Ben-Gurion University of the Negev

BIDR
The Jacob Blaustein Institutes for Desert Research

Below canopy radiation divergence in a vineyard

implications on inter-row surface energy balance

Nurit Agam

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John H. Prueger – National Laboratory for Agriculture and The Environment, ARS/USDA
Joshua L. Heitman, Adam M. Howard – North Carolina State University
Lawrence E. Hipps – Utah State University

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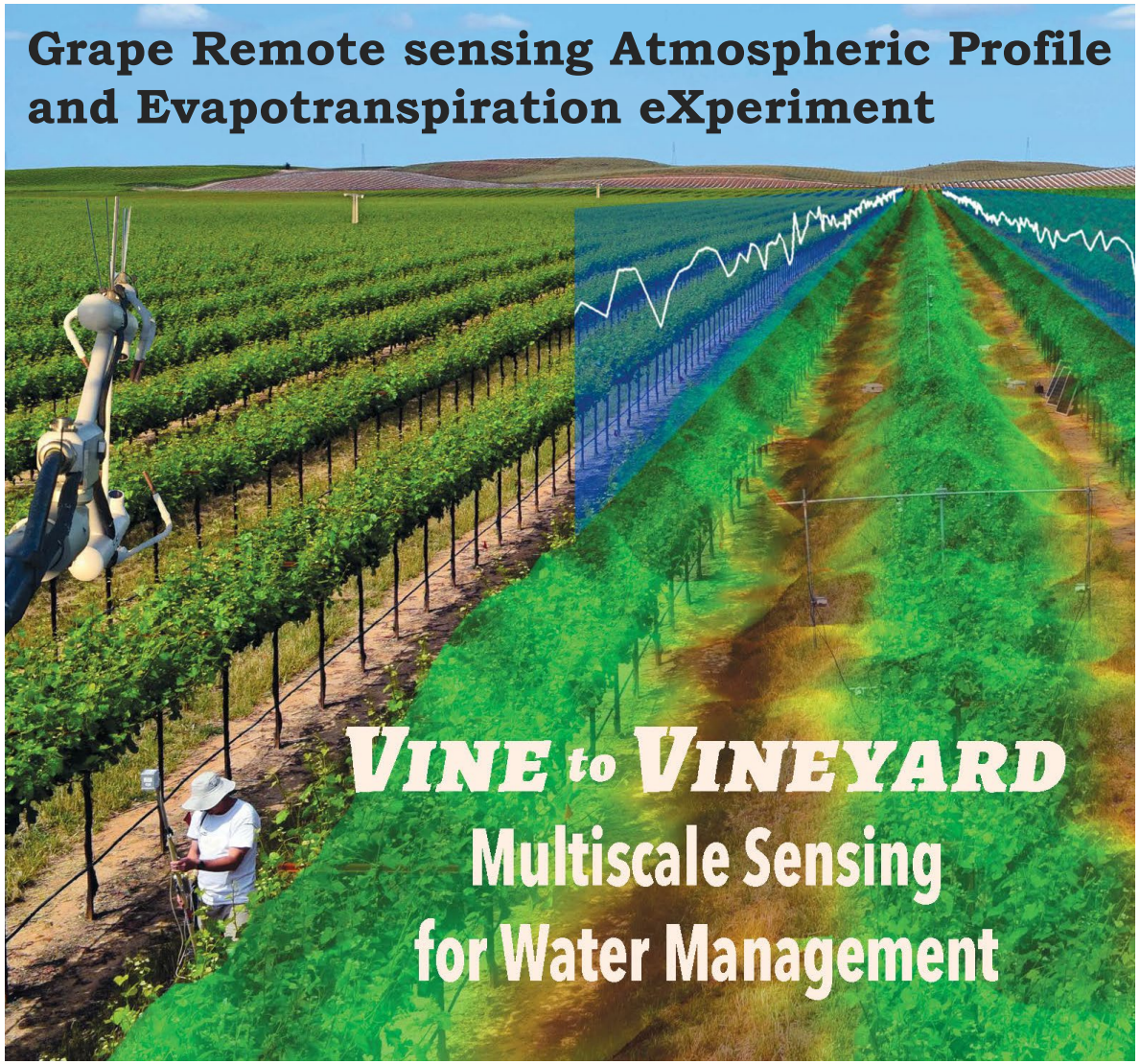
The GRAPEX multi-scale experiment



GRAPEX's overall aim

Develop improved water management tools for vineyards at scales ranging from micro-scale interrow variability to satellite-based ET estimates

Kustas et al. 2018. The Grape Remote sensing Atmospheric Profile and Evapotranspiration eXperiment. BAMS, DOI:10.1175/BAMS-D-16-0244.1

