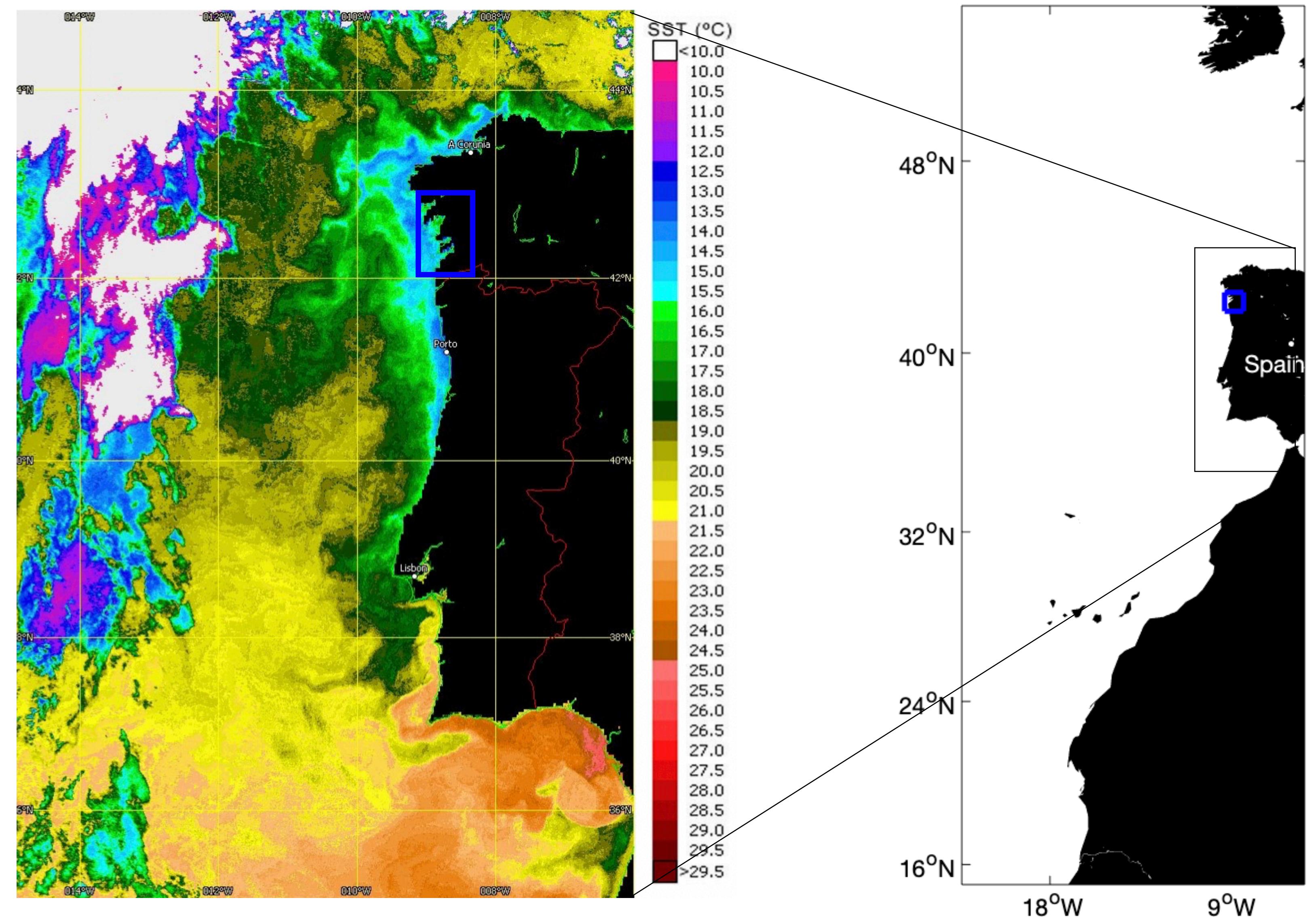


Rapid wind-driven fluctuations of the pycnocline drive phytoplankton blooms in a long, narrow bay

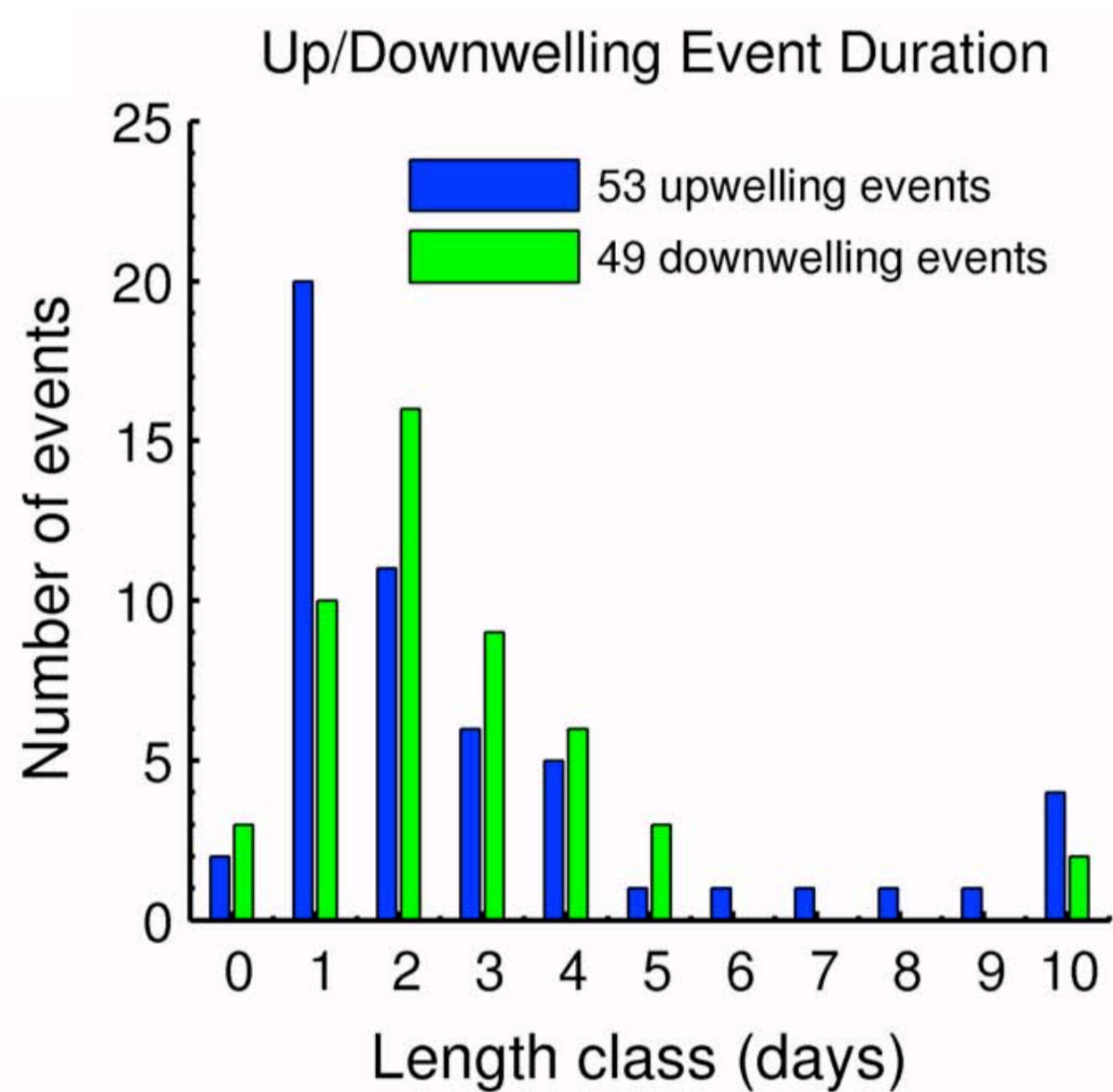
Esperanza Broullón, Peter JS Franks, Bieito Fernández-Castro,
Miguel Gilcoto and Beatriz Mouríño-Carballido



