

# Observing and Modeling the variability of DWLs during the Summer Monsoon in the Northern Indian Ocean

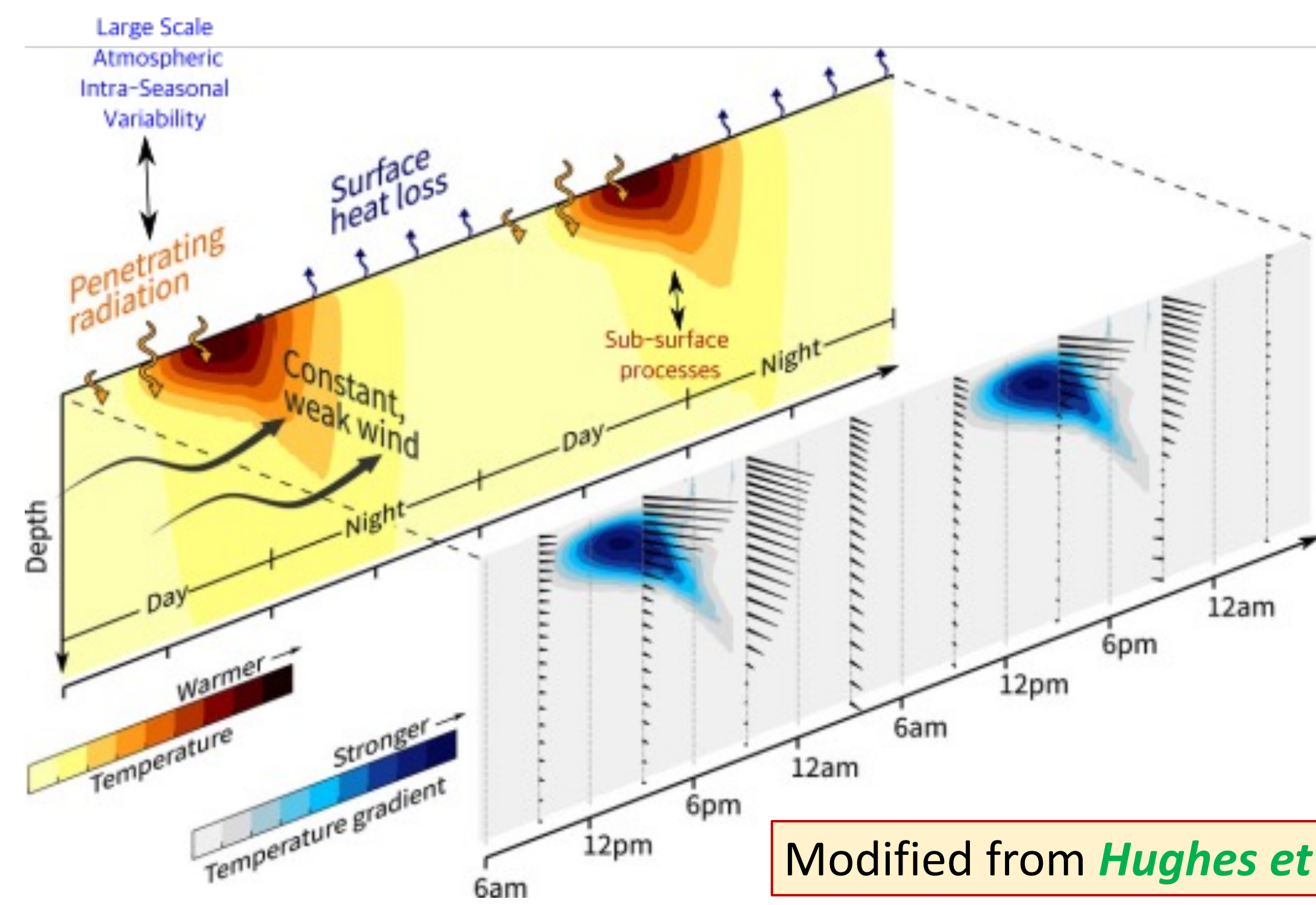
Siddhant Kerhalkar<sup>1,\*</sup>, Amit Tandon<sup>1</sup>, Tamara Schlosser<sup>2</sup>, J. Thomas Farrar<sup>3</sup>, Andrew J Lucas<sup>2</sup>, Leah Johnson<sup>4</sup>, Verena Hormann<sup>2</sup>, Luca R Centurioni<sup>2</sup>

