



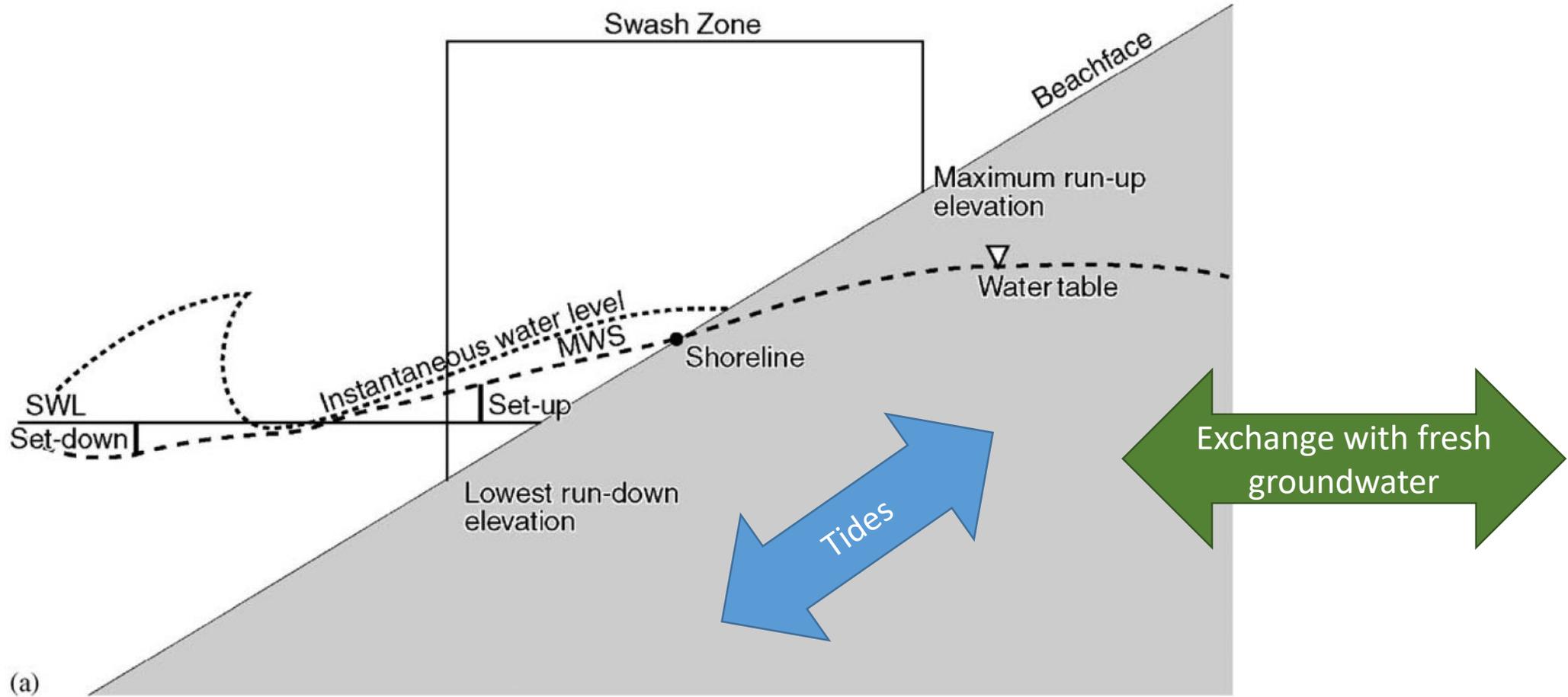
Pore Pressure and Temperature Variations in Mixed-Sand-Gravel Sediments at a Steep, Mega-Tidal Beach

Arash Tavakoli, Nina Stark, Alex E. Hay

E-mail: ninas@vt.edu

Motivation:

Understanding groundwater – surface water interaction in the intertidal zone

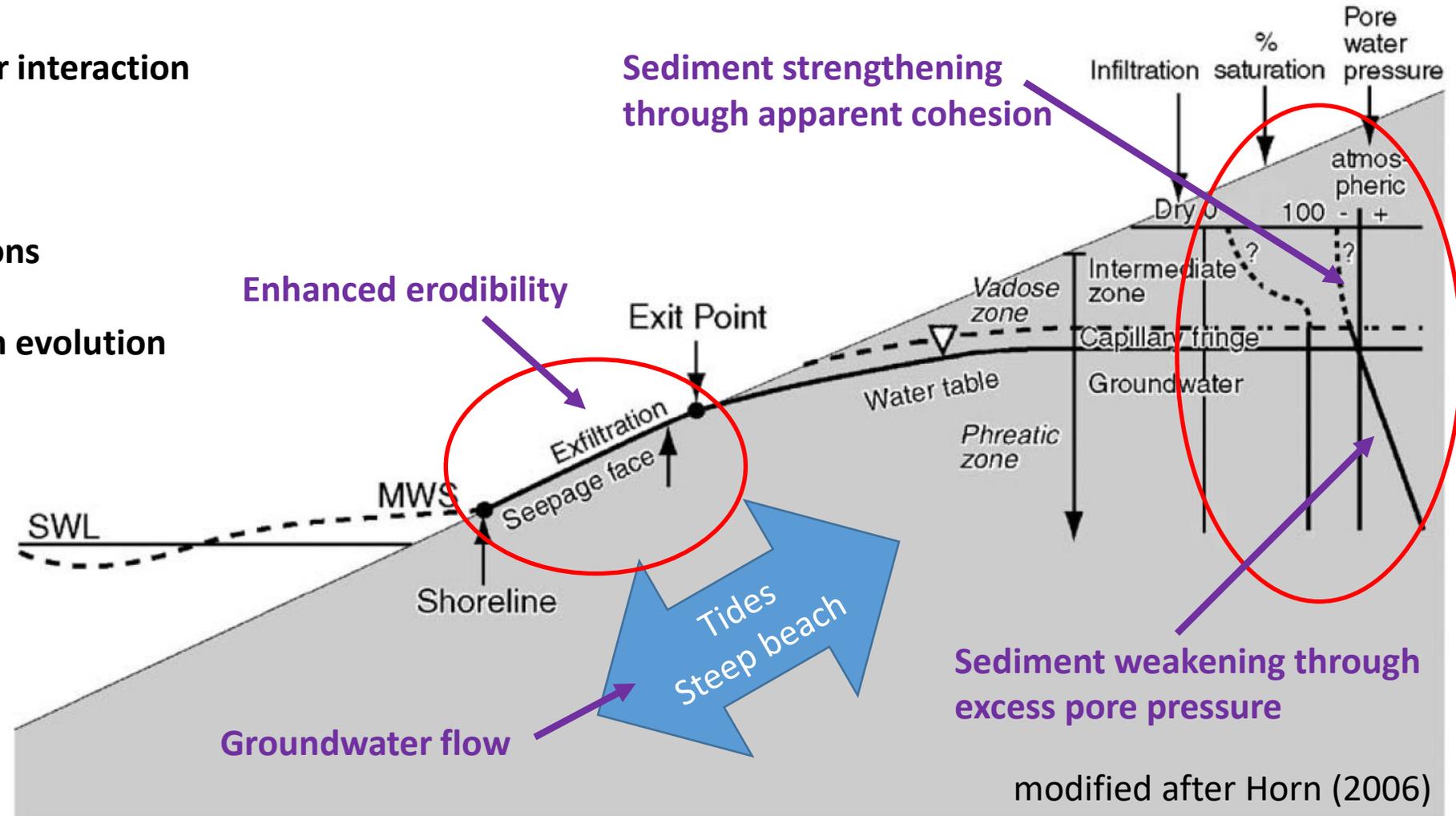


modified after Horn (2006)

Motivation:

Understanding groundwater – surface water interaction in the intertidal zone

- Surface water – groundwater interaction
- Impact of steep beach
- Impact of megatidal conditions
- Impact on erosion and beach evolution



Motivation:

Research goals & questions

Advance the understanding of surface water – groundwater interaction at a mixed sand gravel (MSG), steep, megatidal beach with regards to

- **sediment erodibility**
- **the role of excess pore pressures and liquefaction**

Motivation:

Research goals & questions

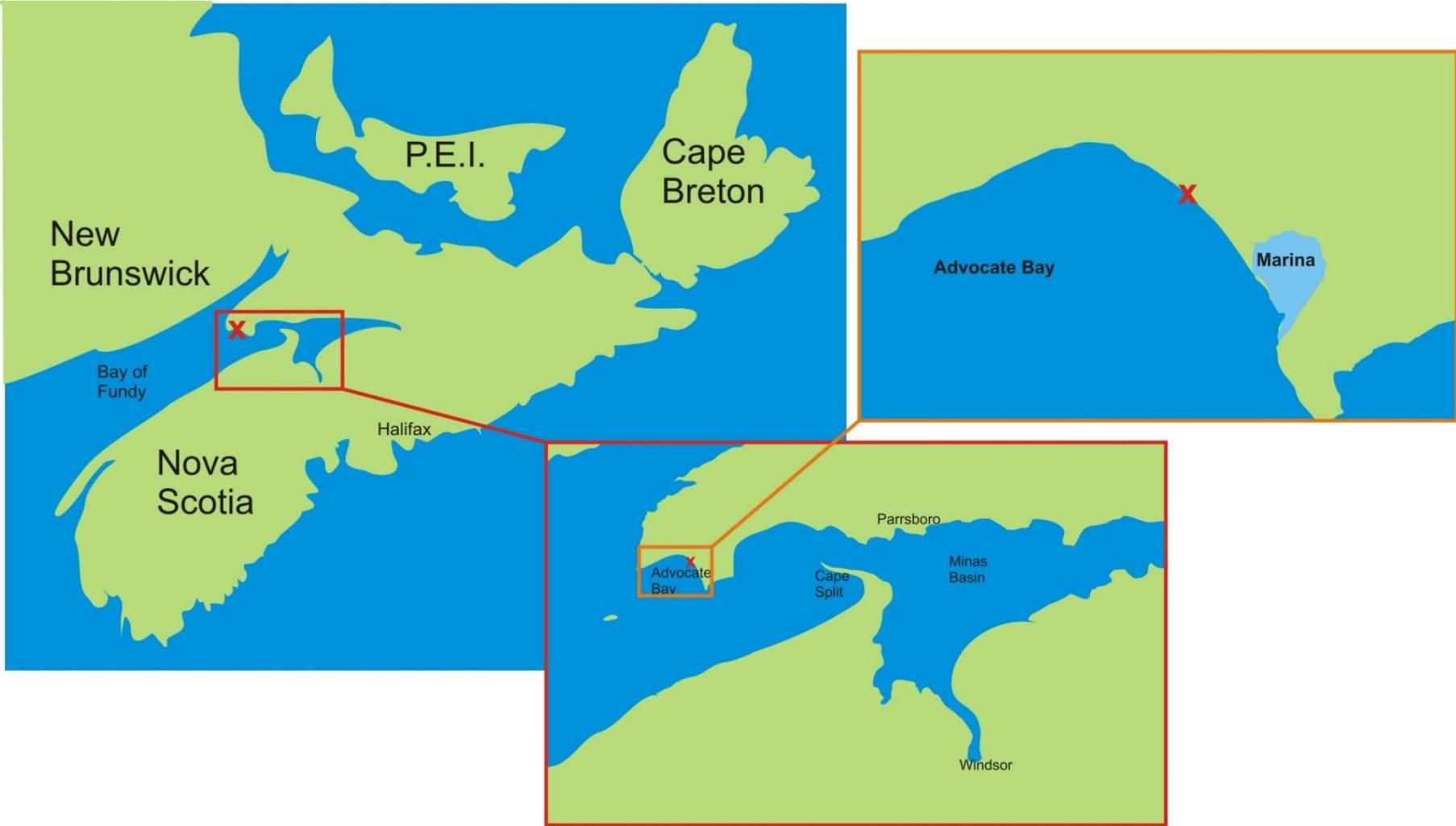
Advance the understanding of surface water – groundwater interaction at a mixed sand gravel (MSG), steep, megatidal beach with regards to

