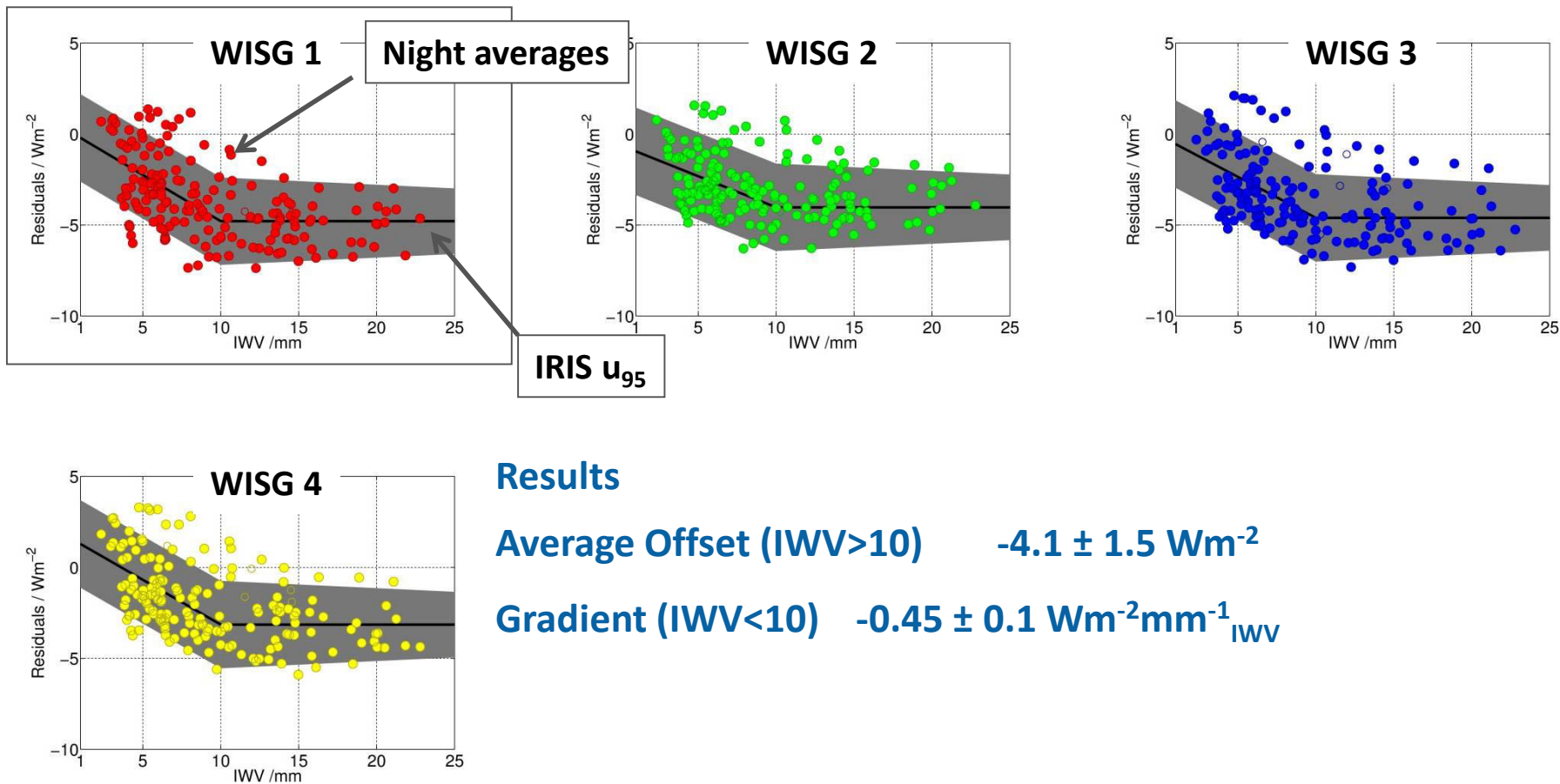


# Results of Comparison between ACPs, IRISs, and AERI at SGP



# Water Vapor effect on Irradiance difference (WISG minus IRIS) at PMOD

*From J. Gröbner et al., JGR, 2014*



## Results

Average Offset (IWV > 10)  $-4.1 \pm 1.5 Wm^{-2}$

Gradient (IWV < 10)  $-0.45 \pm 0.1 Wm^{-2}mm^{-1}_{IWV}$



## Conclusion

- *The difference between the irradiance measured by the ACPs, IRISs, and AERI varied from 0.2 W/m<sup>2</sup> to 2.5 W/m<sup>2</sup> based on the atmospheric conditions, which is within the stated uncertainties of  $\pm 3$  W/m<sup>2</sup>.*
- *The irradiance measured by the WISG is lower than the average irradiance measured by ACPs and IRISs, magnitude of the difference varied from 4.4 W/m<sup>2</sup> to 6.6 W/m<sup>2</sup> depending on the integrated water vapor.*



# WMO CIMO Task Team on Radiation References

- The first session of the World Meteorological Organization (WMO) Commission for Instruments and Methods of Observation Commission (CIMO) Task Team on Radiation References (TT) was held in the National Physical Laboratory (NPL) from November 15 to 17, 2017 in Teddington, United Kingdom.
- The meeting focused on the traceability of terrestrial radiation measurements. It reviewed and evaluated recent developments of reference instruments for terrestrial radiation, and developed recommendations to the attention of CIMO on the appropriateness, requirements and timeliness for a possible future modification of the current reference.
- Relevant recommendations from the TT will be submitted to the CIMO MG (26-29 March 2018), and most likely to CIMO-17 session (12-16 October 2018, Amsterdam) for endorsement. The report of the TT meeting will encompass all the recommendations.



**Nigel, Reda, Isabelle, Bruce, Julian, Peter, Alison, Nozumo**

# Thank You

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