(1) University of Massachusetts Dartmouth (2) Scripps Institution of Oceanography (3) Woods Hole Oceanographic Institution (4) University of Washington

\*Email: [skerhalkar@umassd.edu](mailto:skerhalkar@umassd.edu)

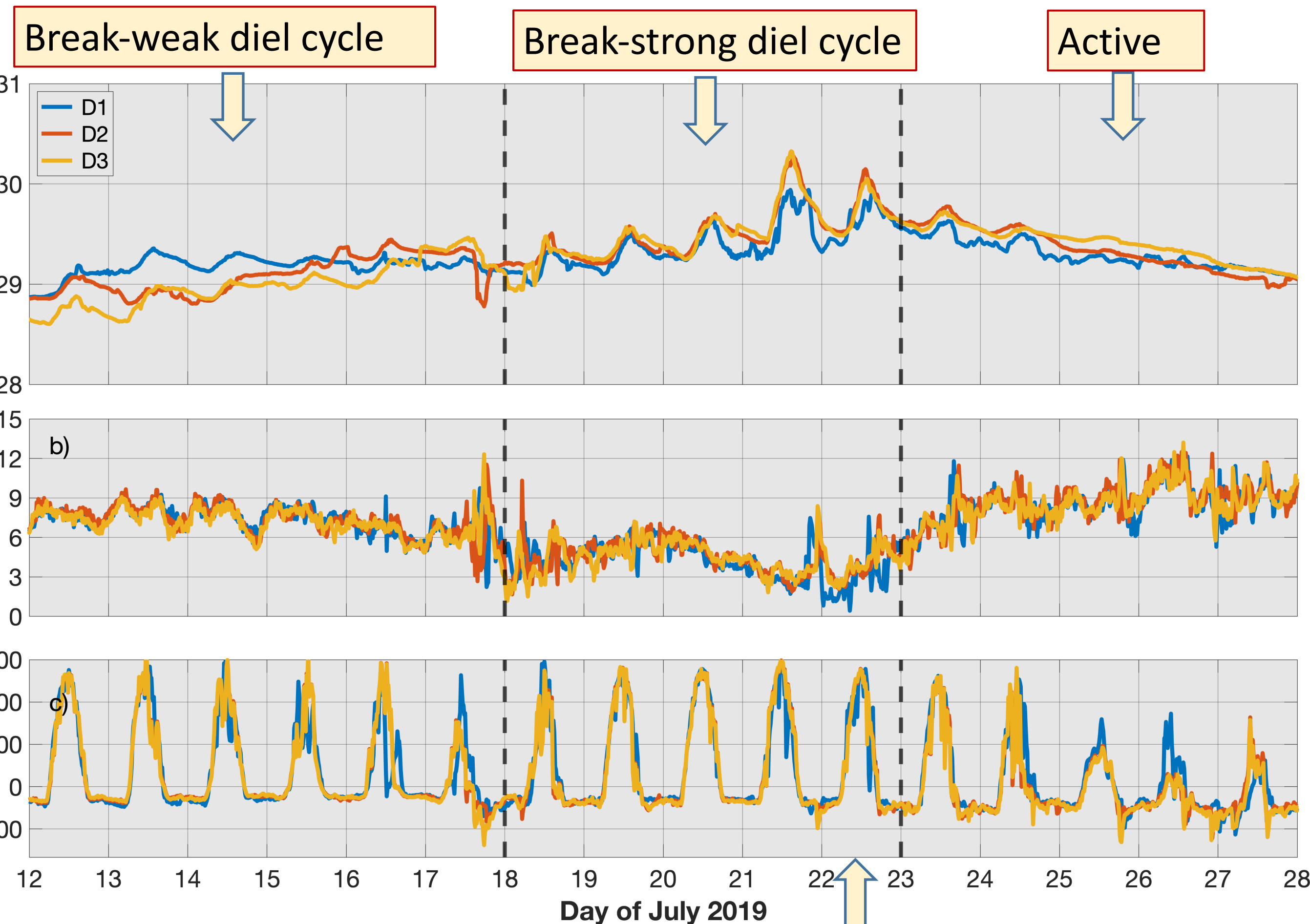


## INTRODUCTION



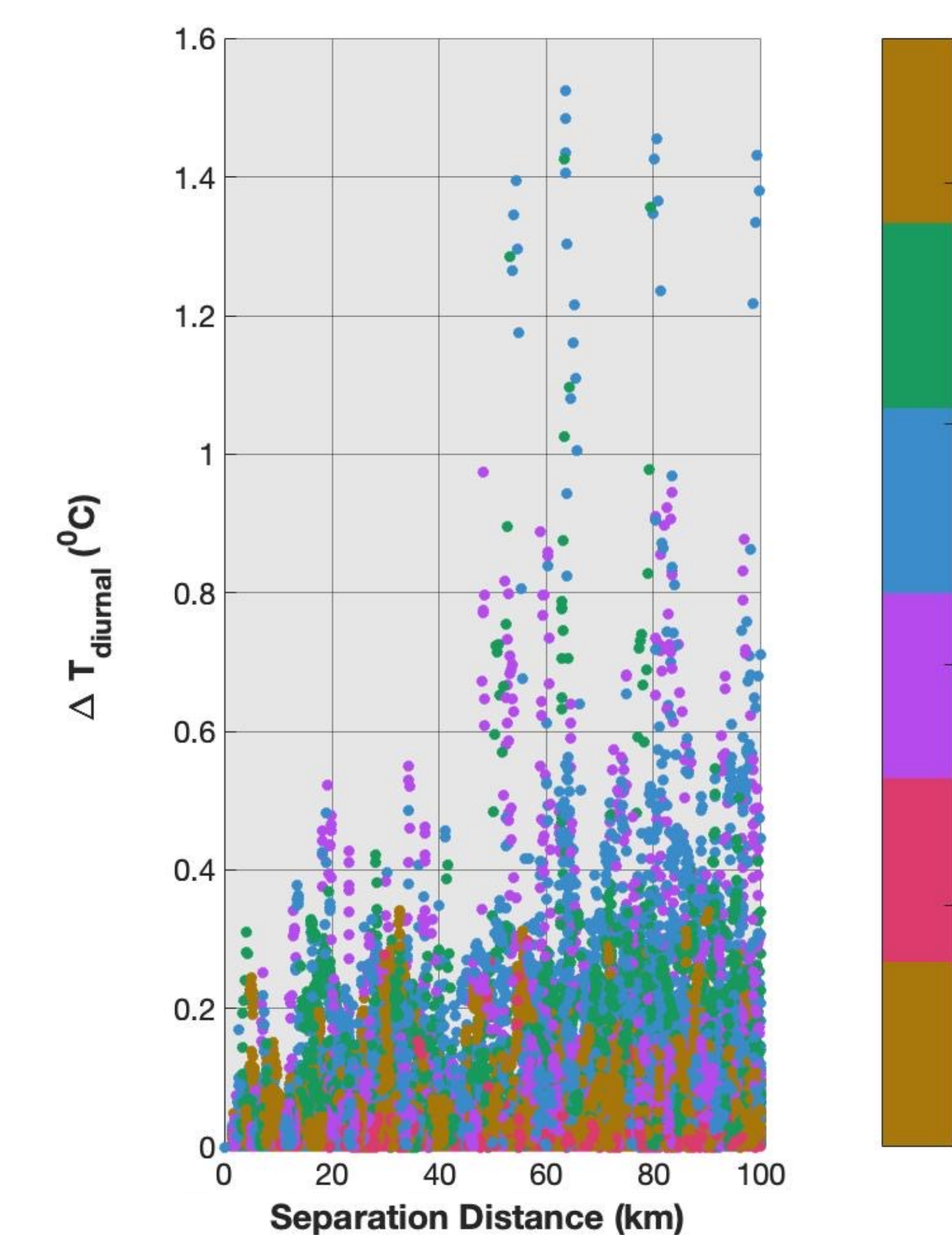
Modified from *Hughes et al. 2020a*