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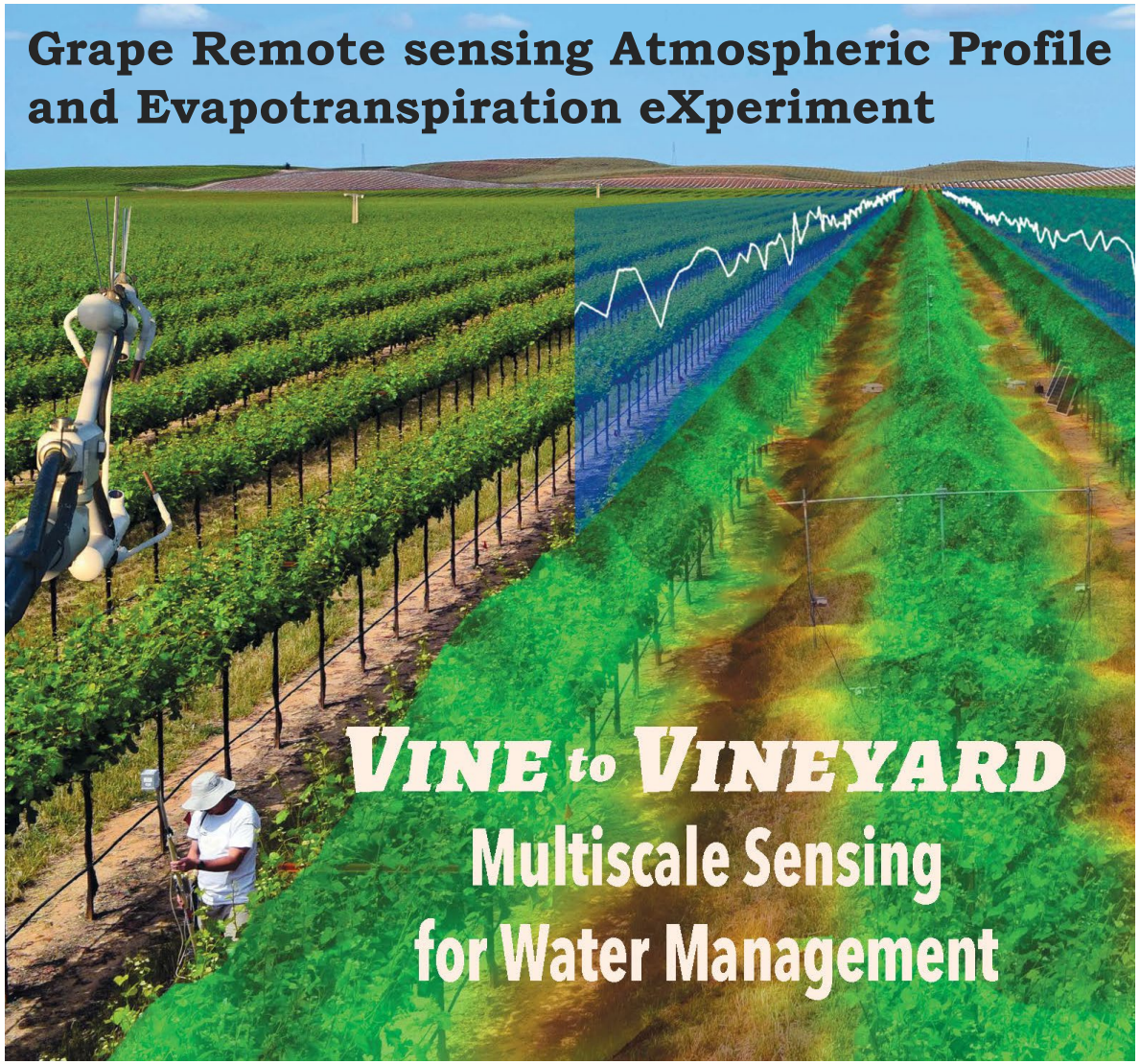

GRAPEX's participants

William P. Kustas • Martha C. Anderson • Joseph G. Alfieri • Kyle Knipper • Alfonso Torres-Rua • Christopher K. Parry • Hector Nieto • Nurit Agam • William A. White • Feng Gao • Lynn McKee • John h. Prueger • Lawrence E. Hipps • Sebastian Los • Maria Mar Alsina • Luis Sanchez • Brent Sams • Nick Dokoozlian • Mac McKee • Scott Jones • Yun Yang • Tiffany G. Wilson • Fangni Lei • Andrew McElrone • Josh L. Heitman • Adam M. Howard • Kirk Post • Forrest Melton • Christopher Hain

USDA/ARS • USU • UC Davis • FART Spain • BGU Israel • E&J Gallo Winery • NCSU • CASU • NASA Ames • NASA MSFC

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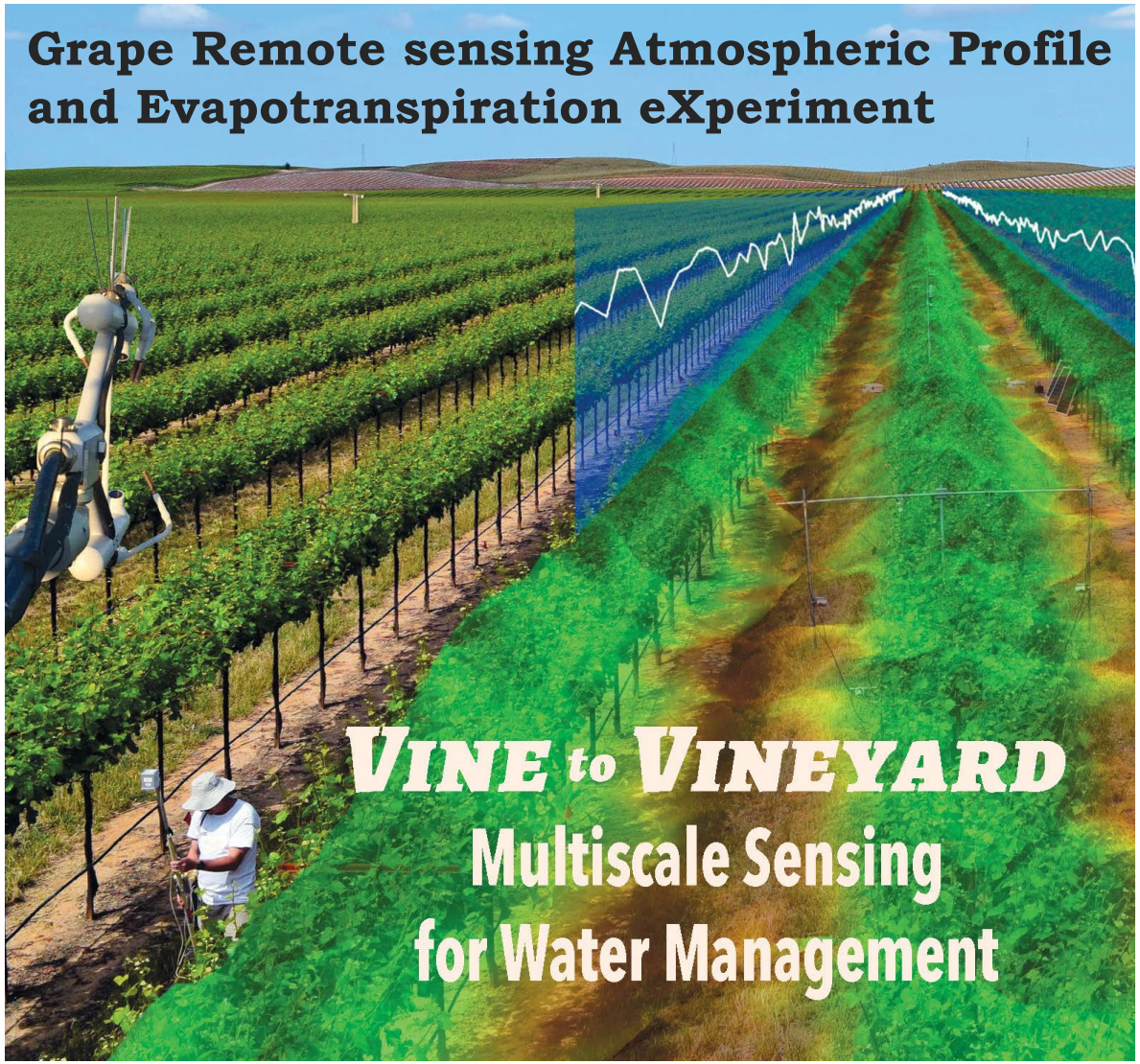