- sediment erodibility
- the role of excess pore pressures and liquefaction

Questions for this study:

- **Do beach soil temperature variations reflect pore space saturation, and wave energy dissipation?**
- **If so, what is the impact of sediment depth?**
- **And, how does it correlate to changes in pore water pressure?**

Regional context:
Advocate Beach, Nova Scotia, Canada



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A) beach cusps at high water level



B)



**C) cobbly beach step
(mostly submerged)**

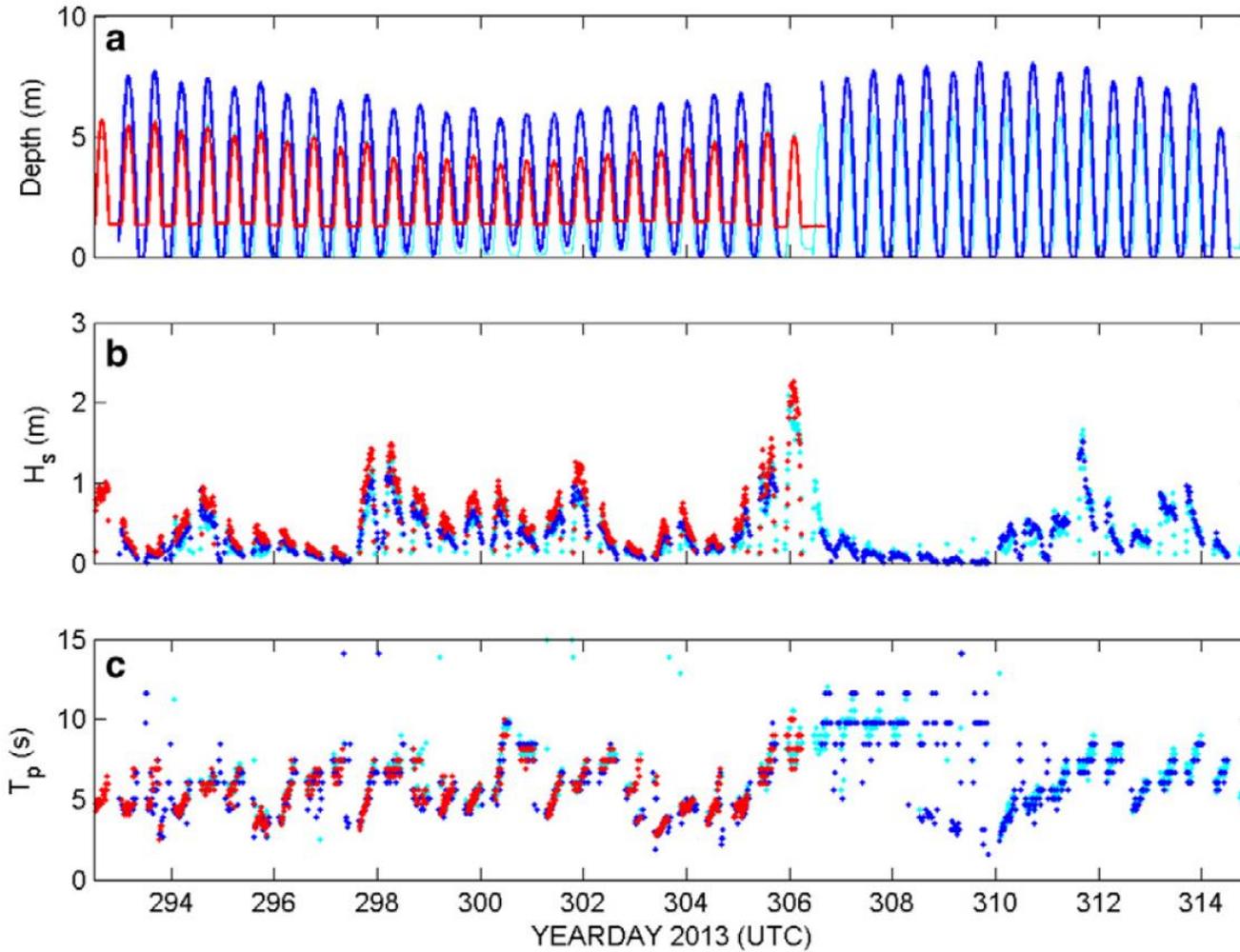


D)



Regional context:

Wave conditions during experiment



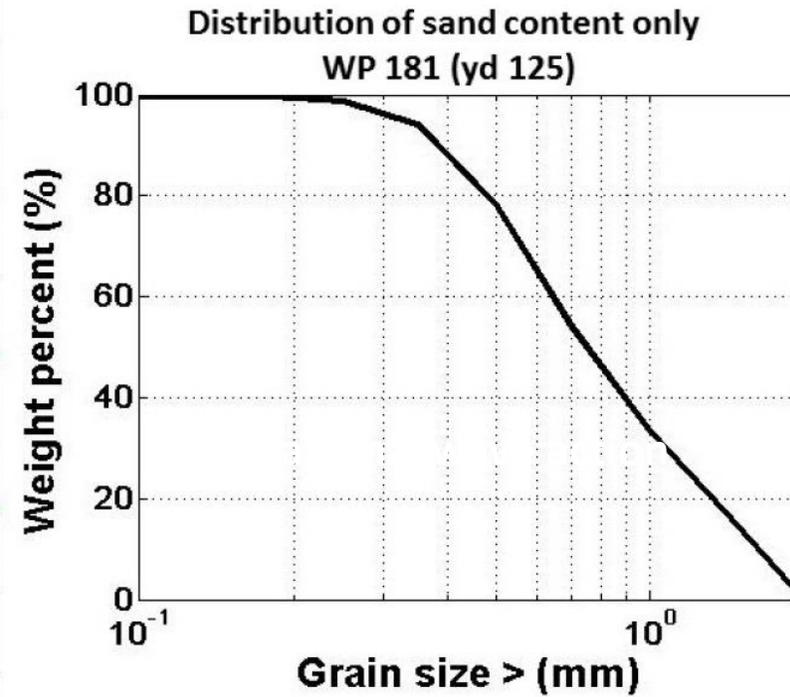
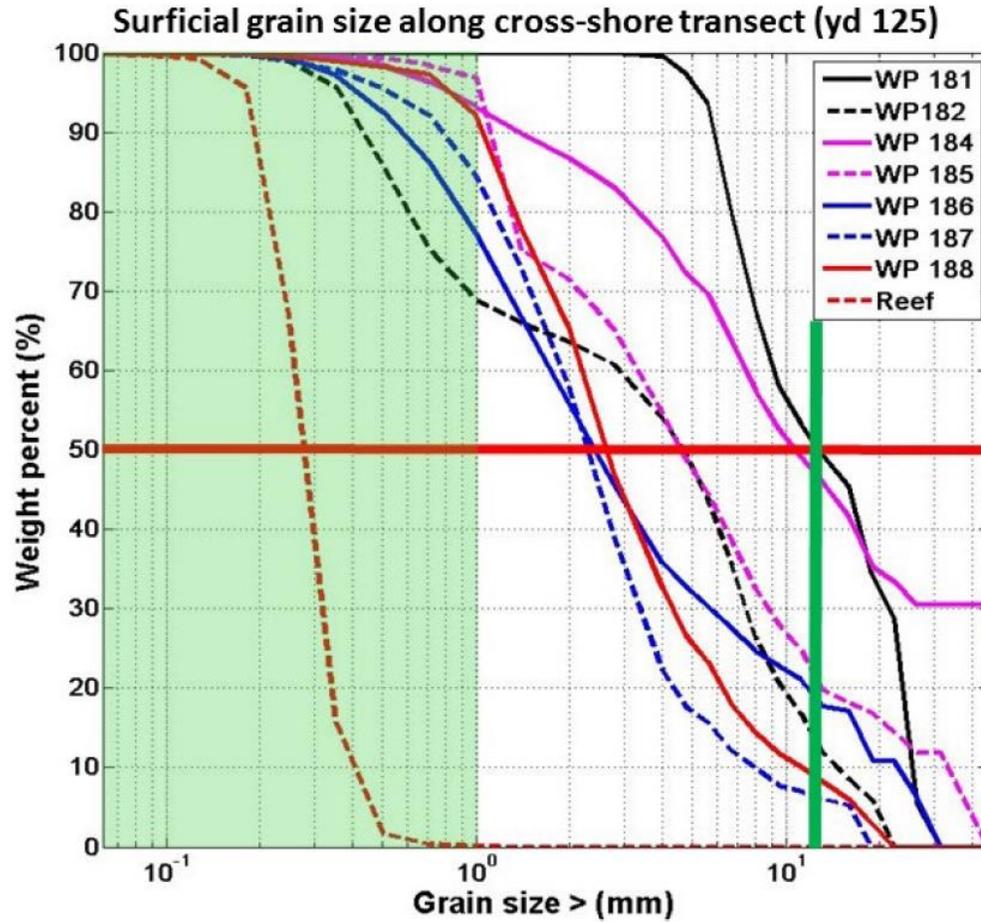
ADCP