## MET MEASUREMENTS



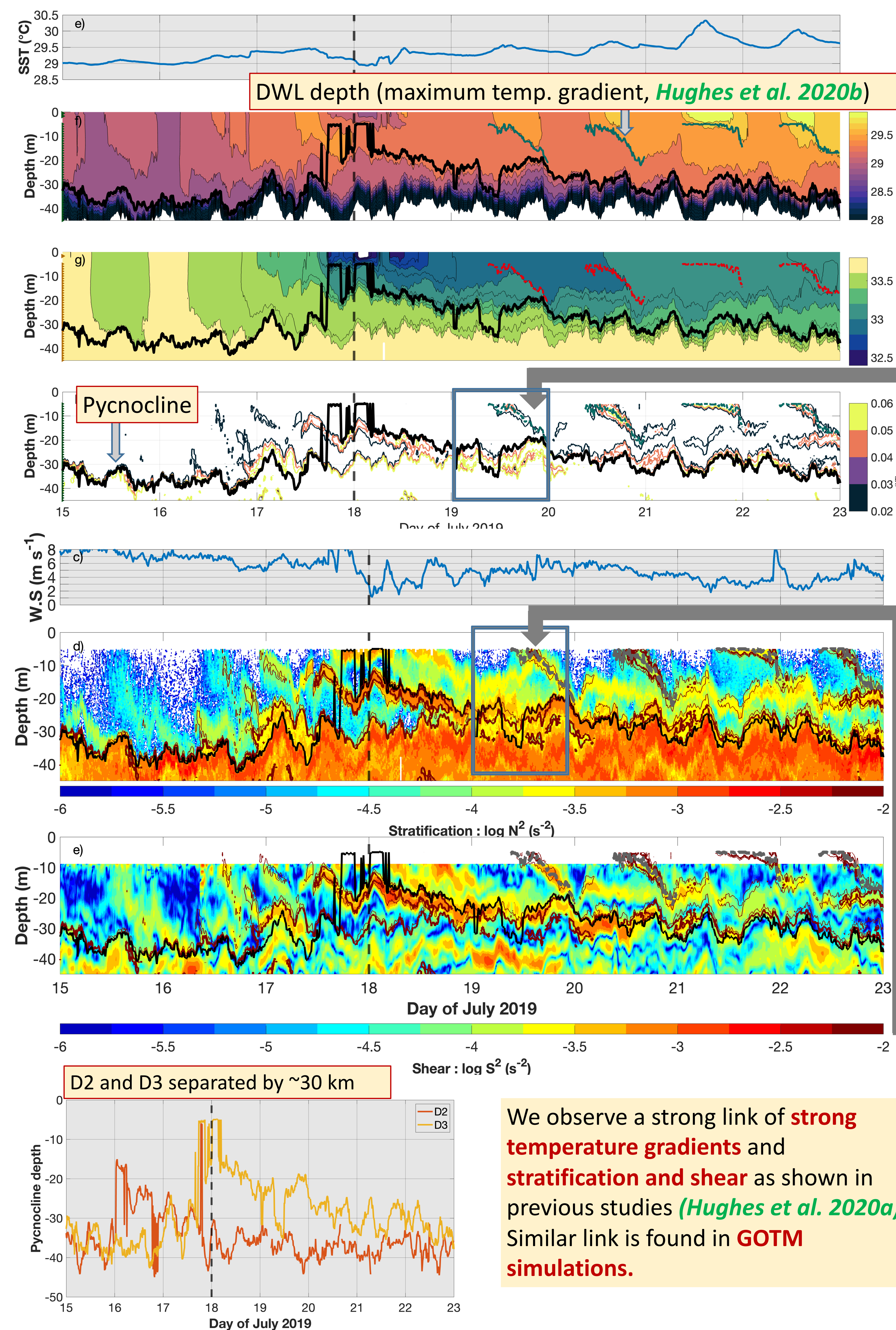
Strong diel cycles in **SST** and **heat fluxes** with a **low wind stress** leads to the formation of **Diurnal Warm Layer (DWL)**