Canary Current-Iberian upwelling system



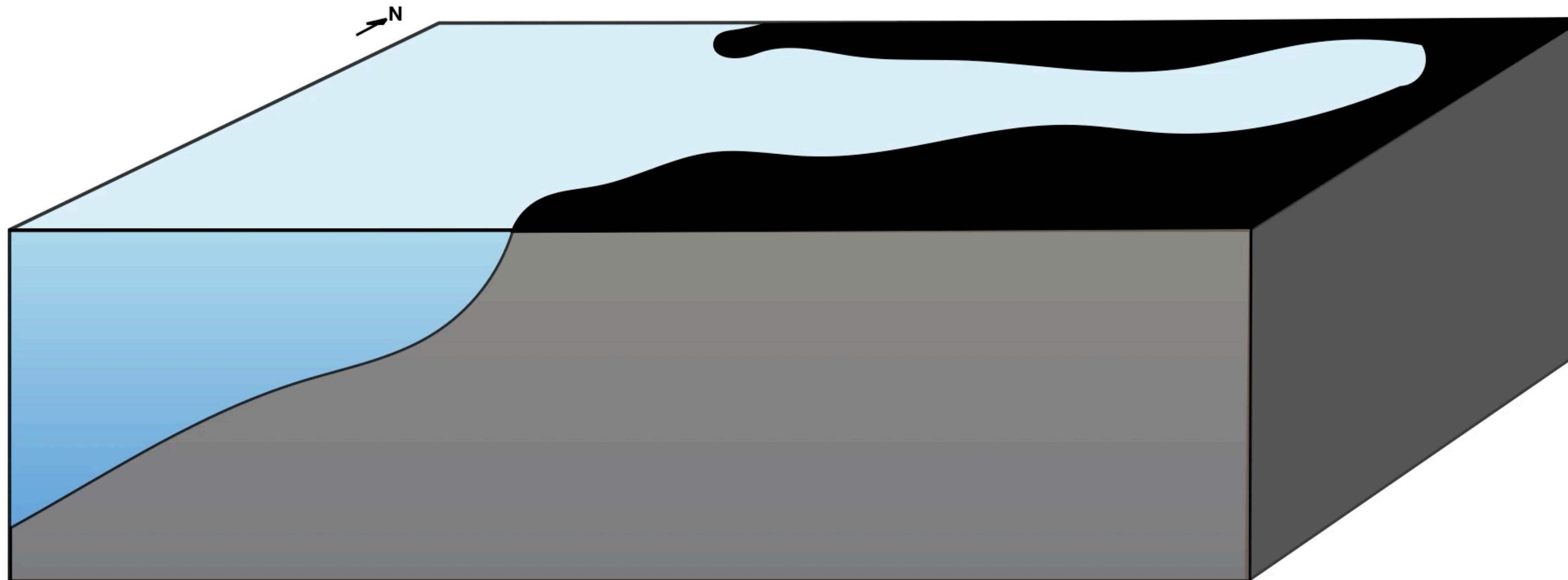
Dynamics



(Gilcoto et al., 2017)

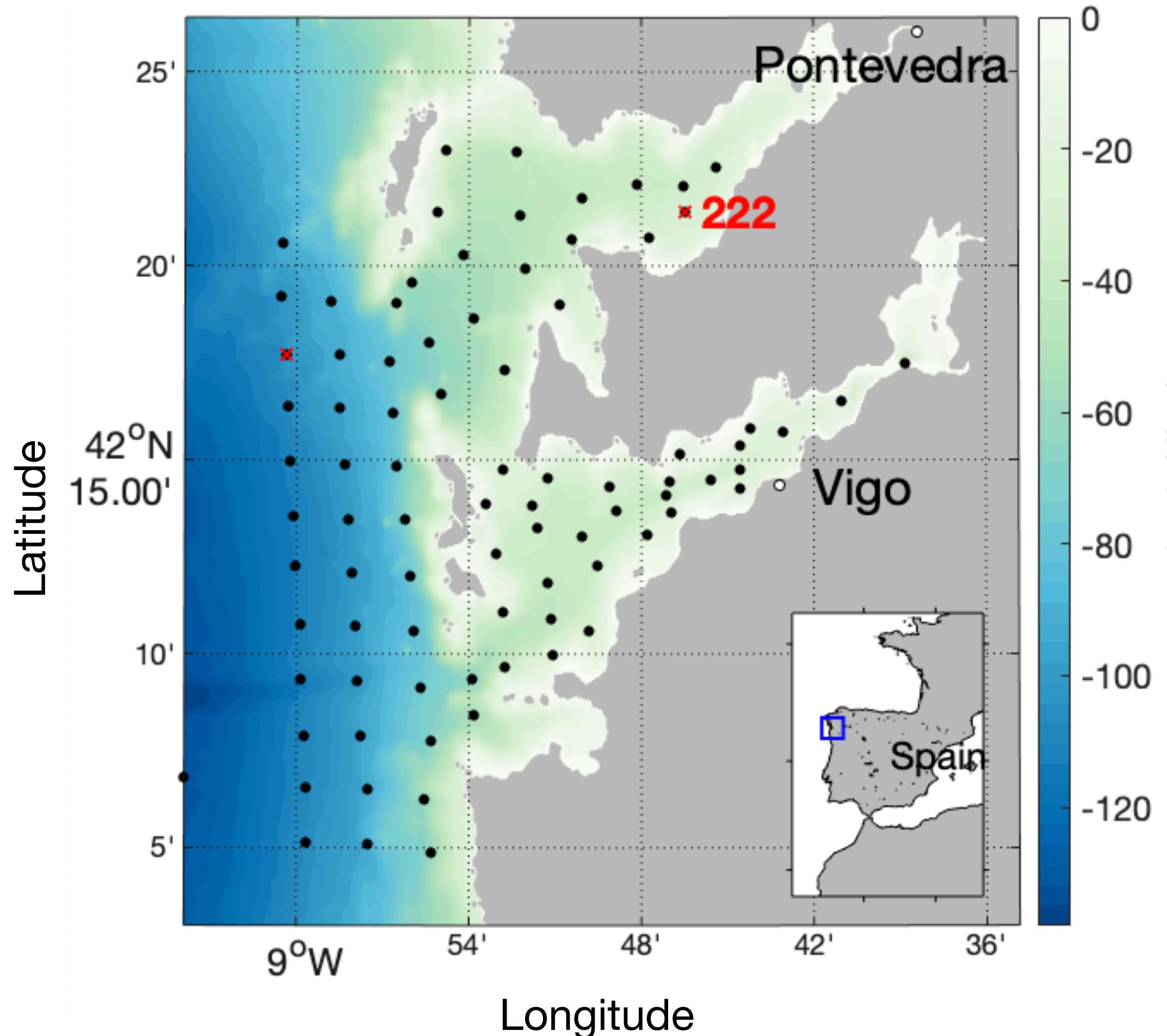
Dynamics

Upwelling in the Rías is enhanced by local wind in addition to the remote wind, leading hydrography changes in an hourly scale, shorter than the Ekman spin-up
(Gilcoto et al., 2017)



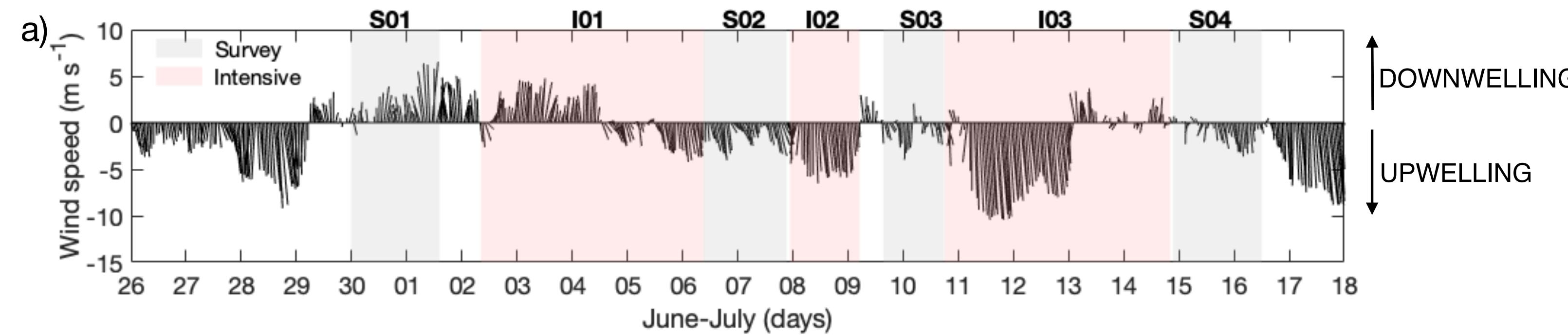
Can phytoplankton bloom in response to these short events?

REMEDIOS-TLP cruise, July 2018

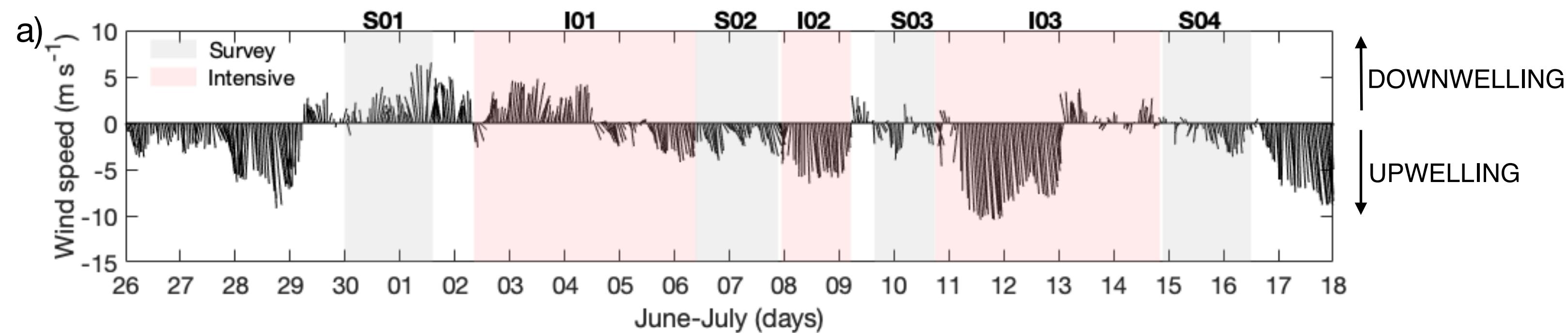


- 4 SURVEYS (84 stations): S01, S02, S03 and S04
 - Hydrographic properties in 225 CTD profiles
- 3 INTENSIVES at **222**: I01, I02, and I03
 - 5 high resolution CTD casts every 30 minutes (1674 profiles)
 - Water sampling at different depths every 6 h