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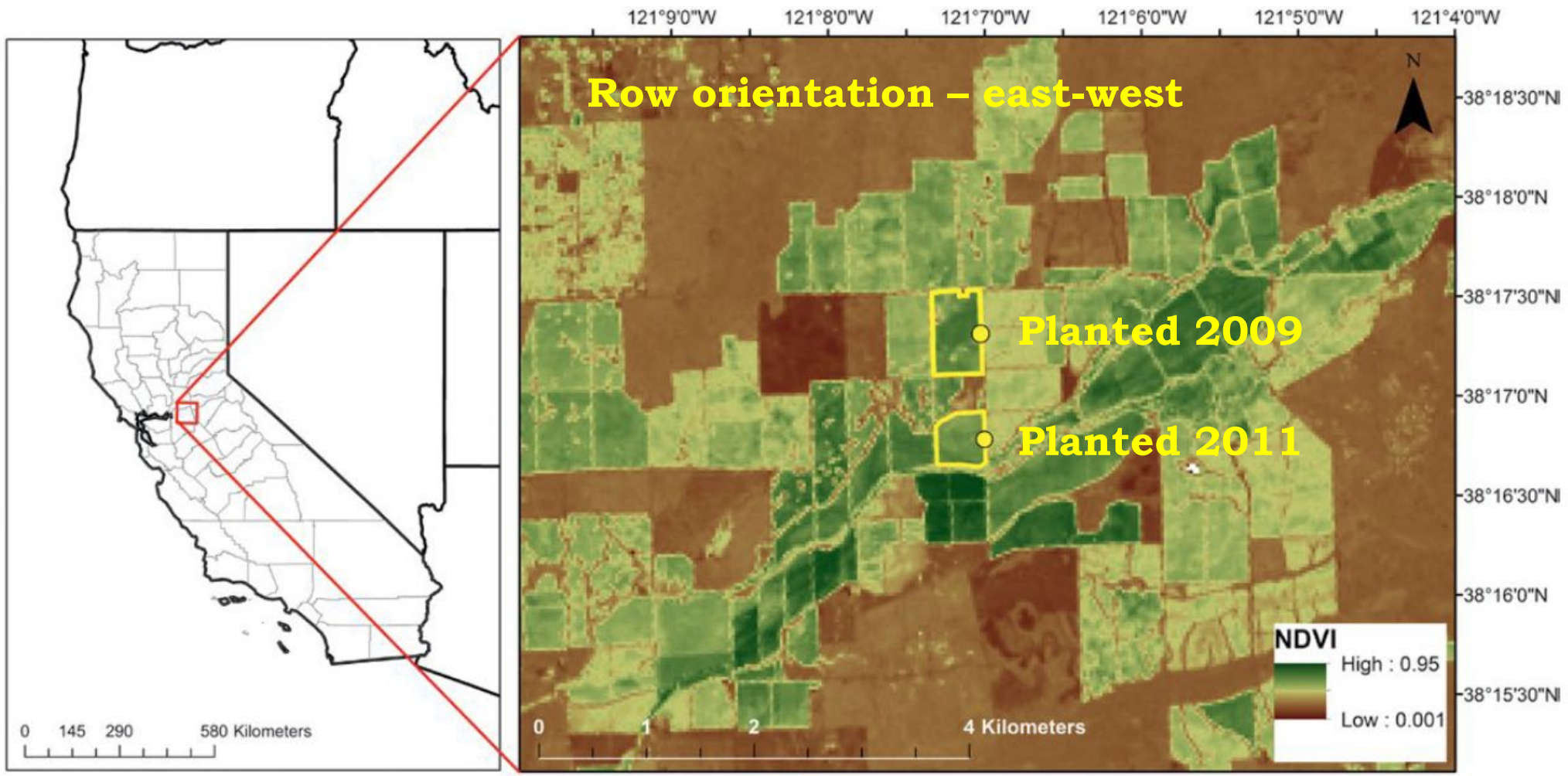
Wine vineyards are complex agricultural systems