## SPATIAL DIFFERENCE IN DWLs



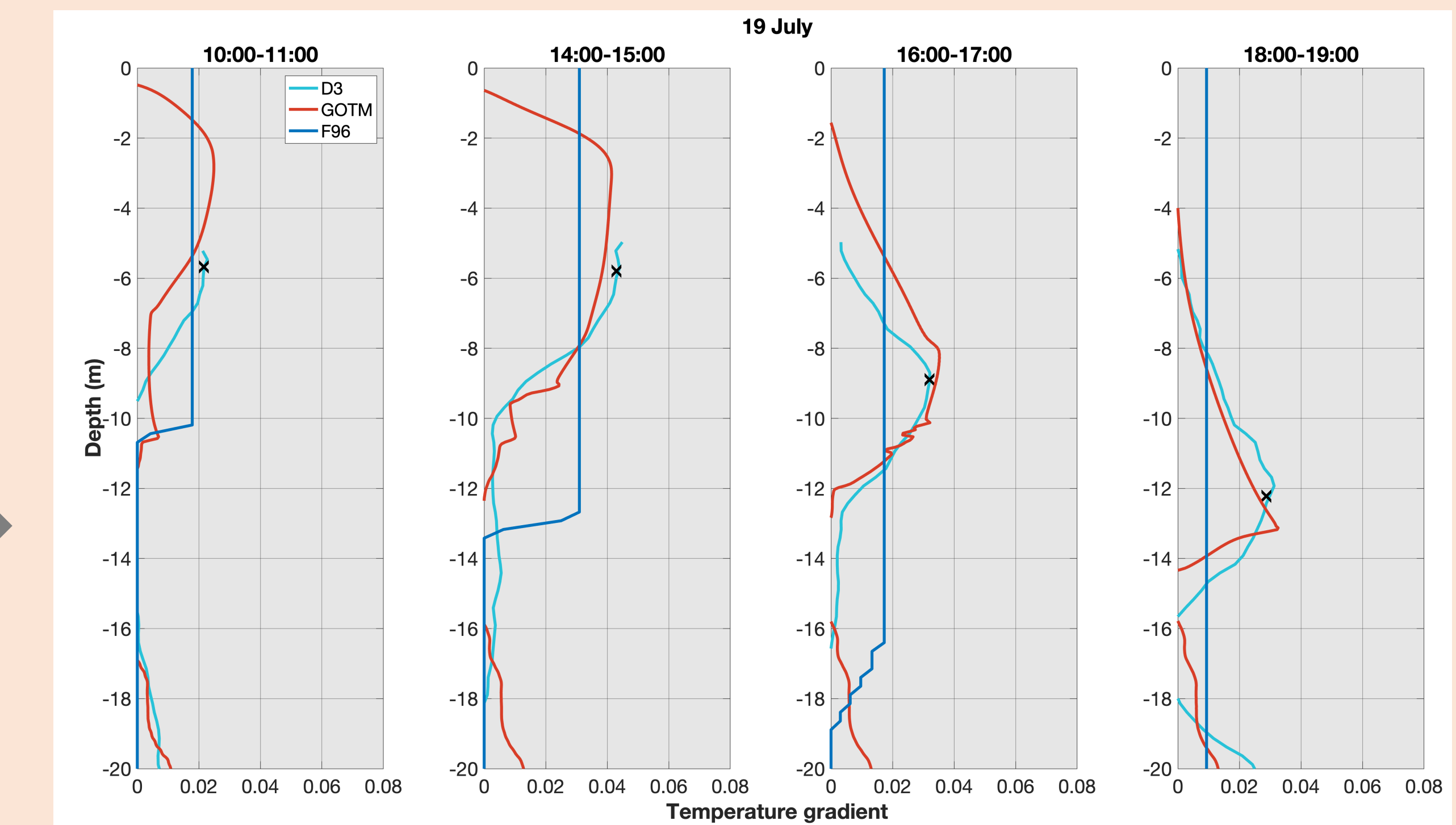
The spatial differences in **diurnal cycles in SST** during the existence of DWL is more prominent with **O(1 K)** or higher differences. The peak differences are observed in **11 am-12 noon** bins and **1-2 pm** bins local time.