REMEDIOS-TLP cruise, July 2018



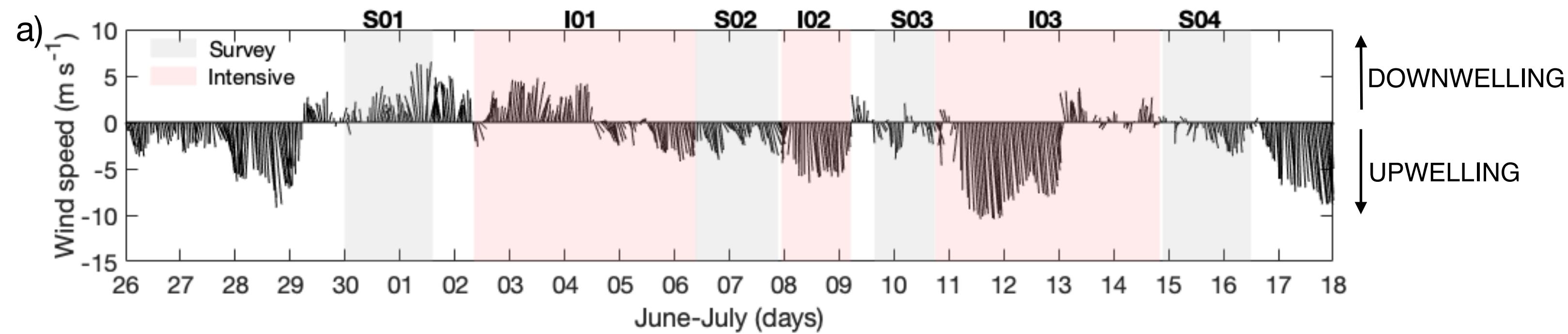
Spatial surveys



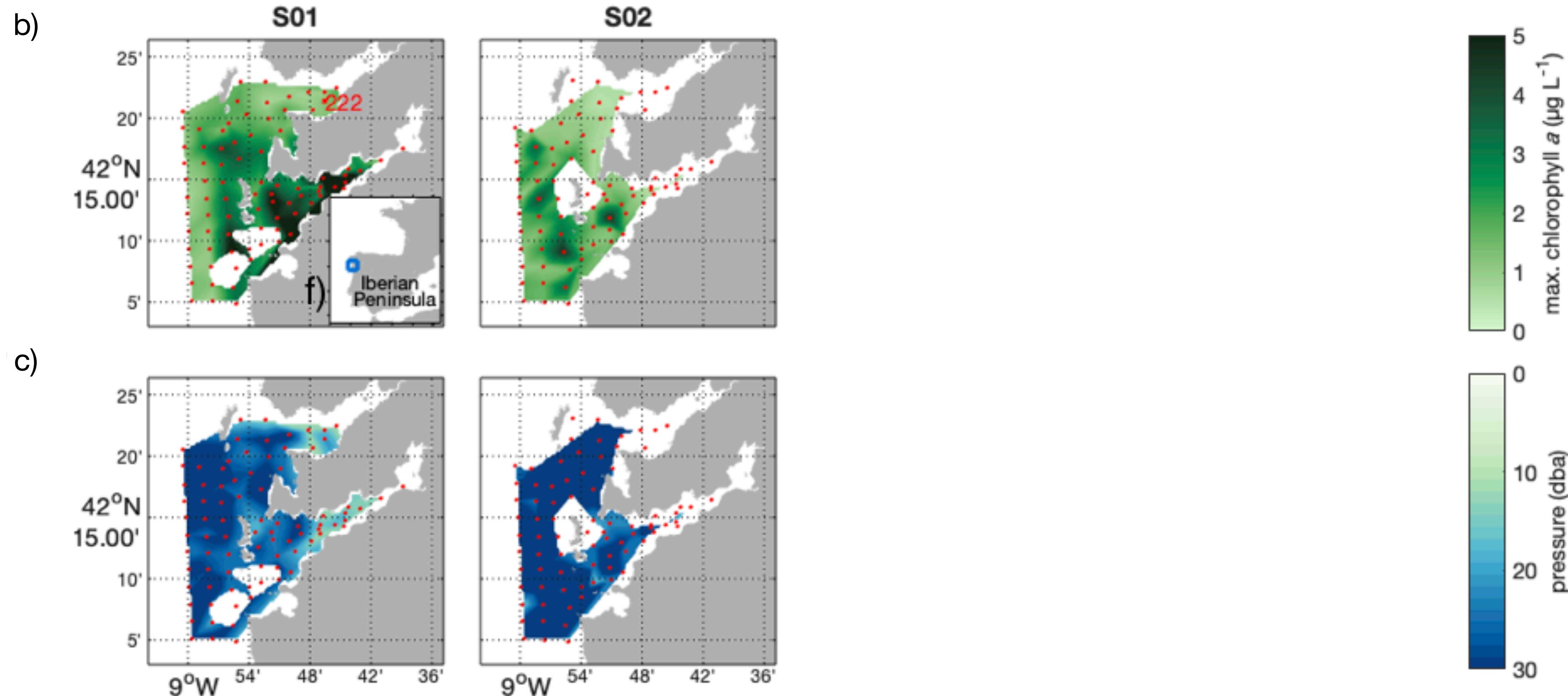
Maximum chlorophyll and its depth at $\sigma_t=26.4\text{-}27 \text{ kg m}^{-3}$