PT sensor 50 cm above beachface

PT sensor 5 cm below beachface

Stark & Hay 2016

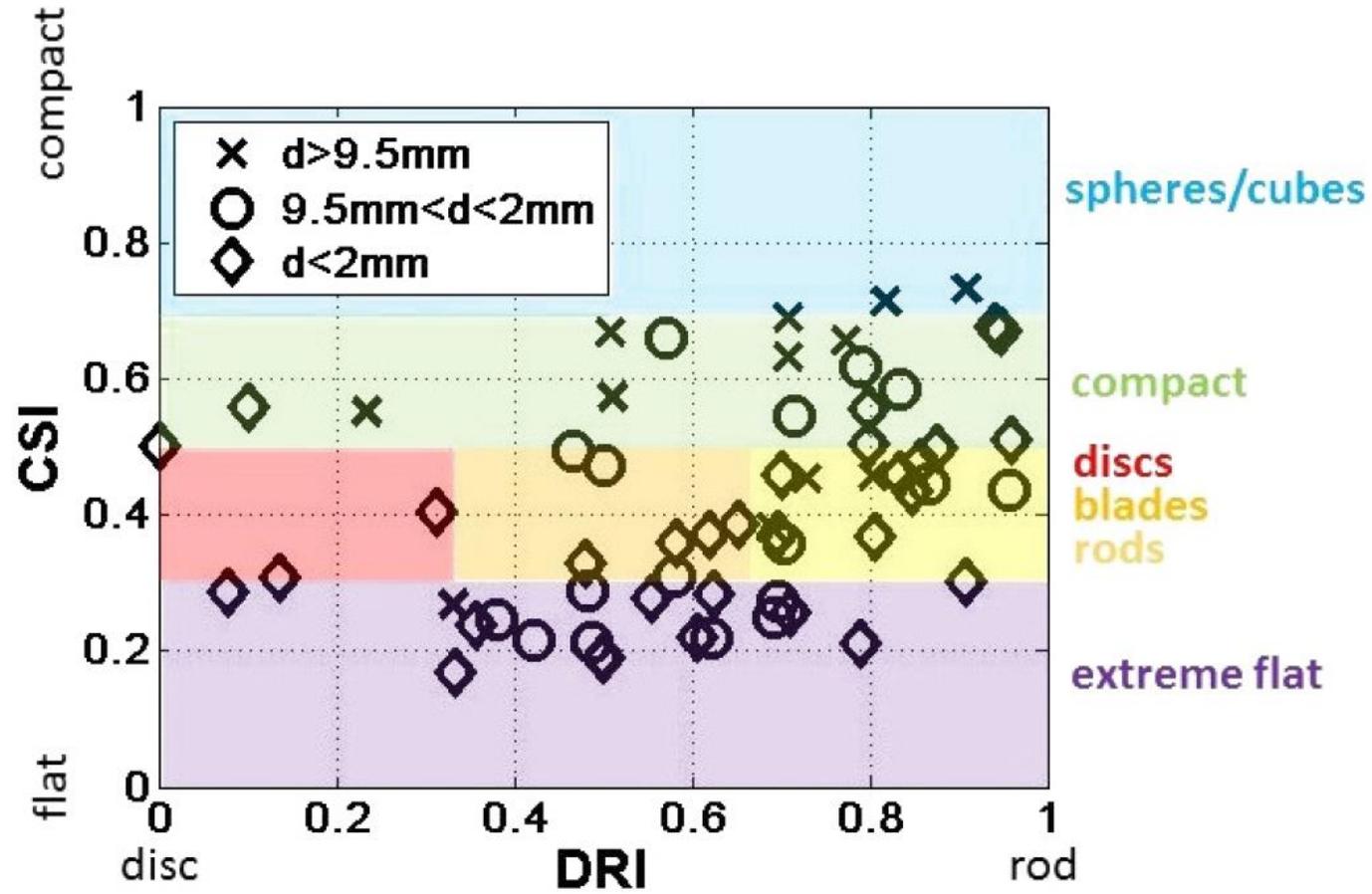
Regional context:
Sediment distributions



Please note data is from 2012.

Stark et al. (2014)

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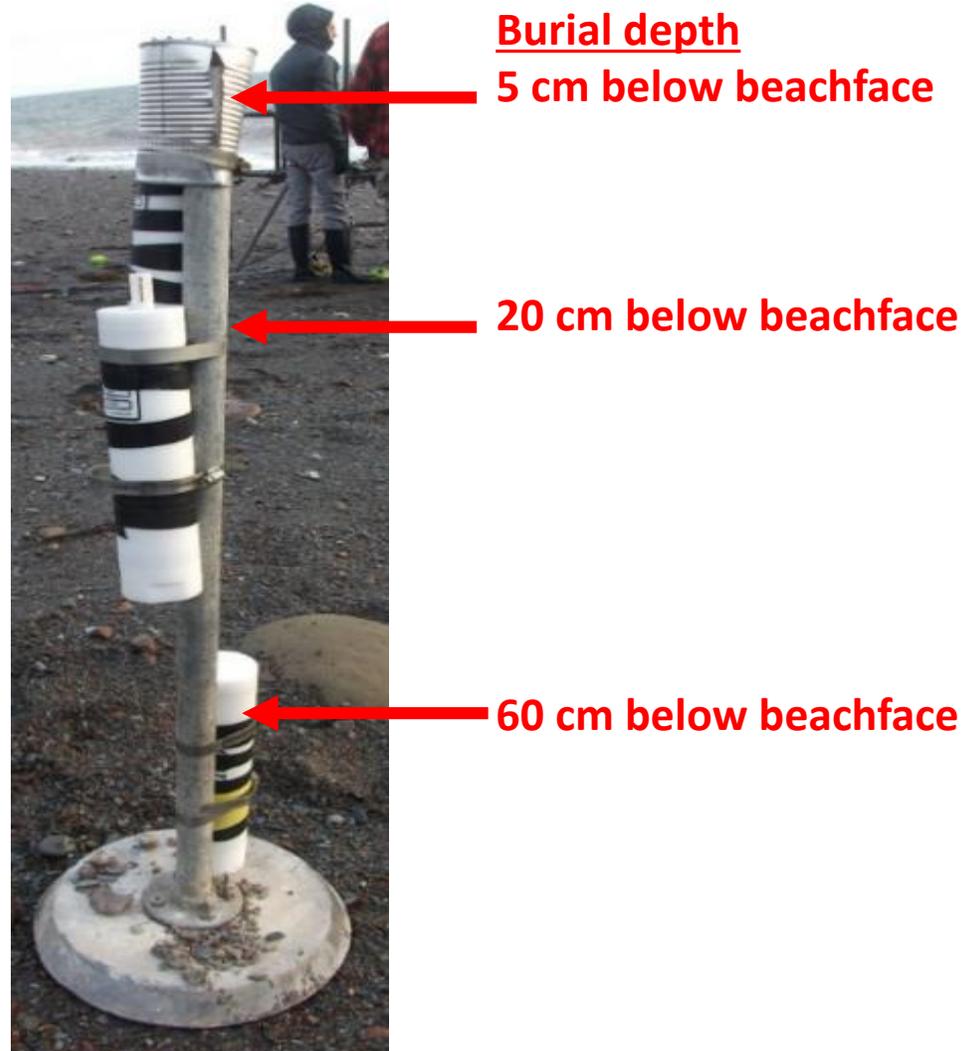


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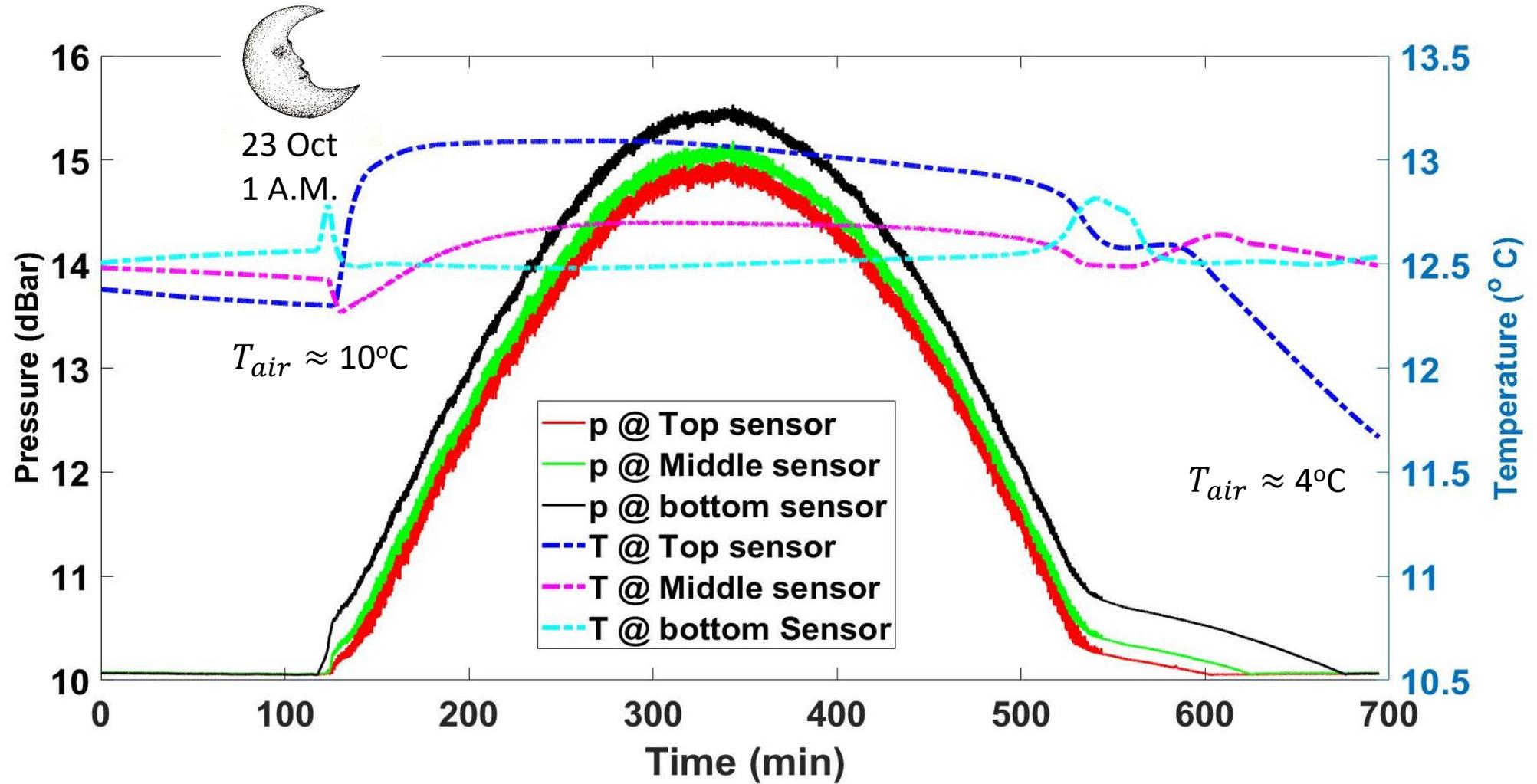
Methods:
pT sensors in vertical array