## DIURNAL WARM LAYERS (DWLs)



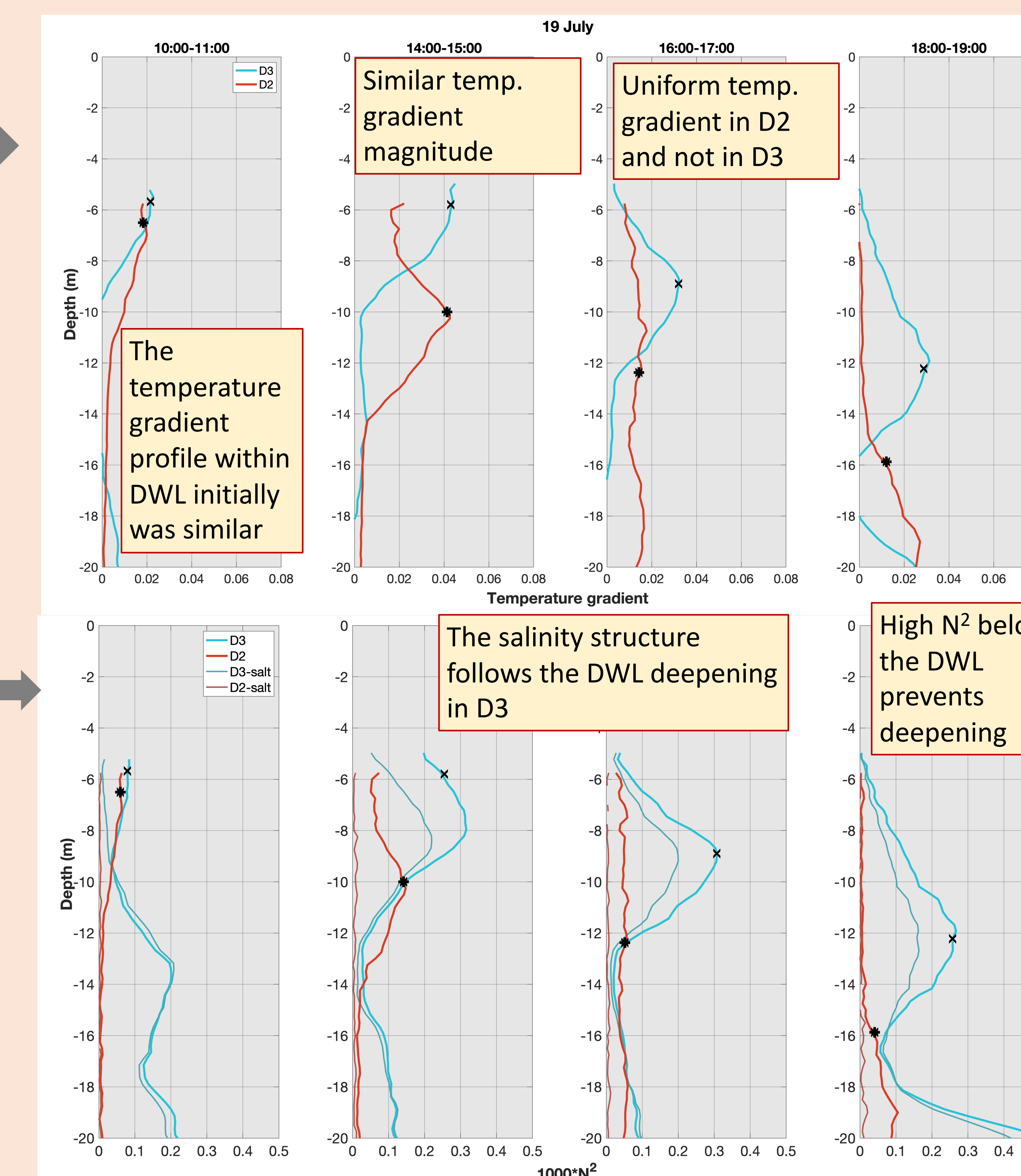
- Previous studies have shown the impact of **winds and optics** on DWLs: an example is July 21, where the DWLs are shallower due to low wind speeds.
- July 19: The impact of **background stratification** can be seen, where the DWL is **shallower** for the profiler with **shallower pycnocline**. This is because the shear due to the DWL must overcome the **high stratification** due to the **shallower pycnocline** to deepen.
- **Warm water advection** causes the DWL on 20 July to be deeper than 19 July despite having similar **wind speed magnitudes**.
- On 18 July, a **high shear and high stratification** region which is driven by **salinity gradients**, is found over the top 10 m. This **prevents the deepening of DWLs**.

## MODEL COMPARISON OF DWLs



**F96 model** (based on *Fairall et al. 1996*) is used to compute the **bulk air-sea fluxes**, and hence is effective in incorporating **DWL effects in SST**. However, **F96 model** is not effective in representing **vertical structure of DWL** in stratified regions.

## EFFECT OF BACKGROUND N² ON DWLs



## SIGNIFICANCE STATEMENT

In a region laden with **submesoscale processes** like the **Bay of Bengal**, **spatial gradients in DWL evolution** exist and can serve as a mechanism to further influence **submesoscale/mesoscale oceanic processes** and **air-sea interaction**