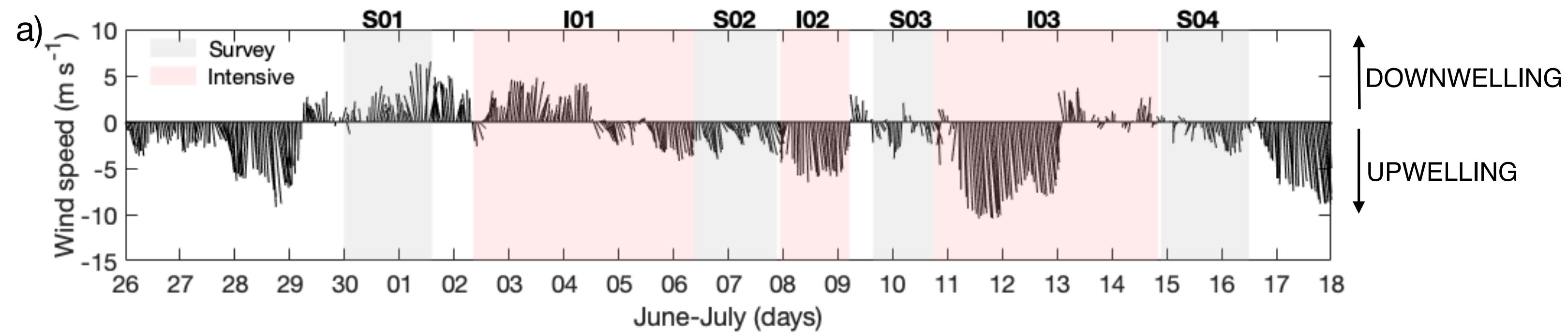
Spatial surveys



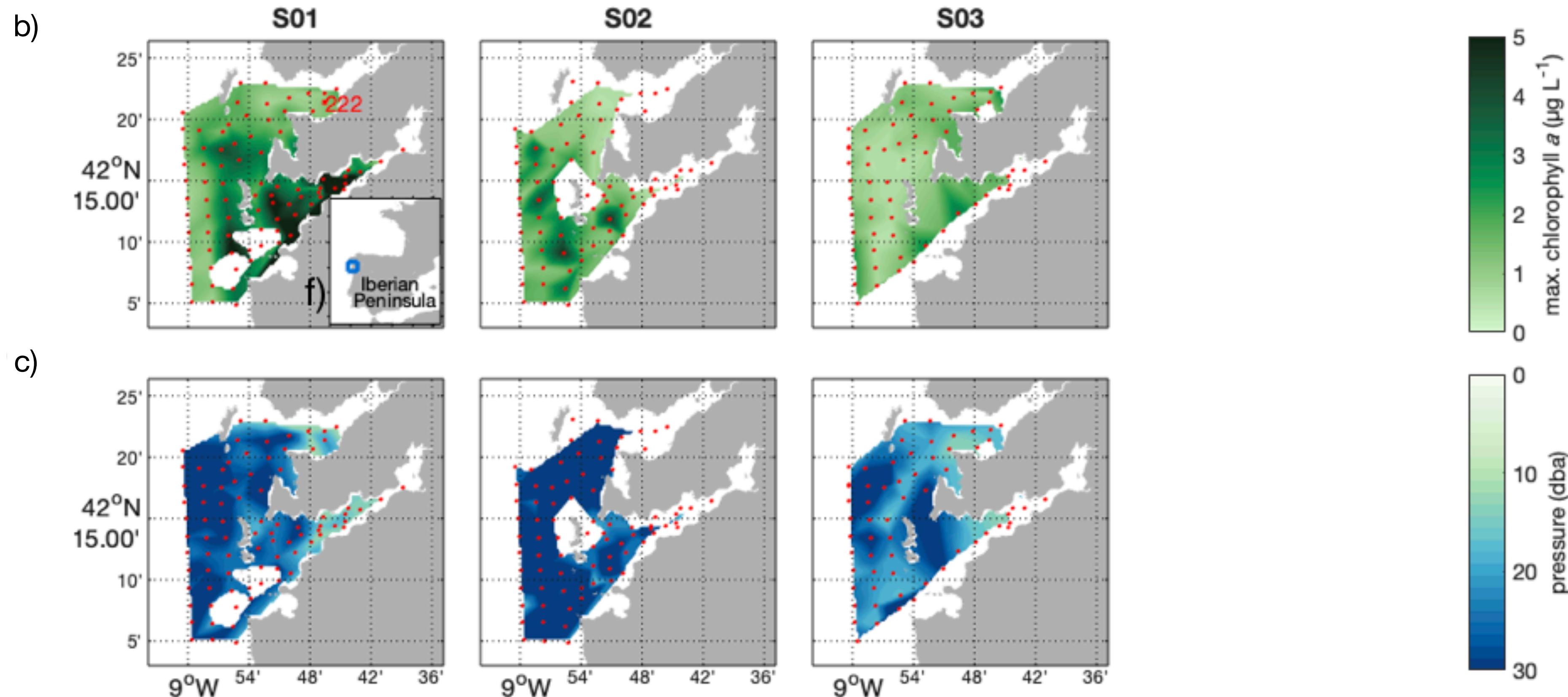
Maximum chlorophyll and its depth at $\sigma_t=26.4-27 \text{ kg m}^{-3}$



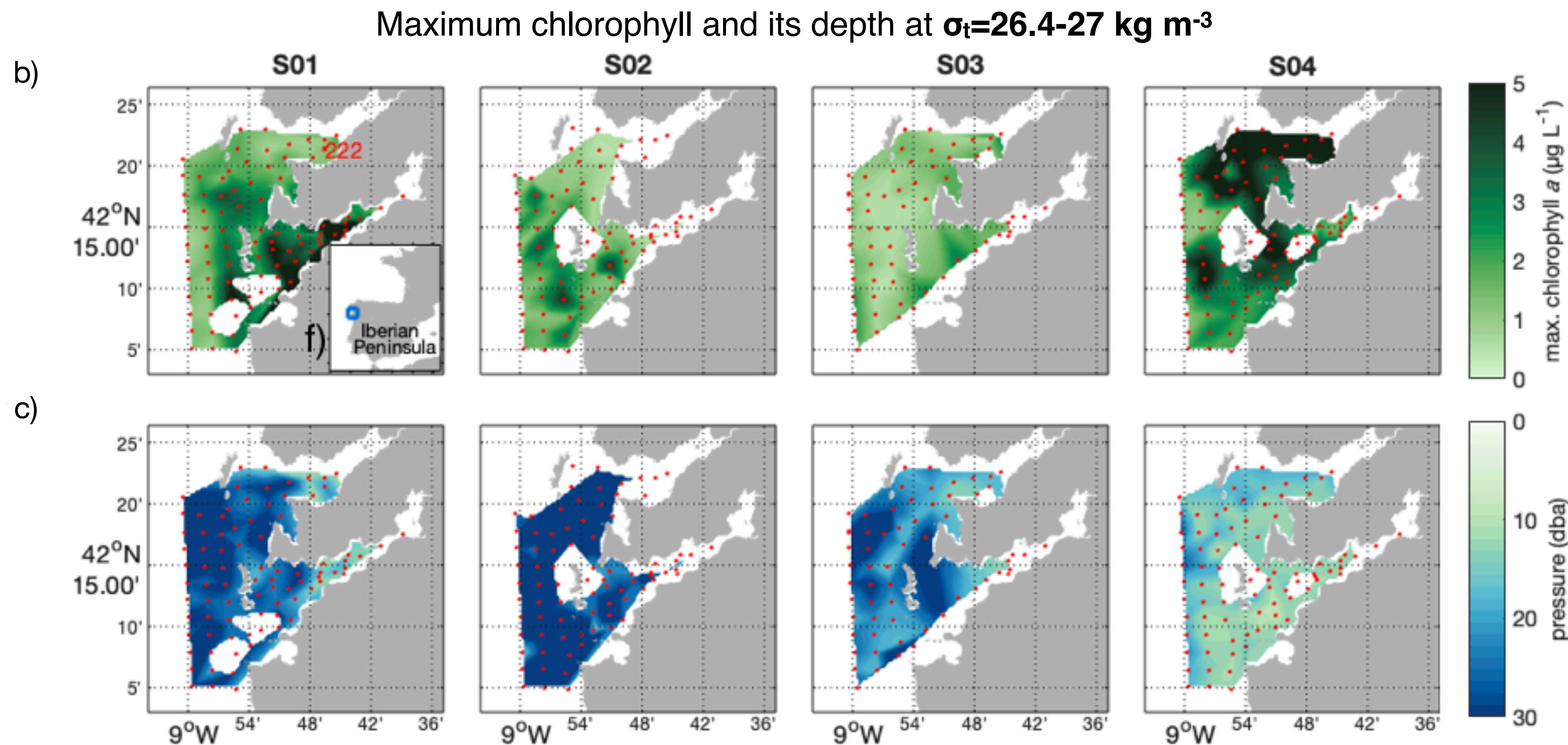
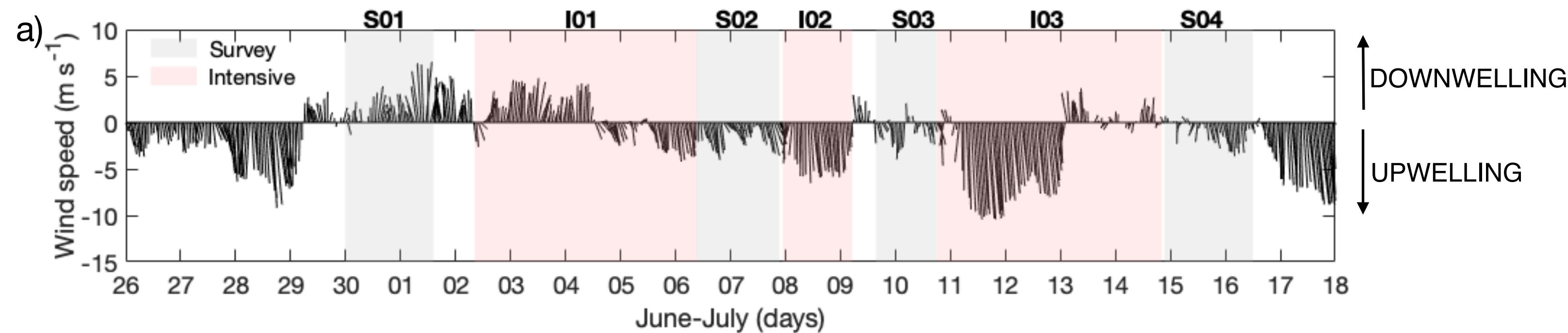
Spatial surveys