- RBR Duo (pressure & temperature)
- Sampling frequency 6 Hz
- Vertical array
- Buried in the central intertidal zone
- Oct 21 – Nov 11 2017
- 43 recorded tidal cycles



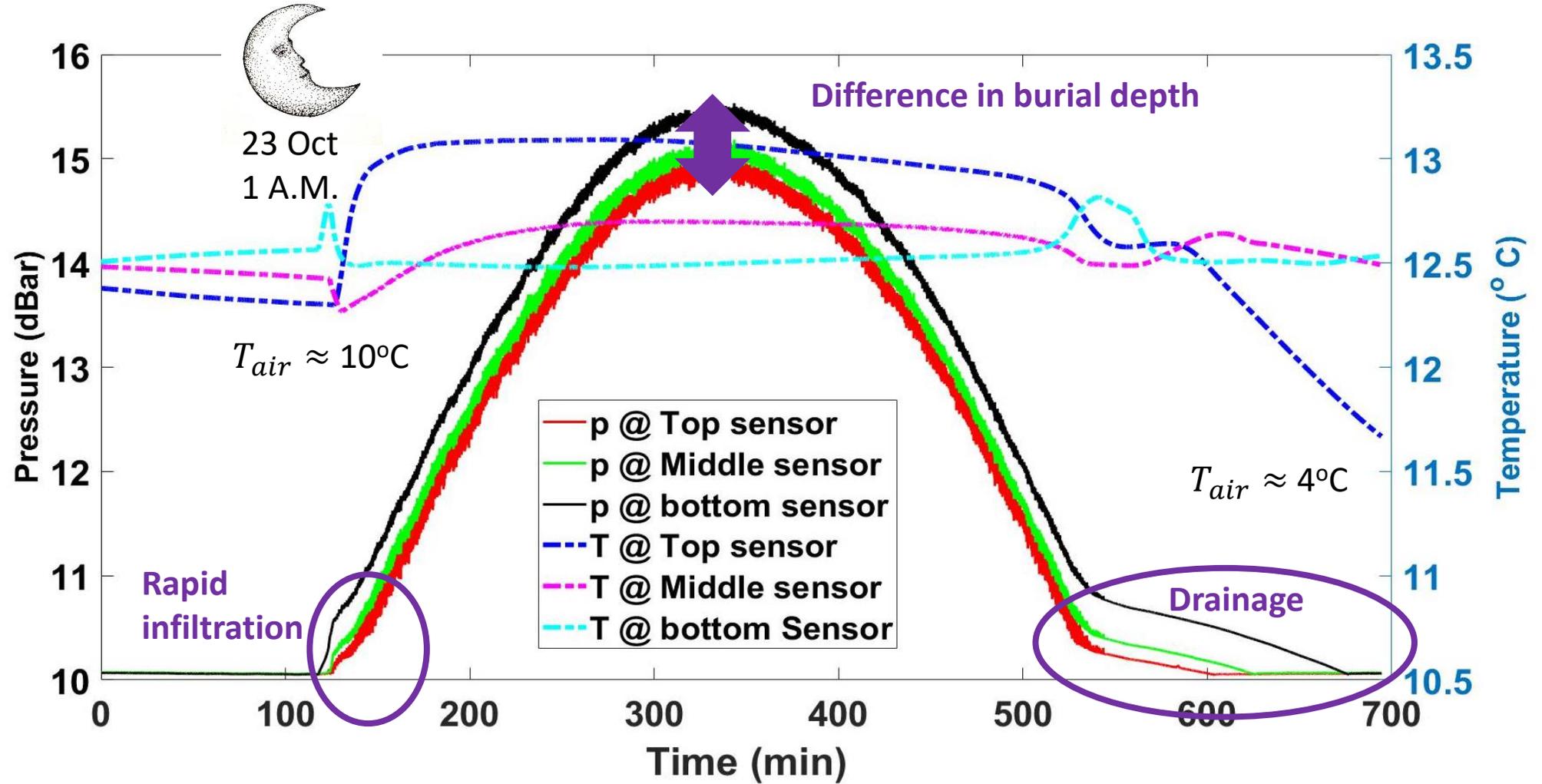
Results:

Tidal cycle #5 ($H_s = 0.2$ m)