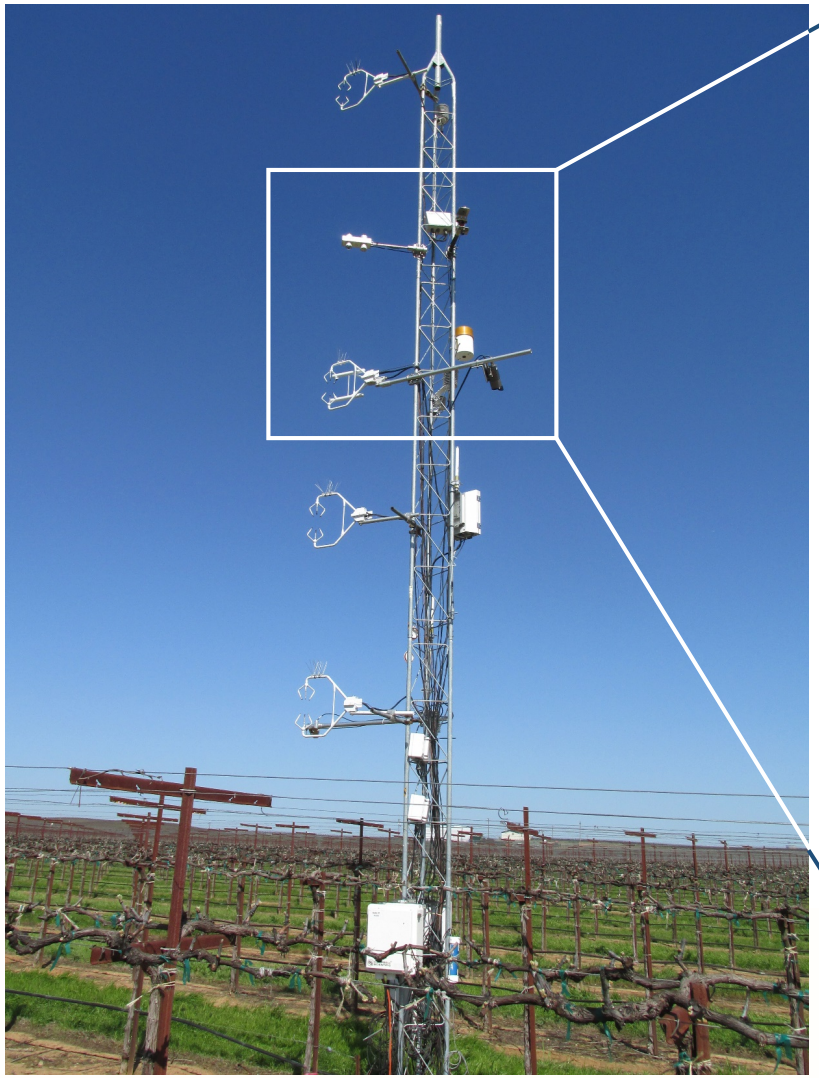
Objective

Describe the radiation reaching the vineyard floor and to relate the radiation patterns to below canopy energy fluxes

Pinot Noir vineyards in California



Above canopy measurements



Rn=H+LE

Pinot Noir vineyards in California

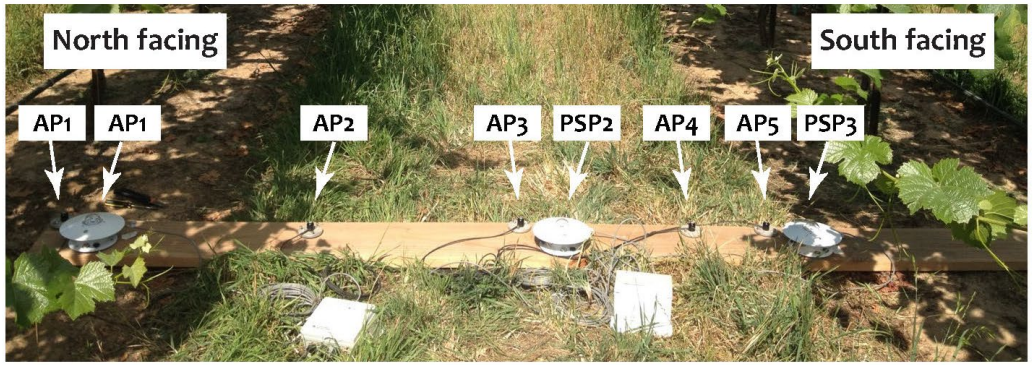
Measurements collected during intensive observation periods (IOPs)

Year	IOP1	IOP2	IOP3	IOP4
2013	10-12 April	10-12 June	5-7 August	
2014	26-28 April	29 June - 1 July	8-10 August	25-27 September
2015*	21-23 April	31 May – 2 June	10-12 July	11-13 August
2016	1-3 May	10-12 June	28-30 July	

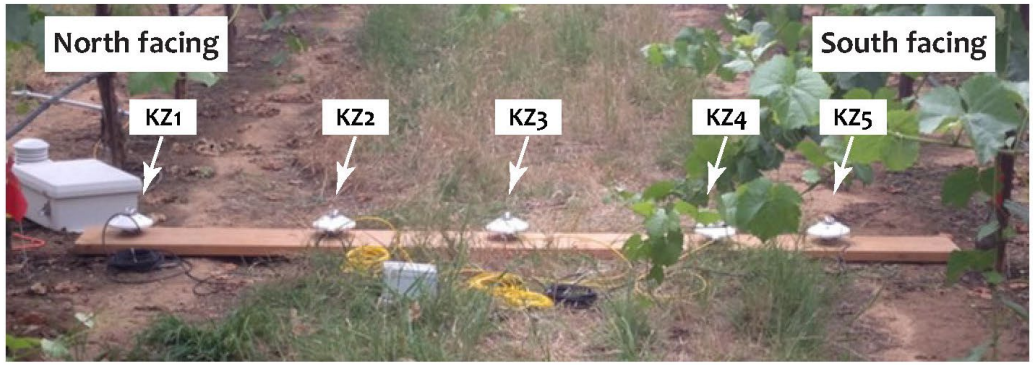
*Below canopy flux measurements were collected only for the 2015 IOPs