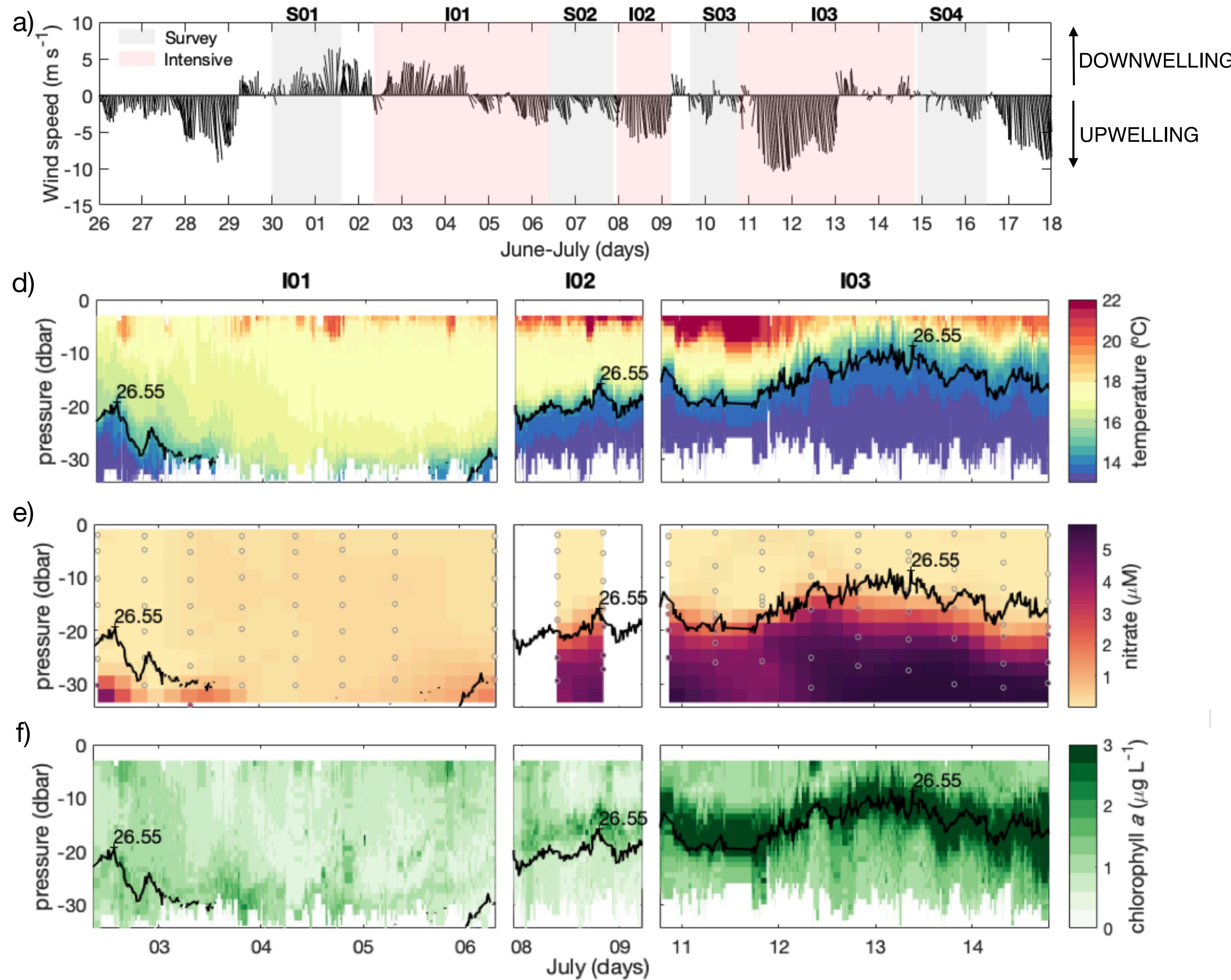
Maximum chlorophyll and its depth at $\sigma_t=26.4-27 \text{ kg m}^{-3}$



Spatial surveys



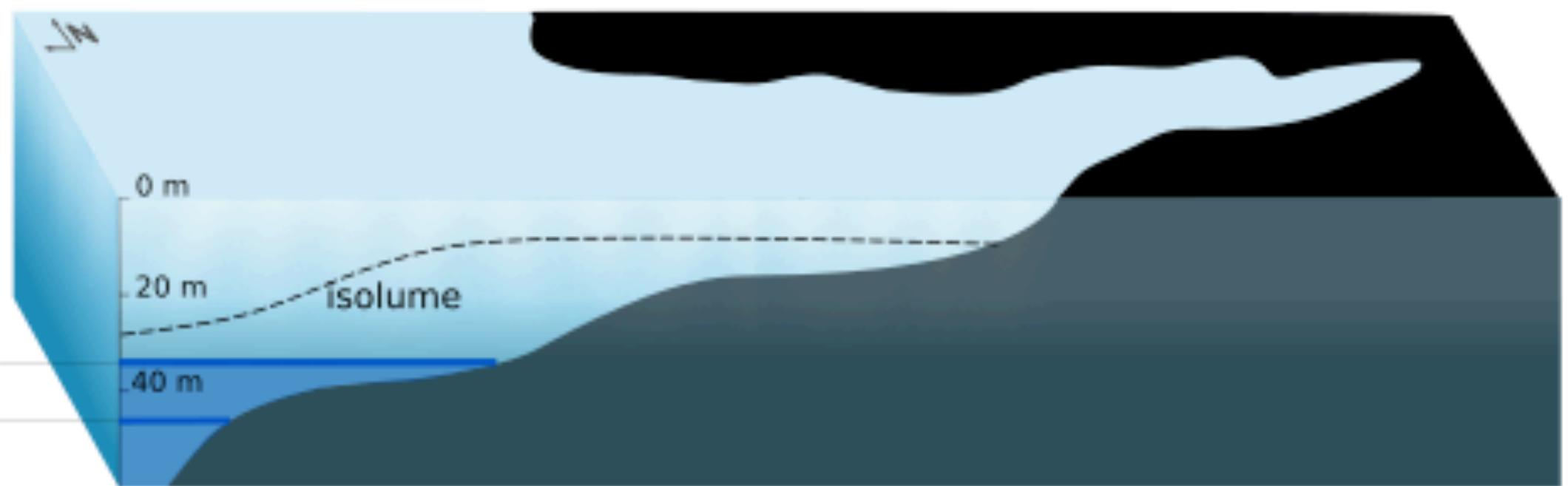
Intensive samplings



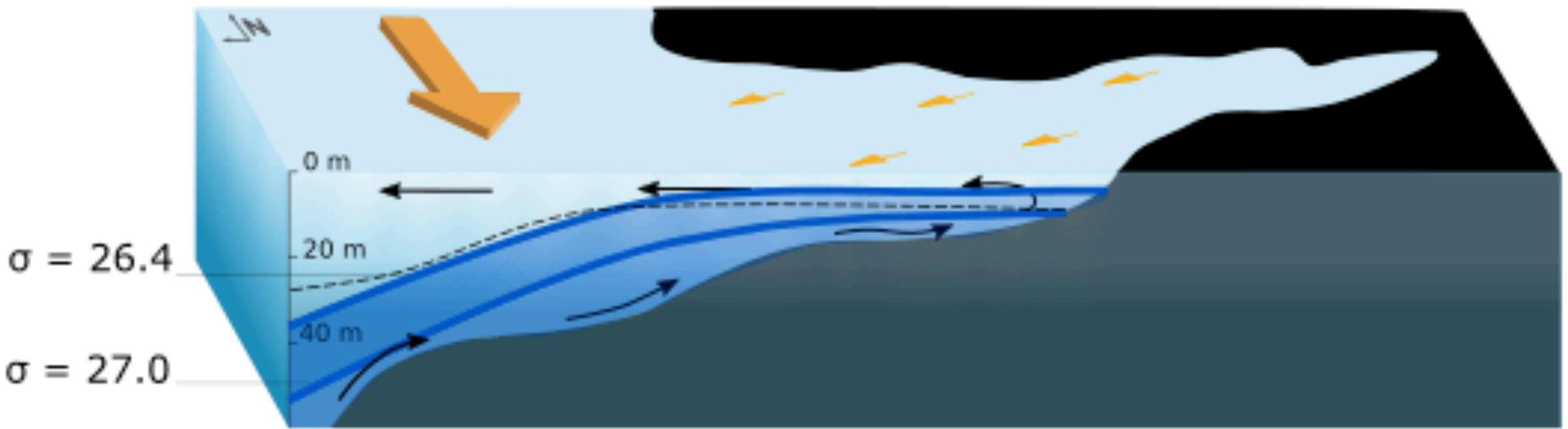
Wind-driven upwelling cycle

← Water circulation ↘ Shelf wind ↗ Local wind — Subsurface chlorophyll maximum — Nutrient-rich layer