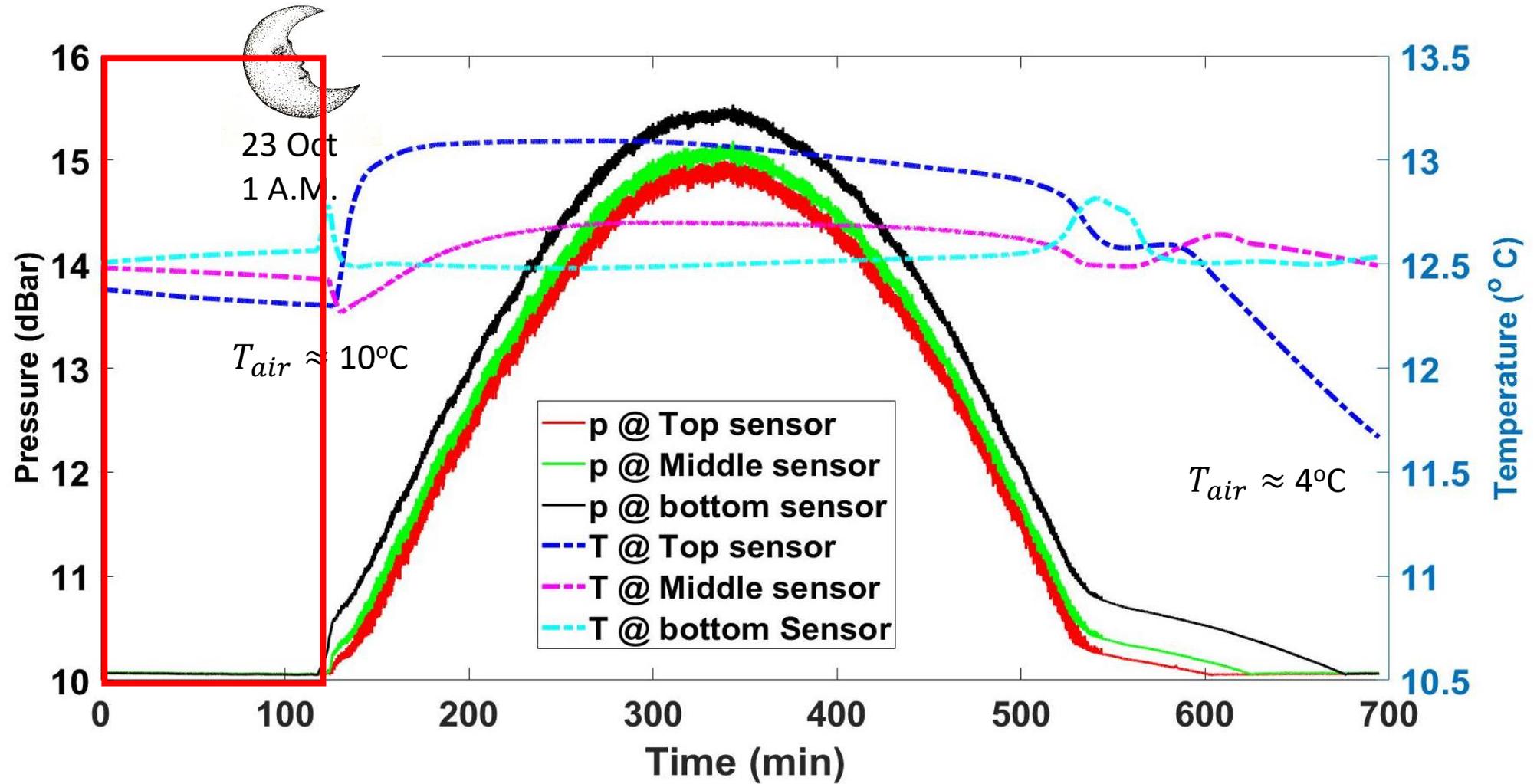
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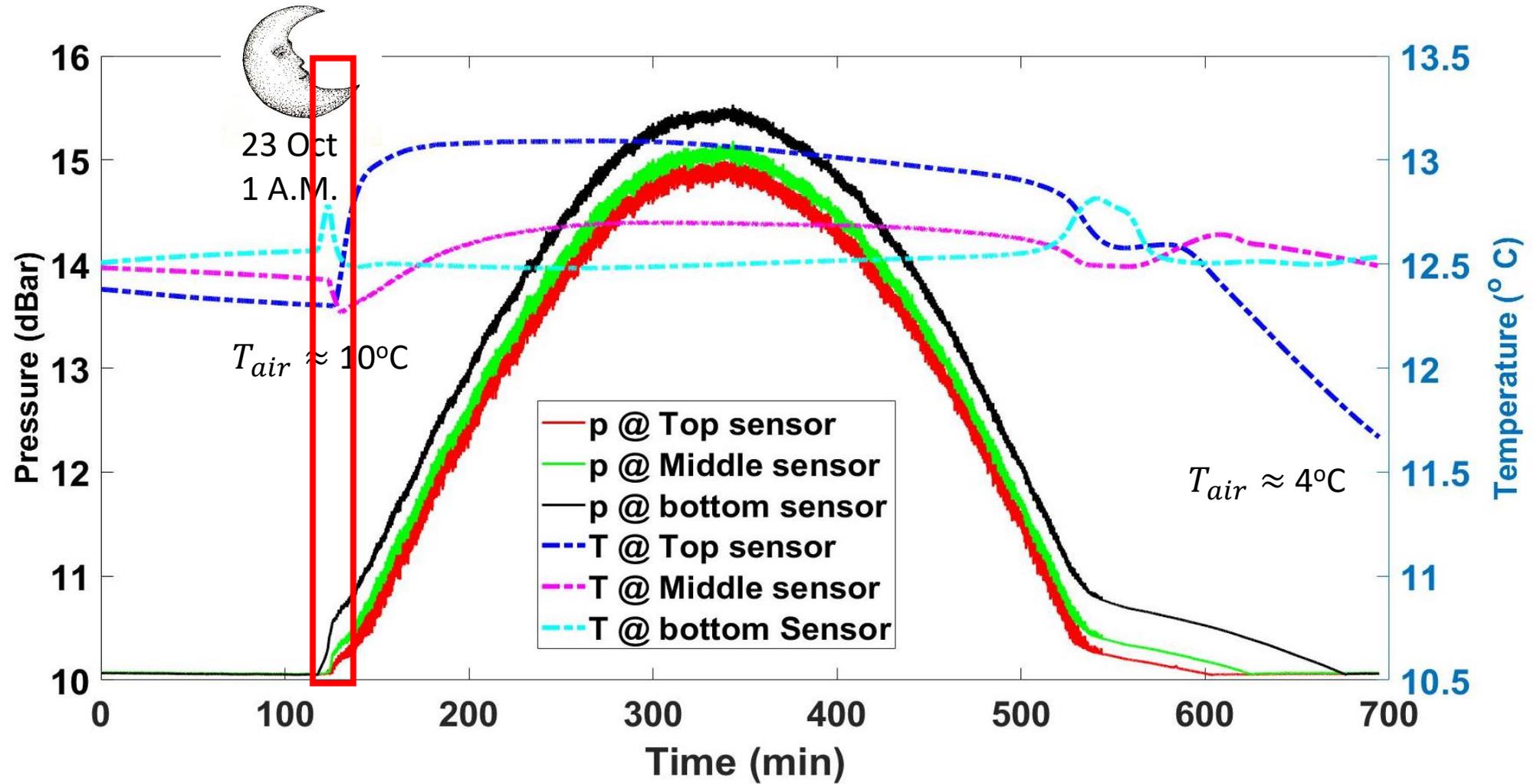
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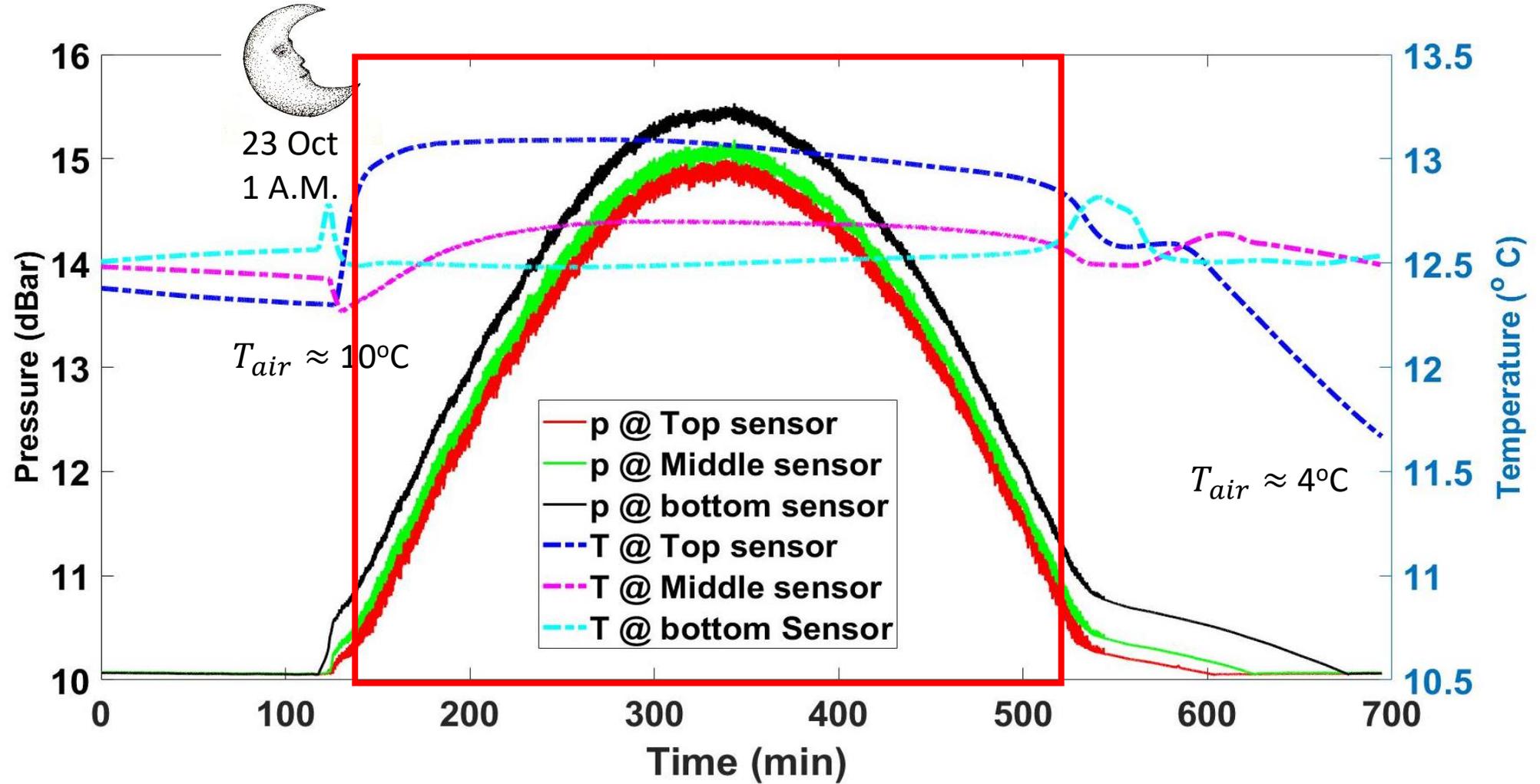
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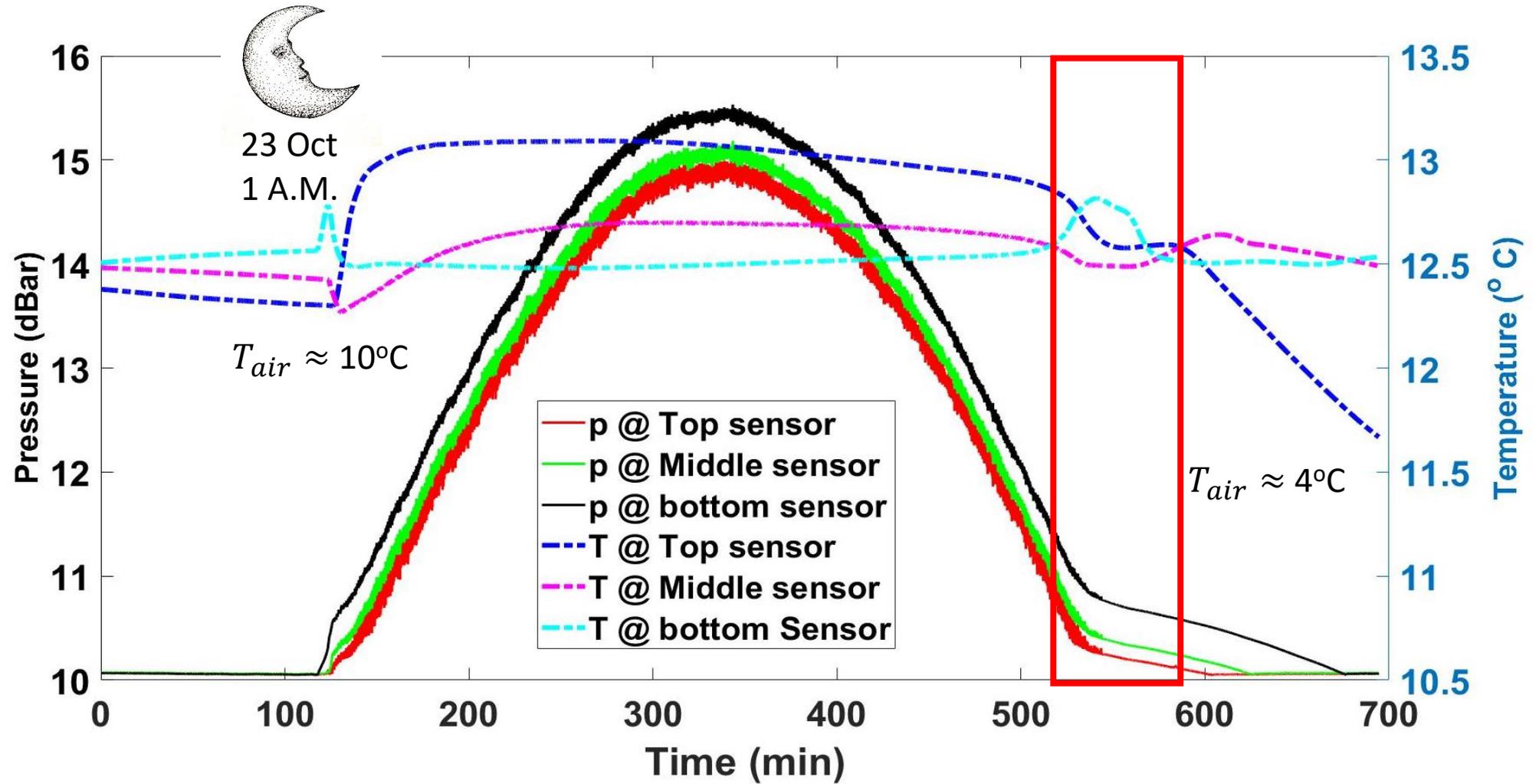