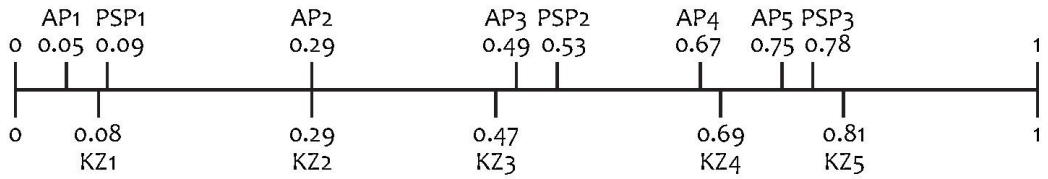
Below canopy measurements

Relative locations of Apogee (AP) and Epply (PSP) radiation sensors



Relative locations of Kipp & Zonen radiation sensors





Fraction of row width (335 cm) based on distance from north facing vine row

$$Rn=G+H+LE$$

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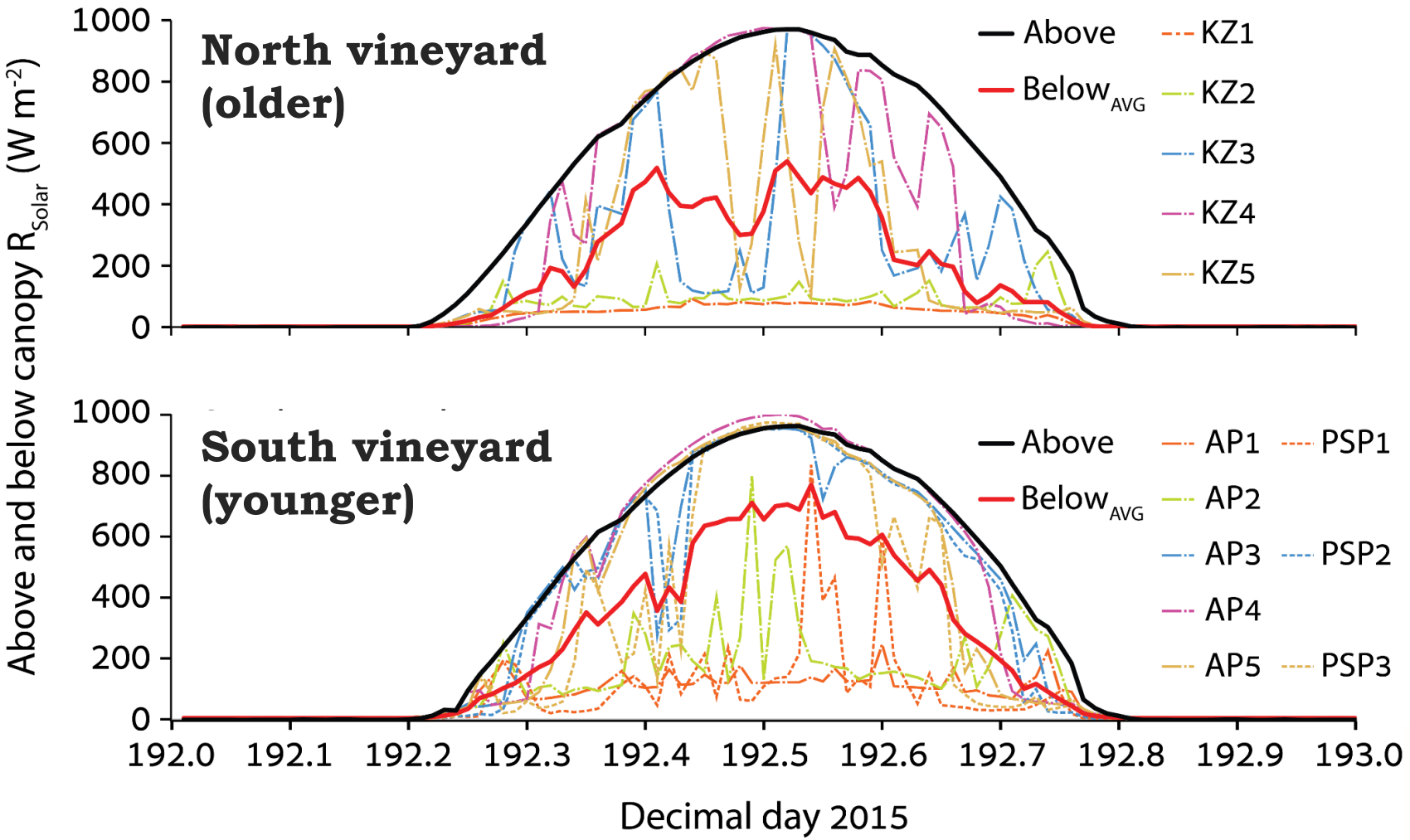
Below canopy radiation

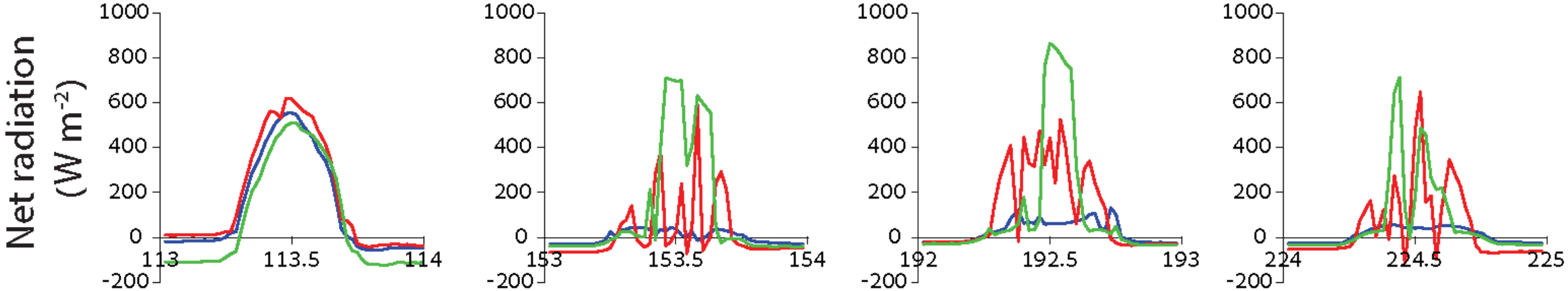


11 July 2015
(IOP3)

Below canopy energy fluxes

IOP1 – Apr 22 **IOP2 – Jun 1** **IOP3 – Jul 11** **IOP4 – Aug 12**



Rn=G+H+LE

North facing Interrow South facing

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Below canopy energy fluxes

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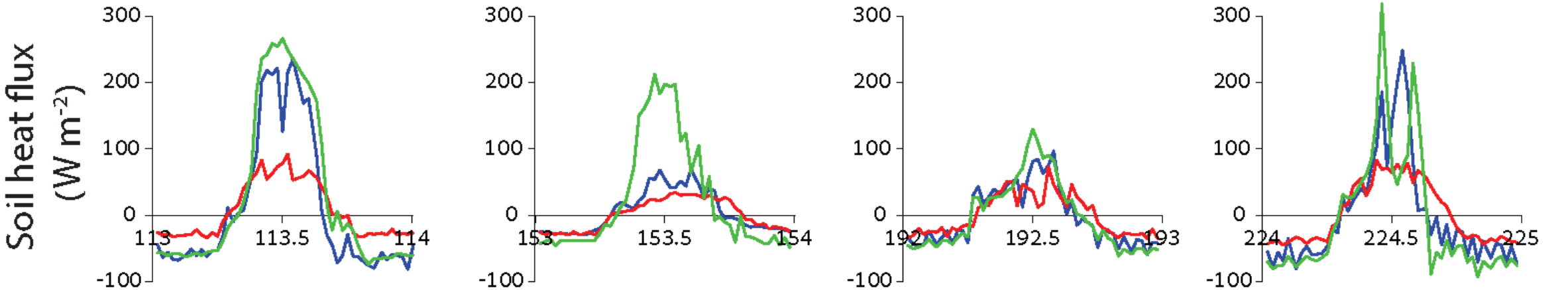