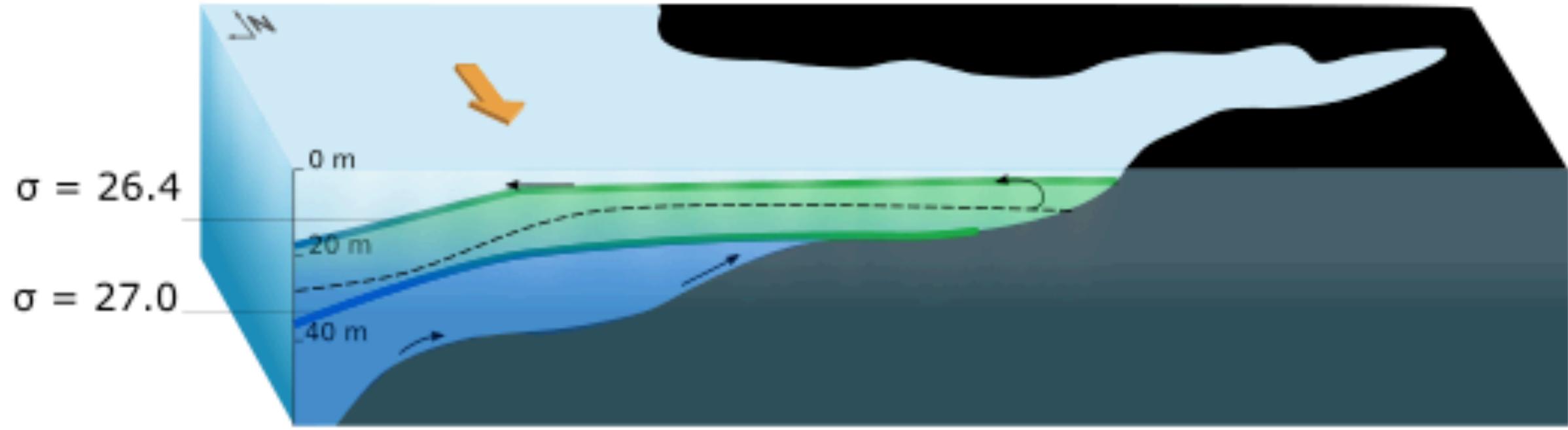
t_0 : before upwelling



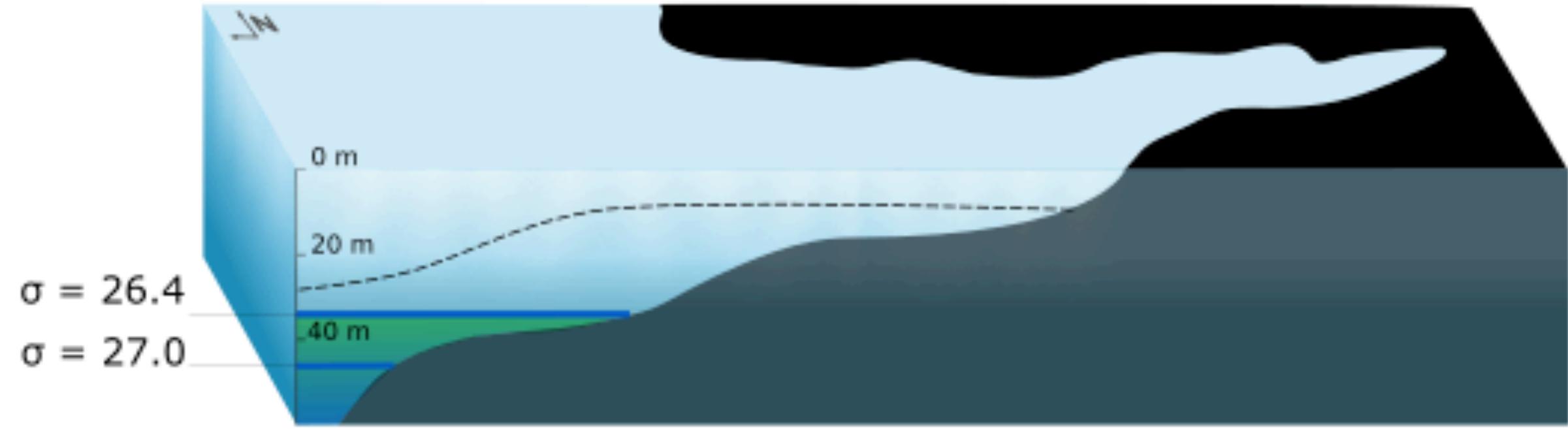
t_1 : early upwelling



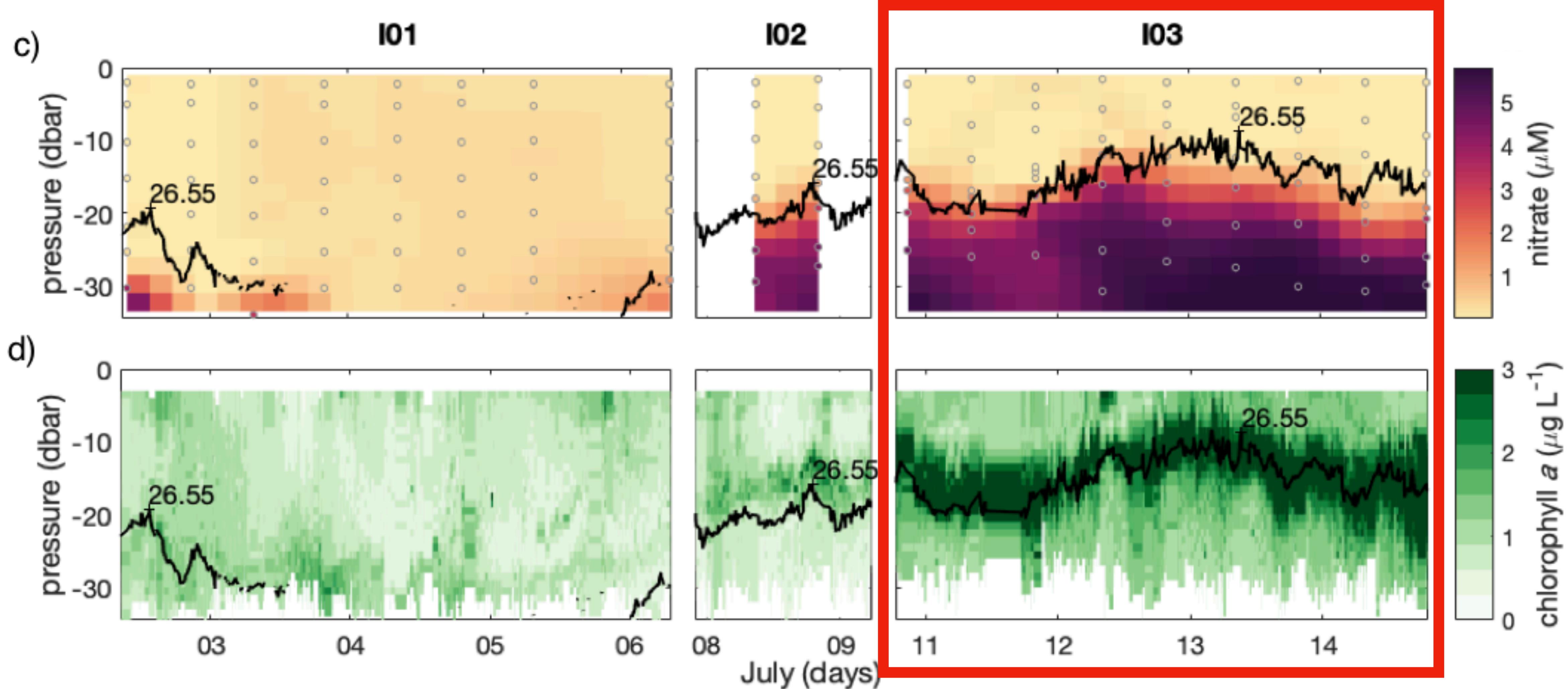
t_2 : late upwelling