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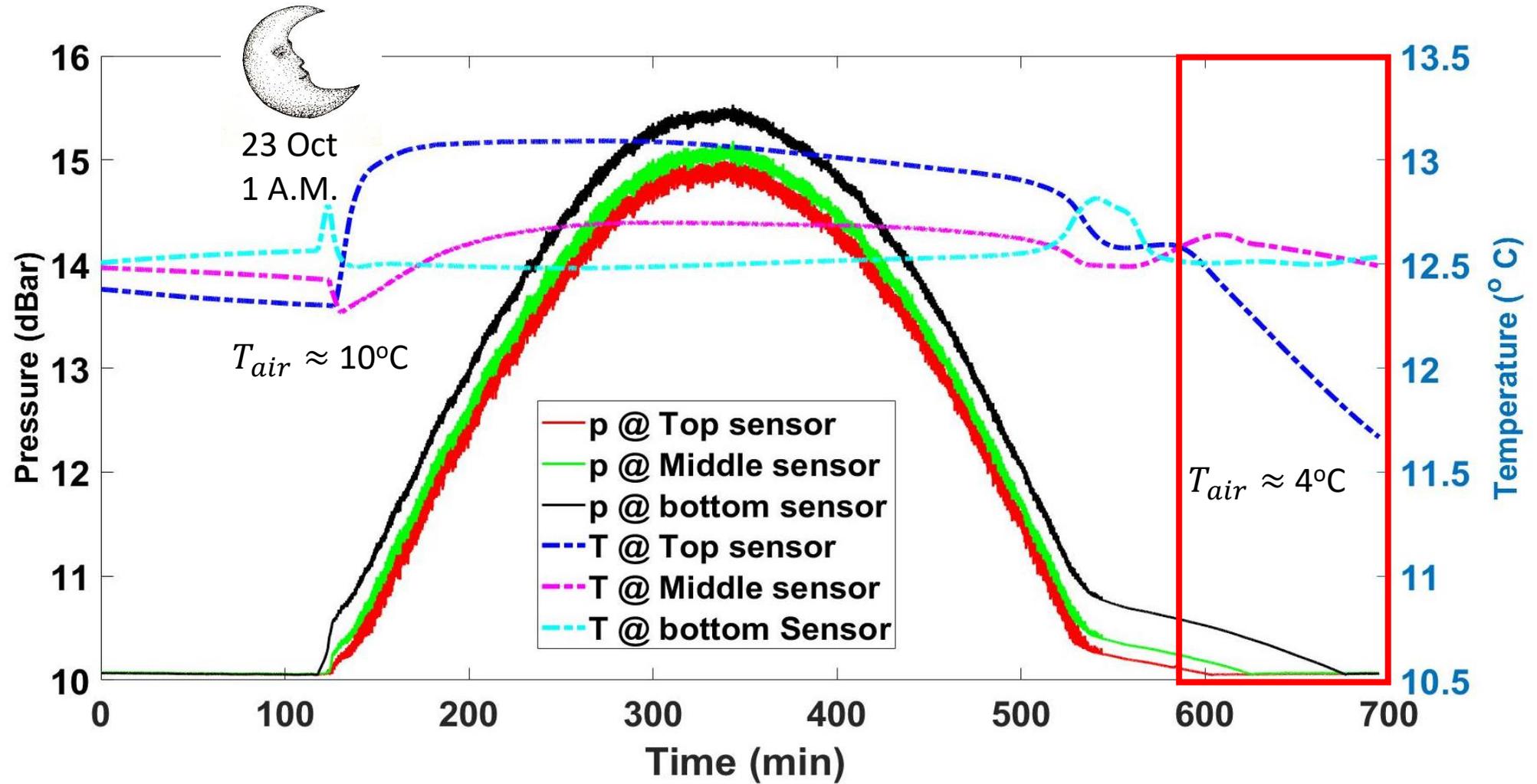
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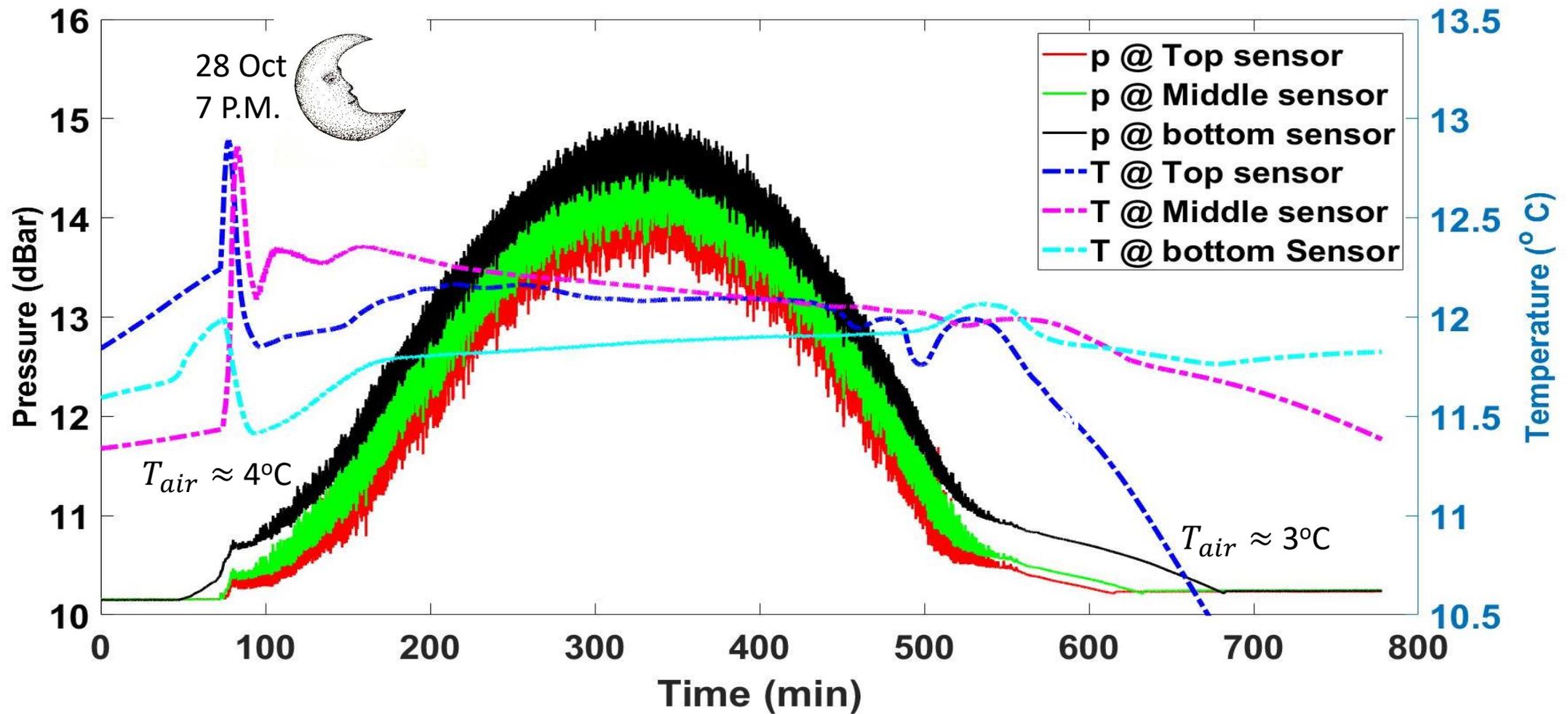
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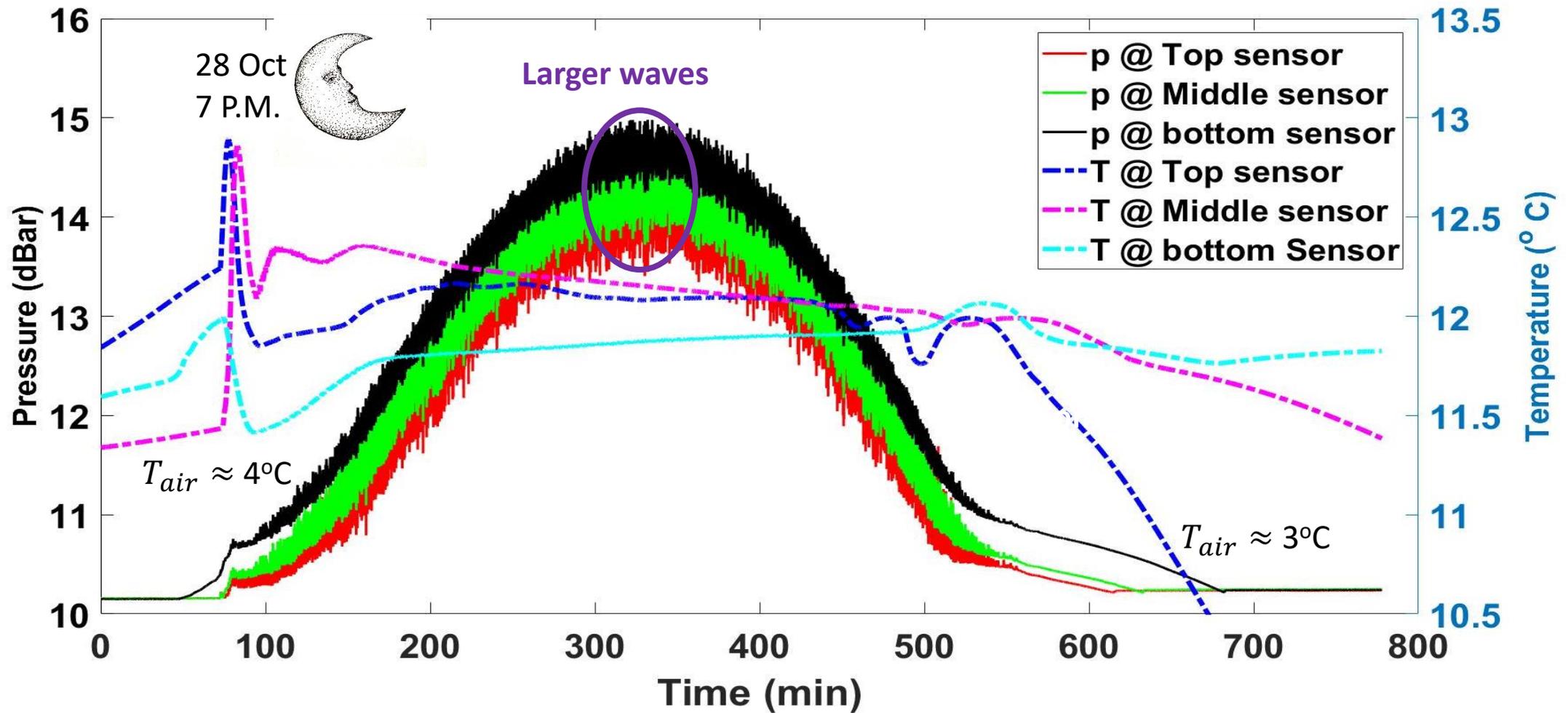
Results:

Tidal cycle #16 ($H_s = 1$ m)



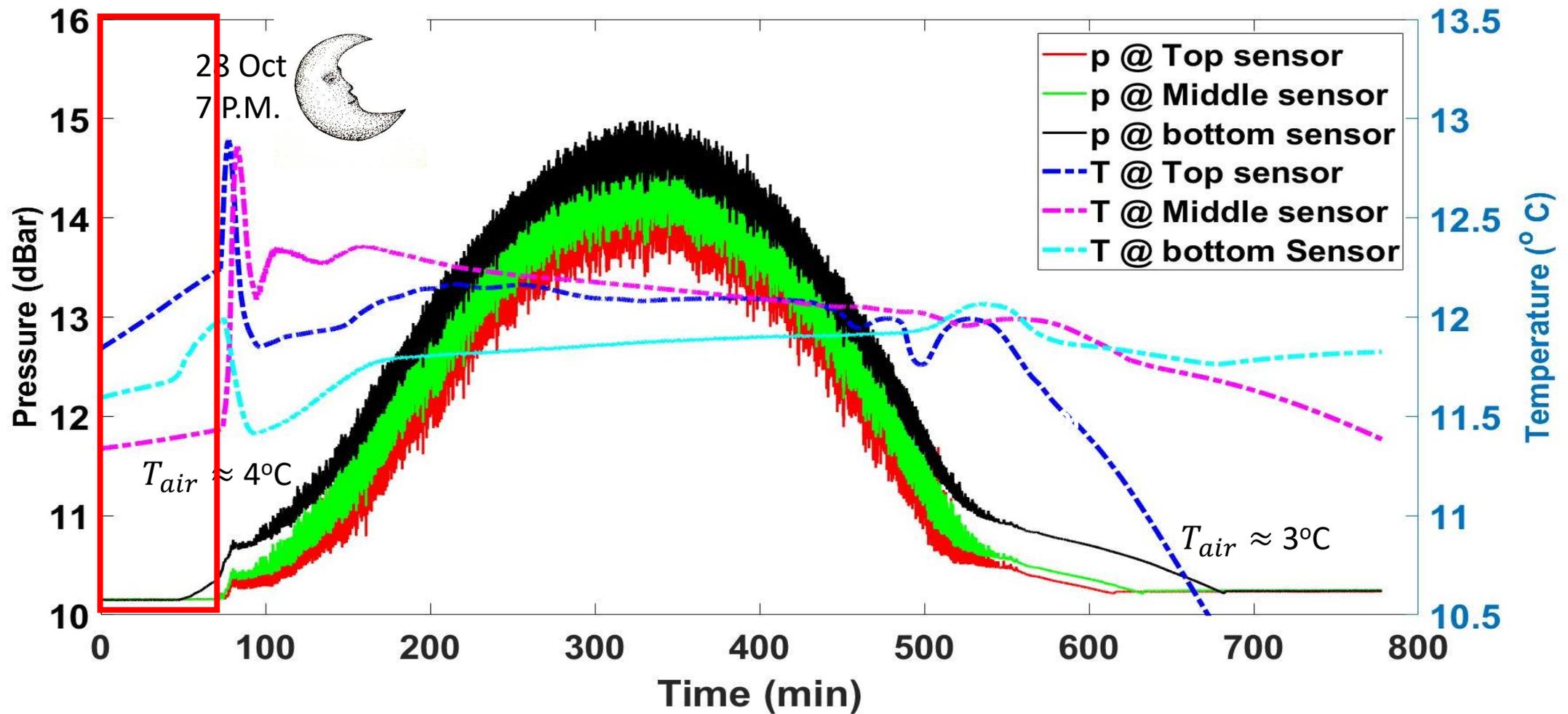
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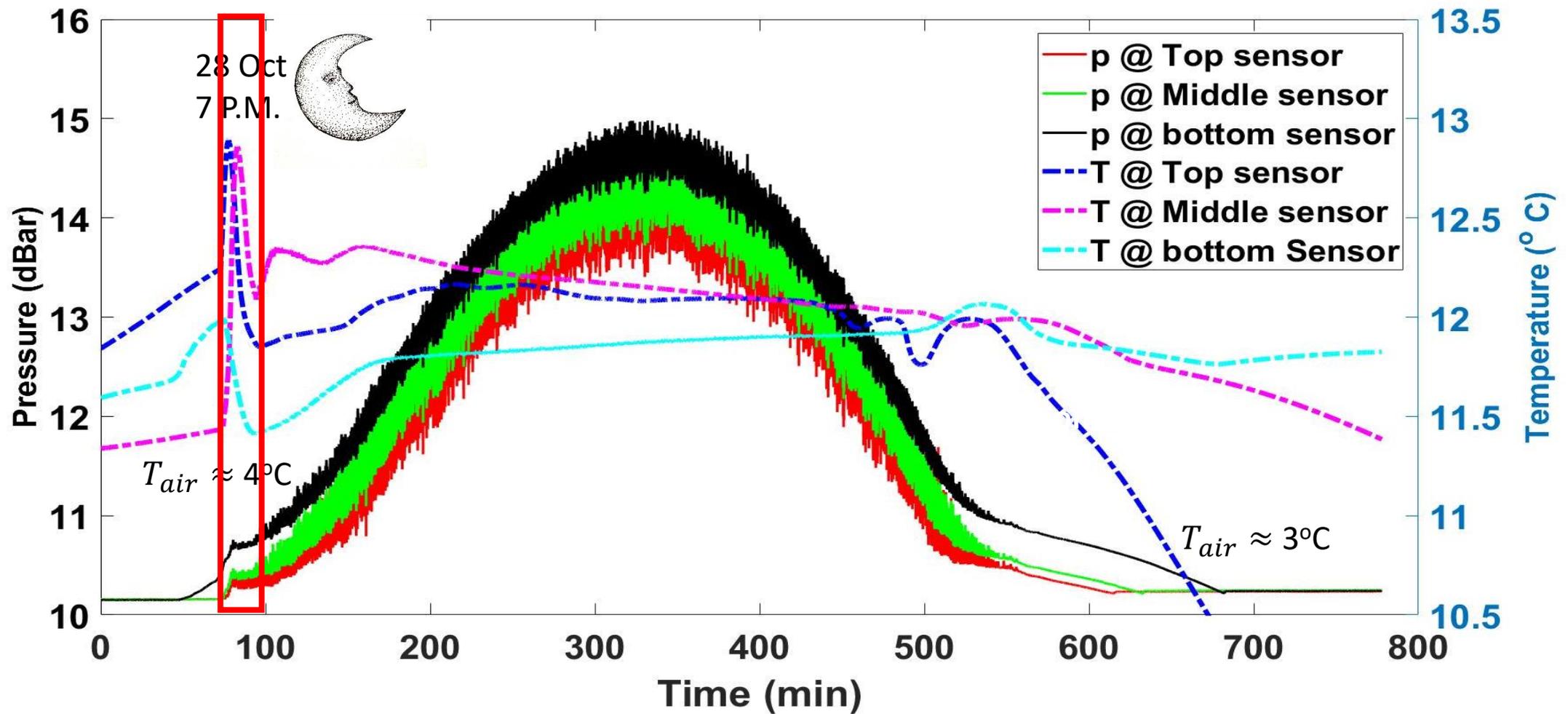
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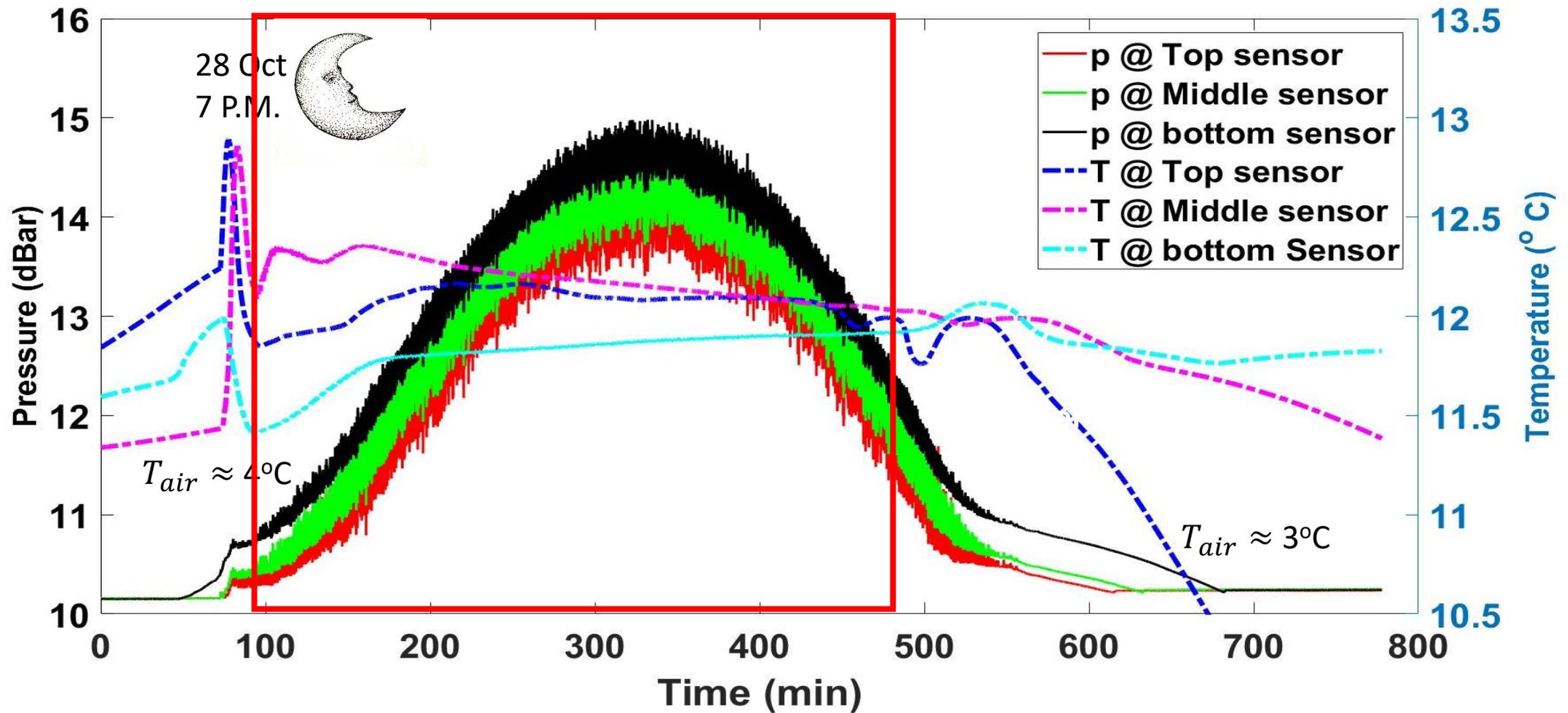
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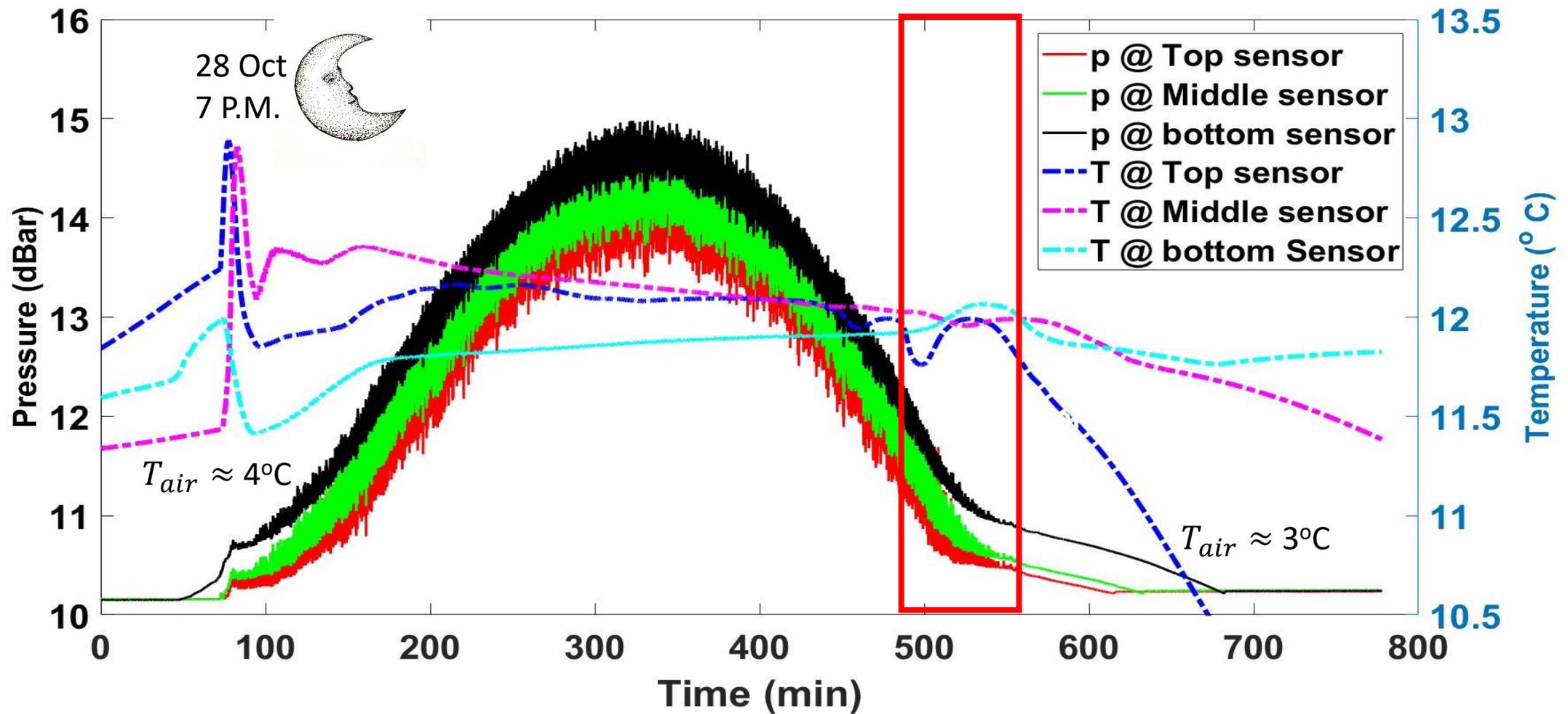
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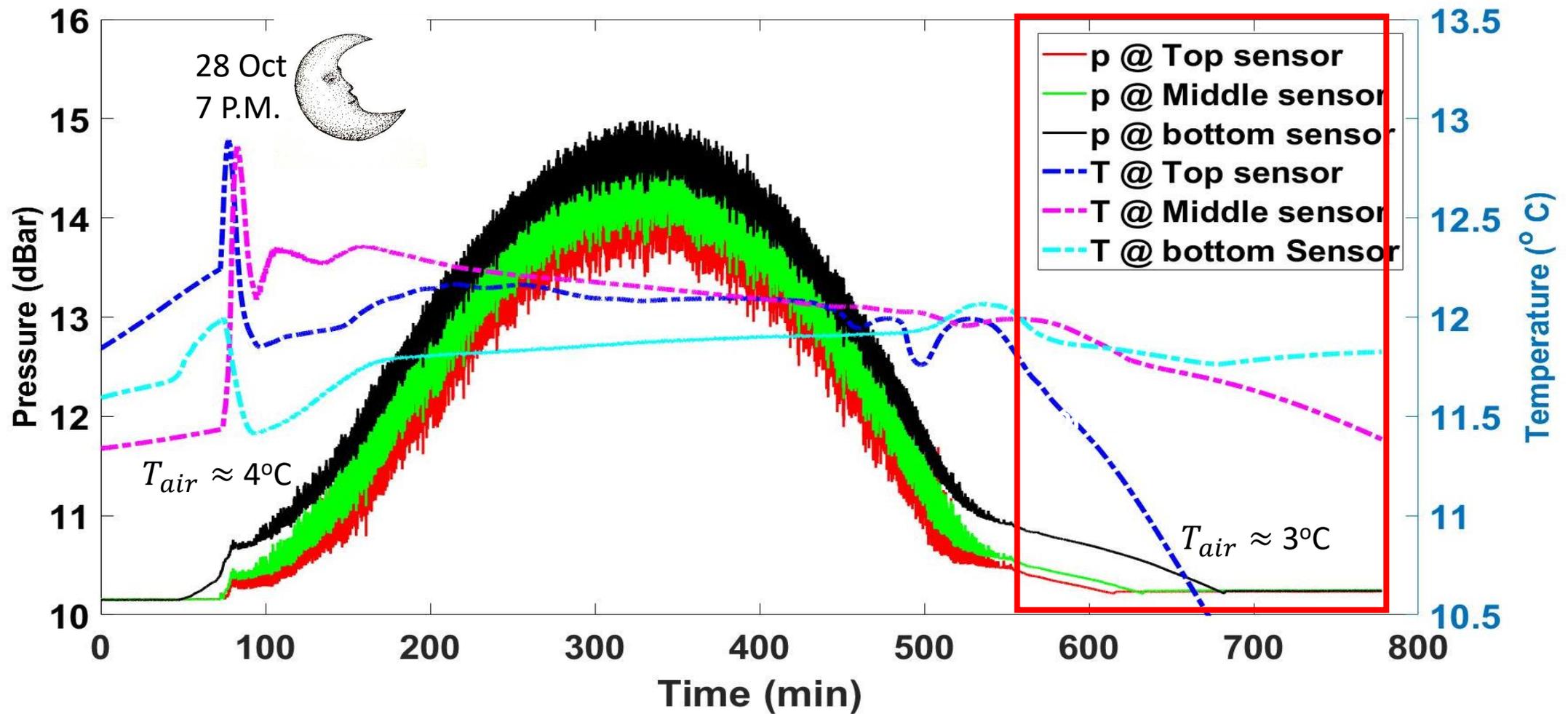
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Observation summary

- **Air temperature was mostly significant lower than water temperature. Sudden decreases in temperature at the end of the ebb tide likely indicate first air ventilation.**
- **This observations applies always to the top sensor, and to the middle sensor in case of calm conditions, while the bottom sensor shows the opposite behavior.**

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- Friction from sediment transport may be responsible for short-term heat generation?
- **Sediment drying was directly correlated to sediment cooling of surficial sediments.**

Next steps

- Statistical analysis of all tidal cycles for process detection, and determining certainty.
- Investigate additional sites.
- Implement in groundwater – surface water model.

Acknowledgments

Thank you for your attention!

Corresponding author: Nina Stark (ninas@vt.edu)

The authors thank the Advocate Harbour experiment field team (R. Cheel, L. Zedel, D. Barclay, M.G. Hatcher, J. Hare, T. Guest, W. Judge, Ø. Lundesgaard and D. Schillinger). The authors acknowledge financial support from the Natural Sciences and Engineering Research Council of Canada (grant numbers 198845-2012 and 429584-2012), the Atlantic Innovation Fund (award number 193499) and Nortek.