North facing Interrow South facing

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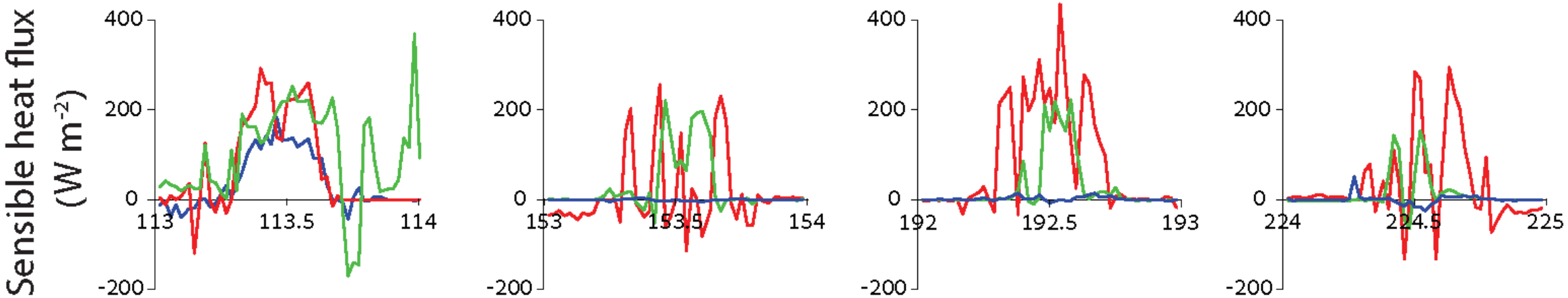
Below canopy energy fluxes

IOP1 – Apr 22

IOP2 – Jun 1

IOP3 – Jul 11

IOP4 – Aug 12



North facing Interrow South facing

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Below canopy energy fluxes

IOP1 – Apr 22

IOP2 – Jun 1

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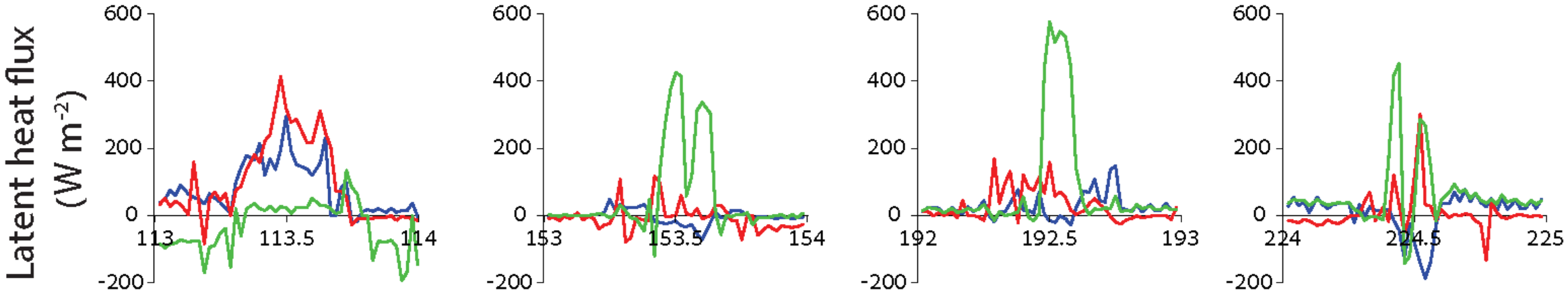
IOP4 – Aug 12



North facing Interrow South facing

Below canopy energy fluxes

IOP2 – Jun 1

North facing

Center

South facing

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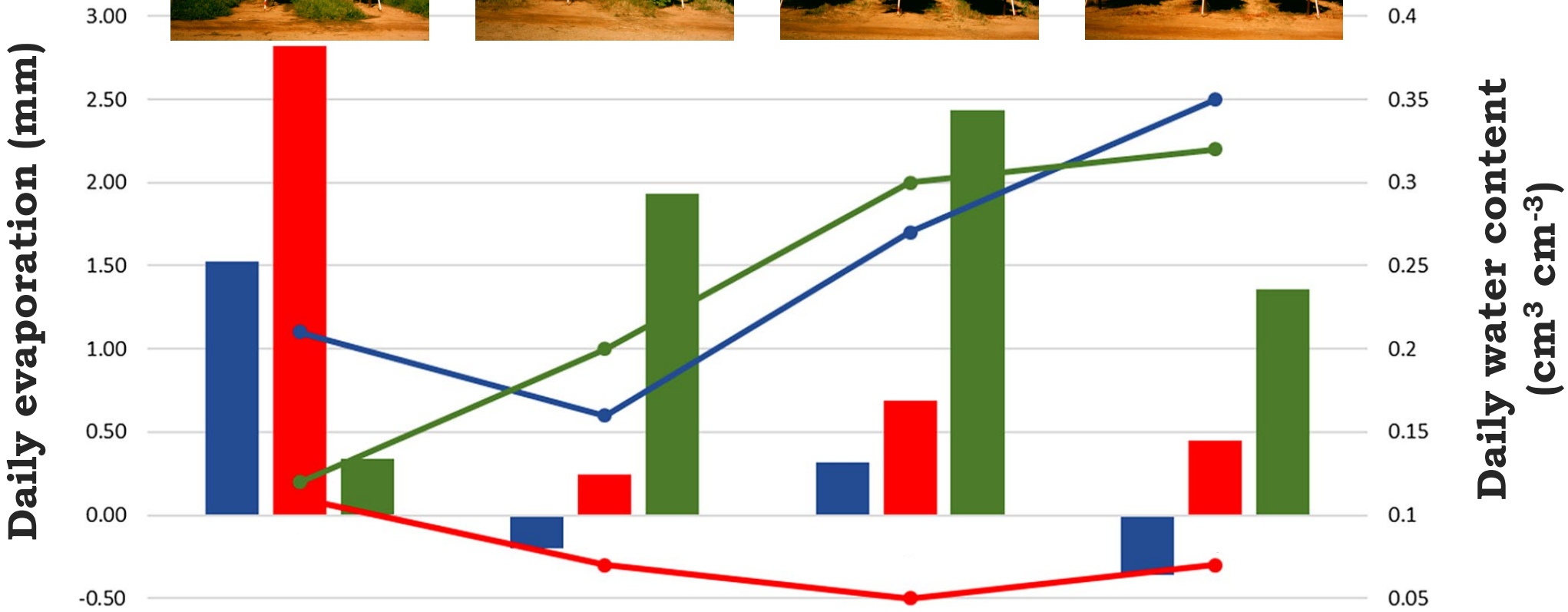
Radiation and water content are main players