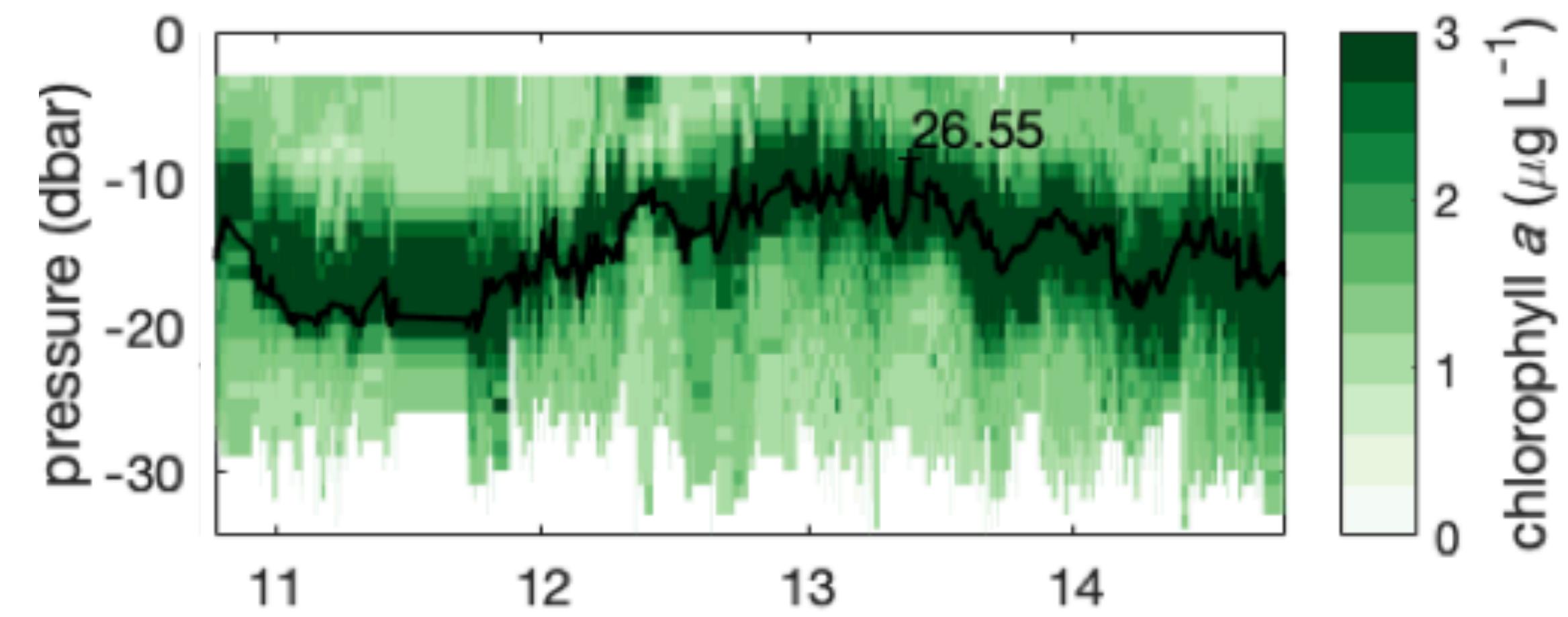
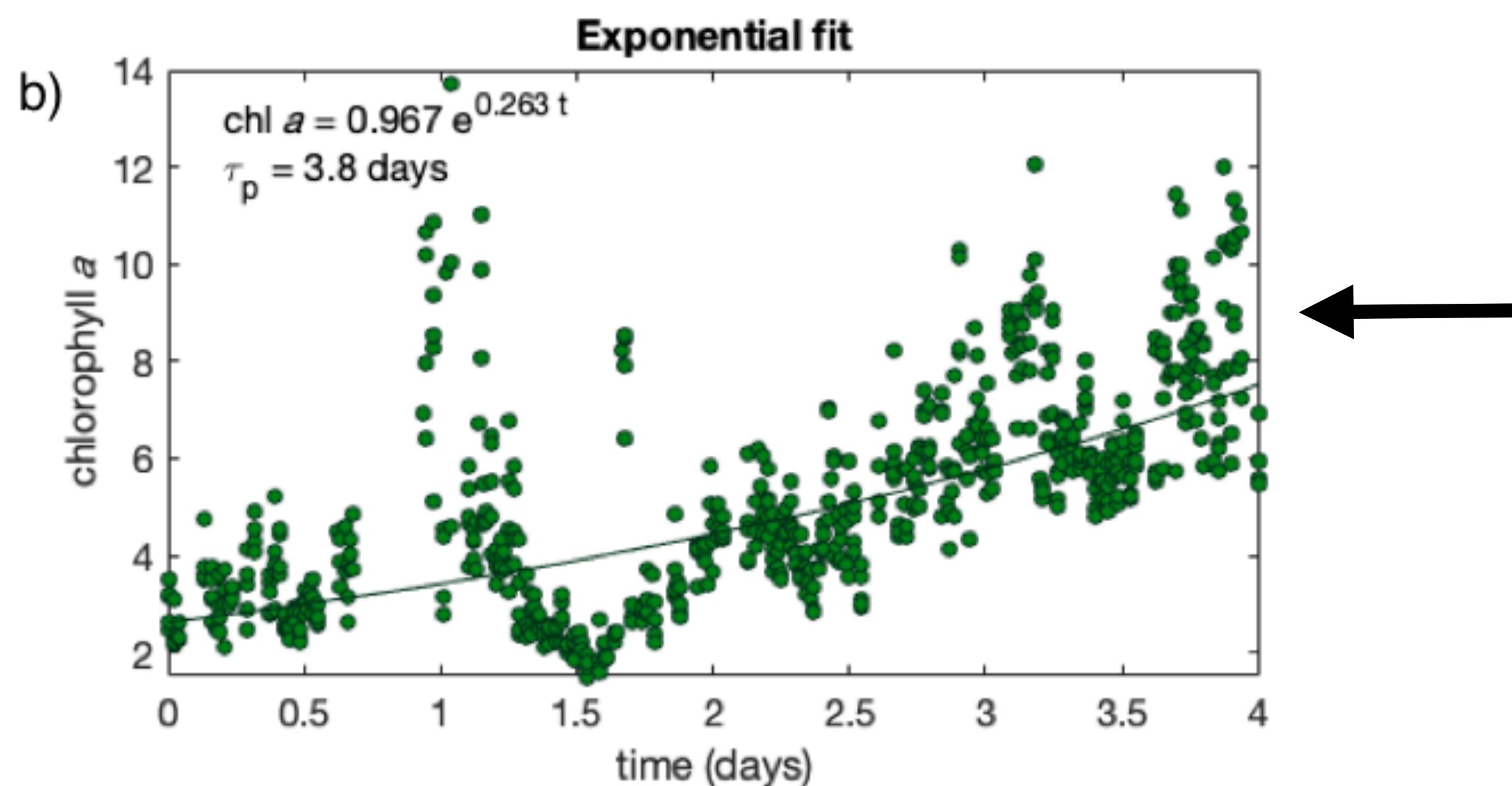
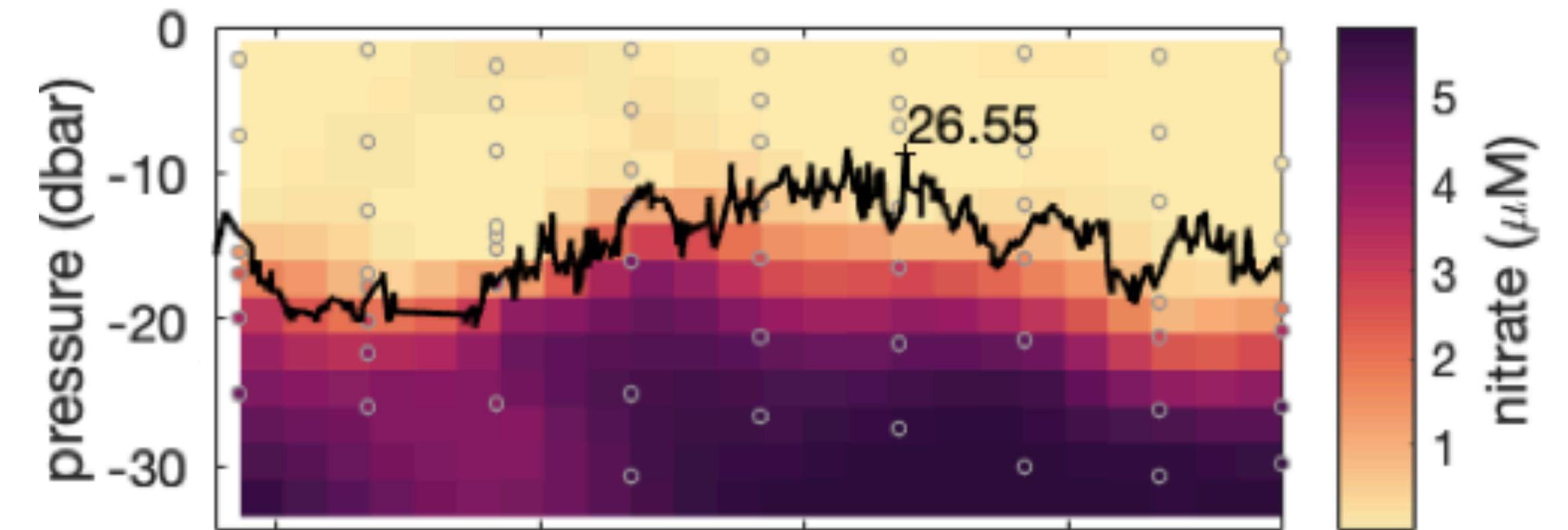
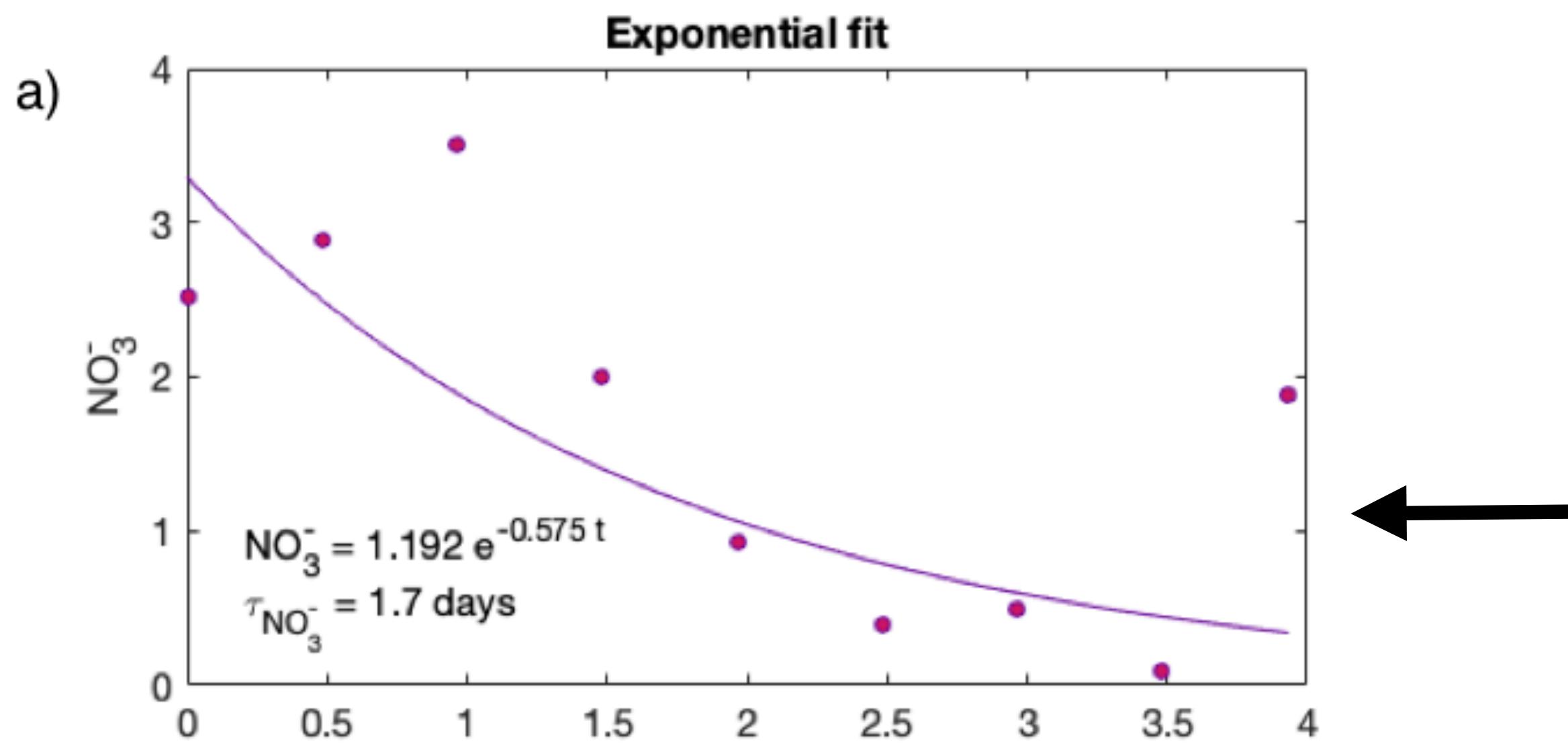
t_3 : after upwelling