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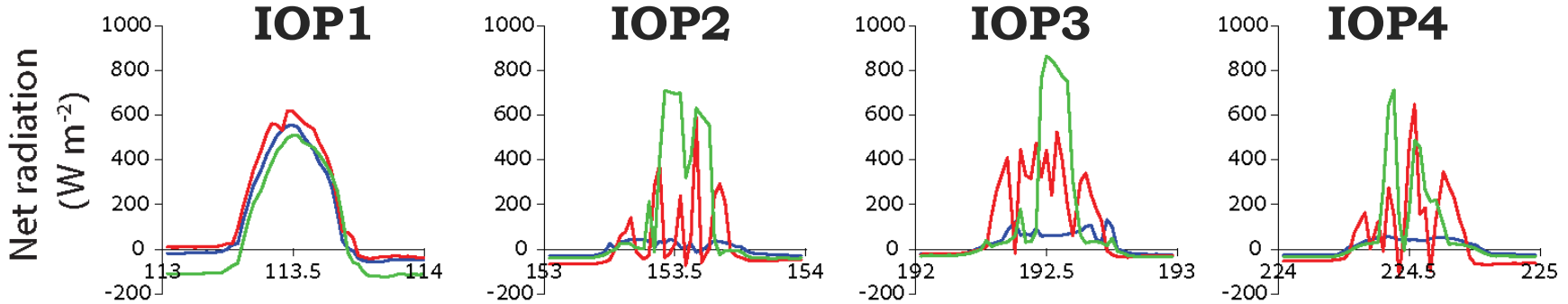
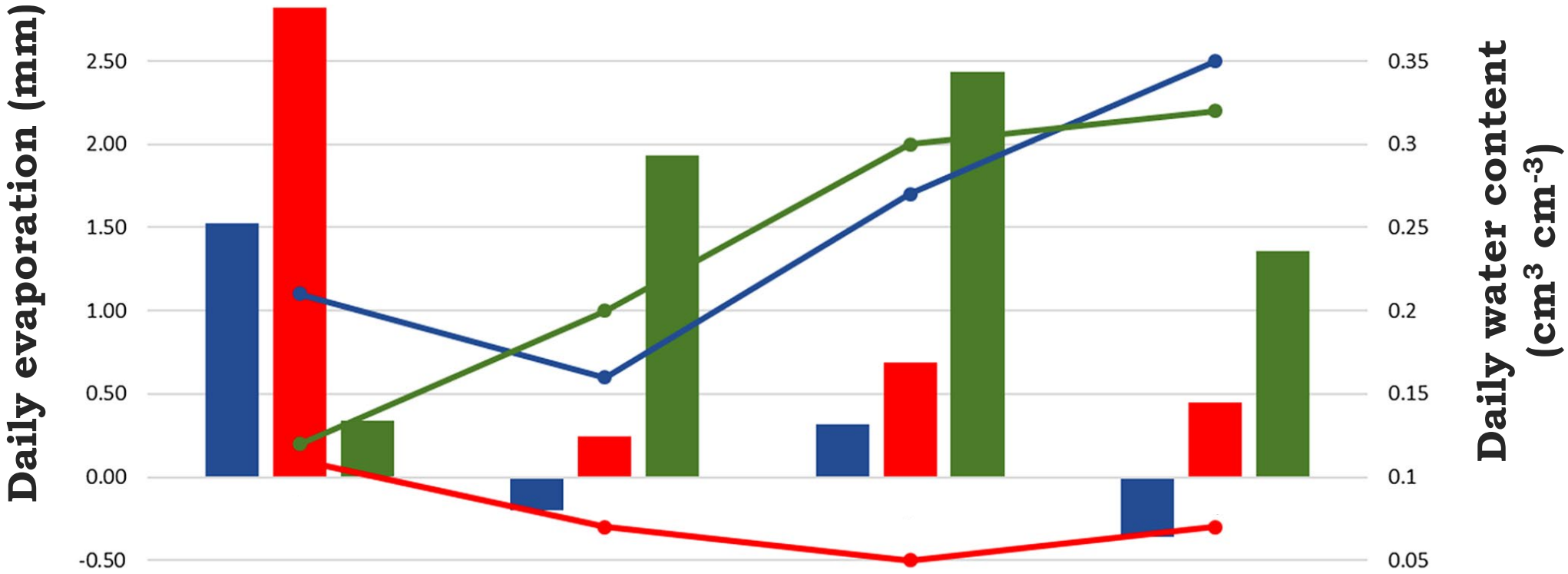

IOP1
IOP2
IOP3
IOP4
Net radiation (W m-2)
1000
800
600
400
200
0
-200
113
113.5
114
153
153.5
154
192
192.5
193
224
224.5
225


Daily evaporation (mm)
2.50
2.00
1.50
1.00
0.50
0.00
-0.50
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
Daily water content (cm3 cm-3)
North facing
Interrow
South facing

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Mean below canopy radiation

Assumption

The mean of 5 measurements is representative of below canopy radiation

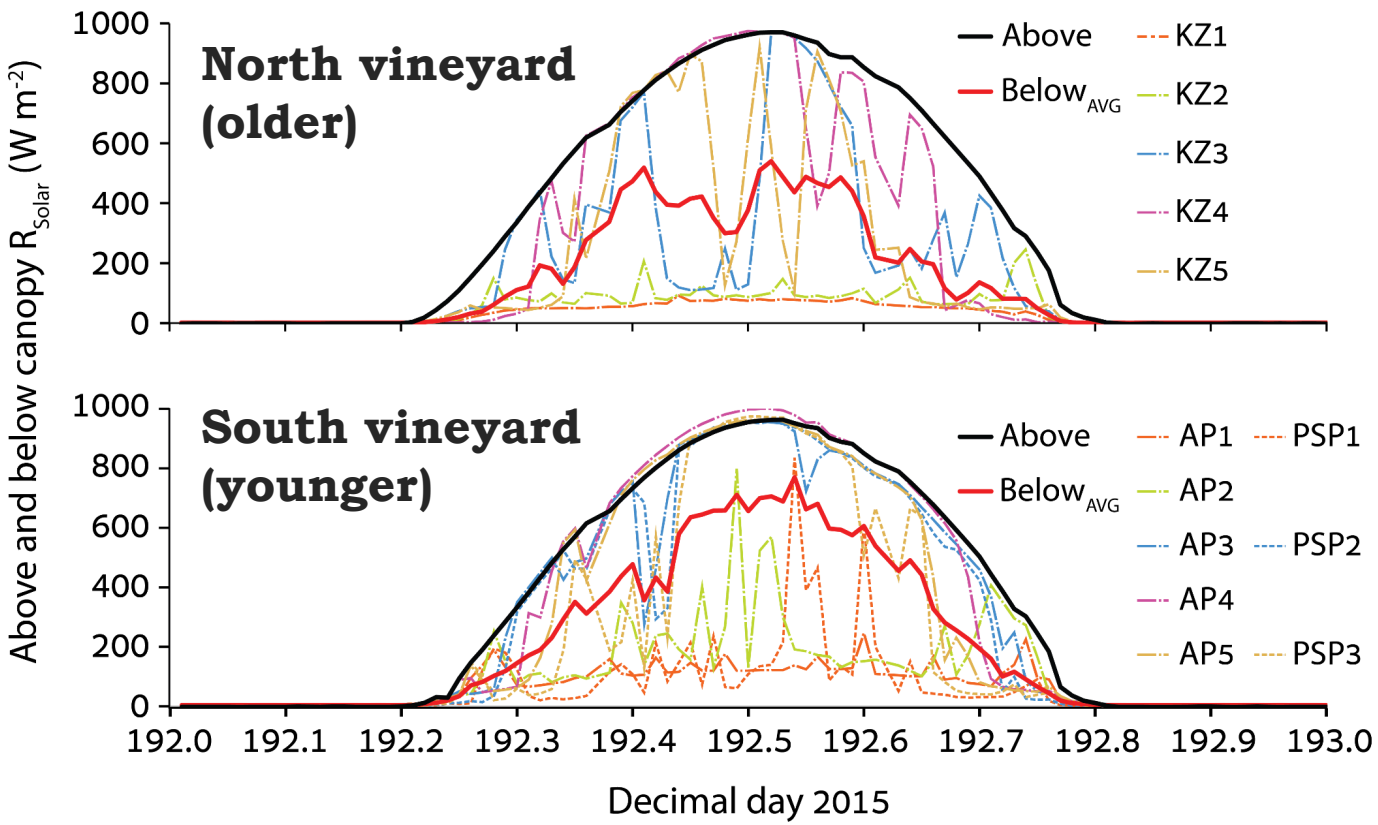
Test

Does daily radiation follow Bear's law?

$$\frac{R_{S_{Below}}}{R_{S_{Above}}} = e^{-\kappa LAI}$$

κ -extinction coefficient

$$0.3 \leq \kappa \leq 0.6$$



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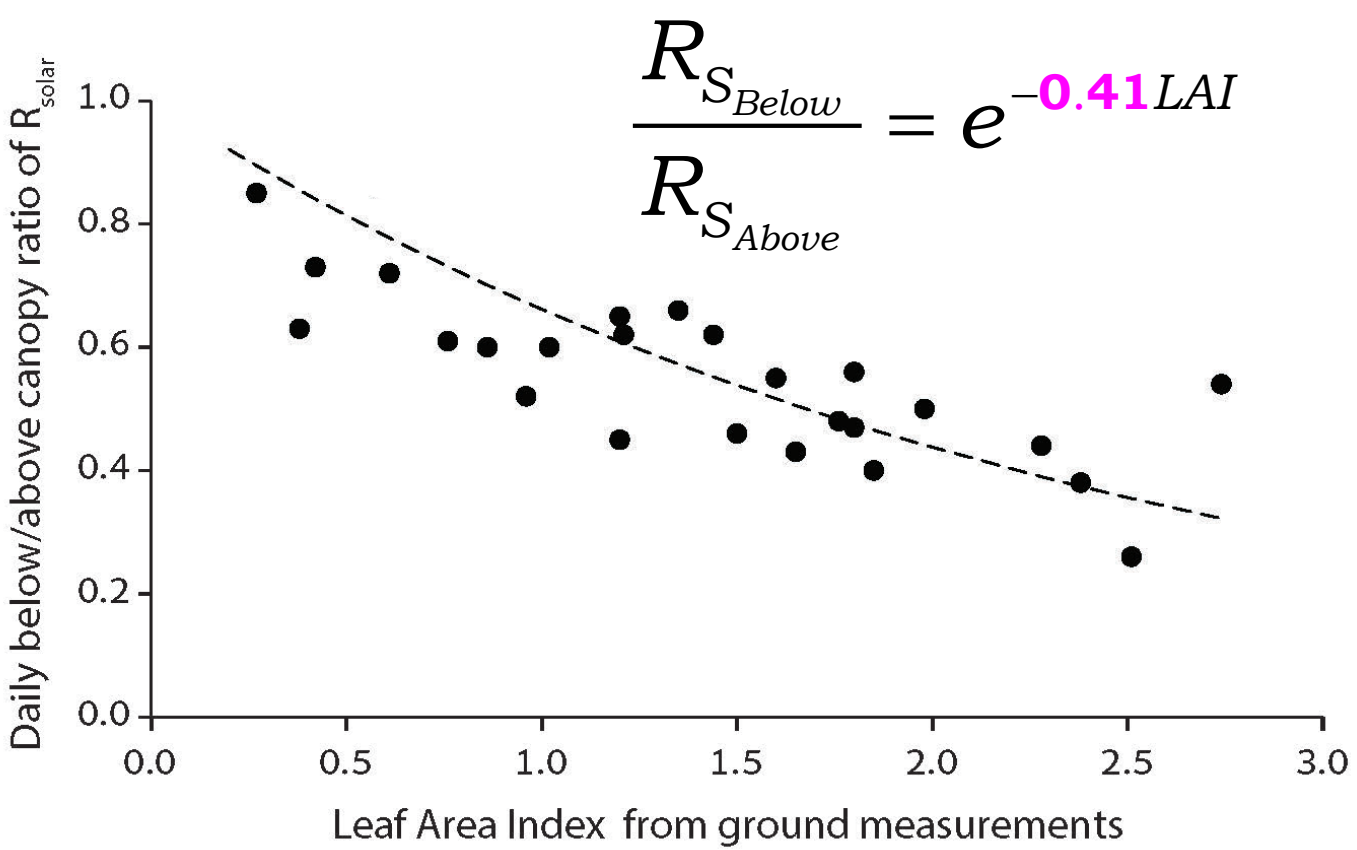

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4th Annual GRAPEX Meeting – E&J Gallo Winery Modesto, California – March 6-8, 2018

Special issue in ***Irrigation Science*** coming up

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