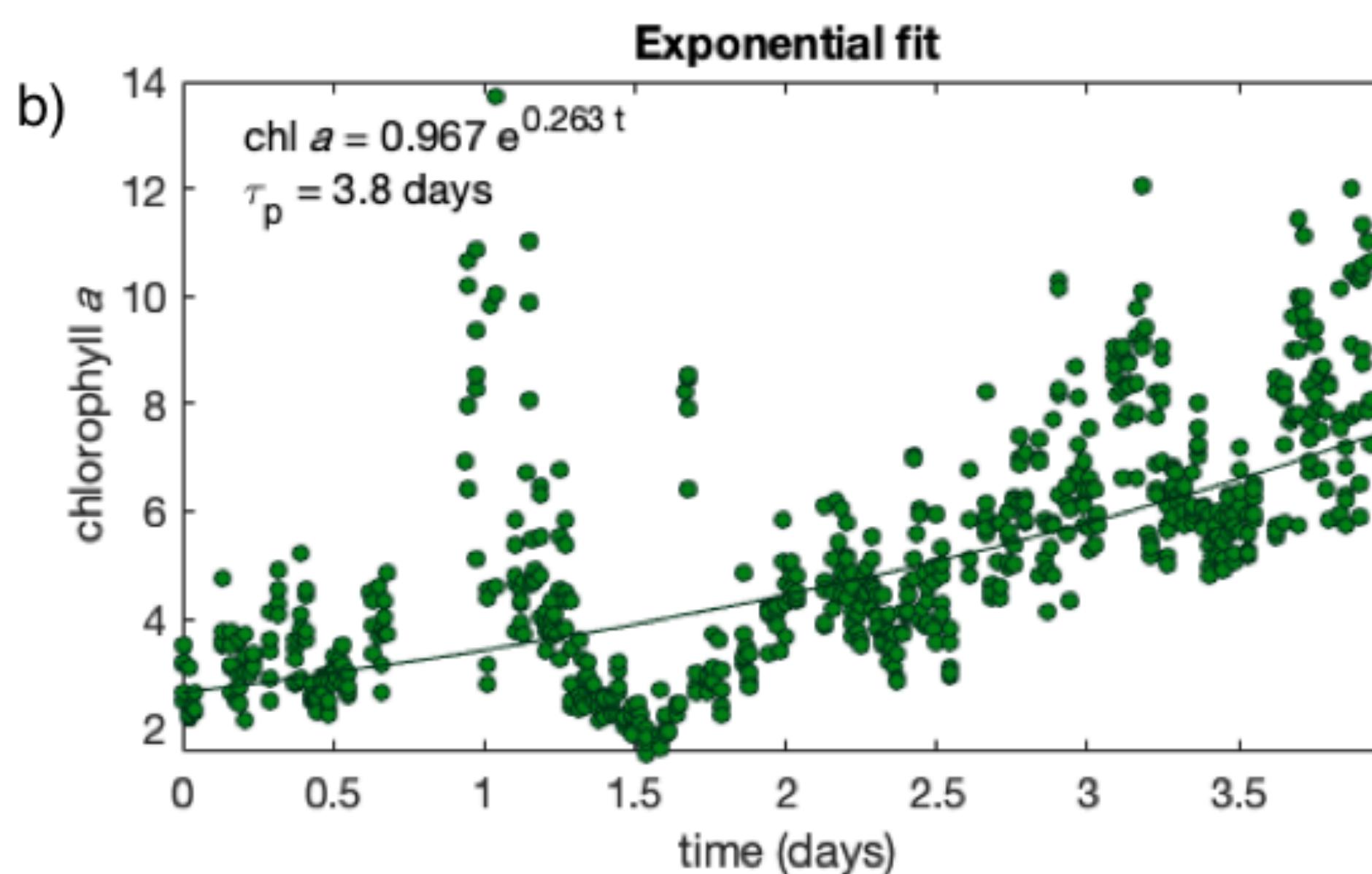
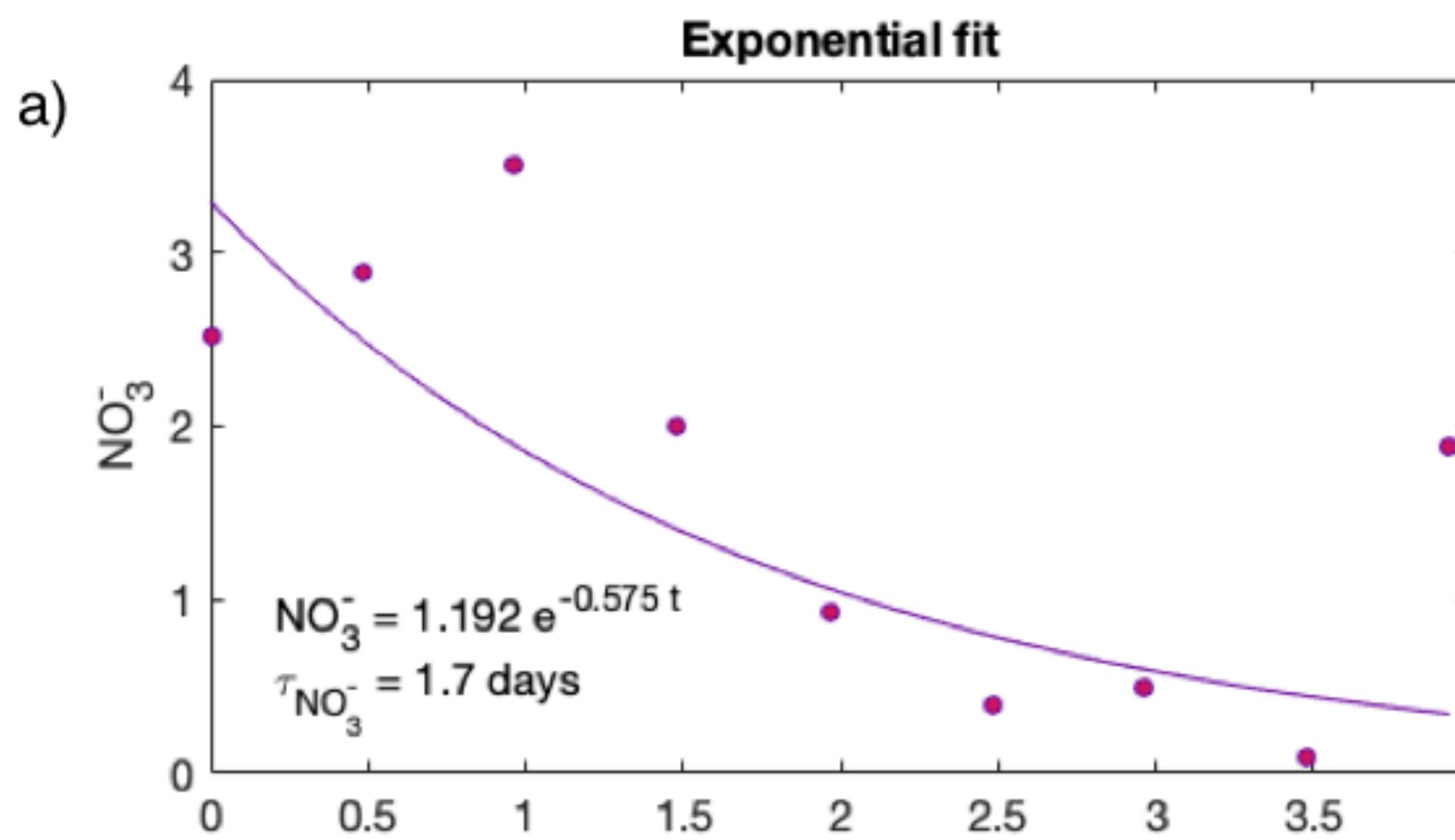
Time-scales



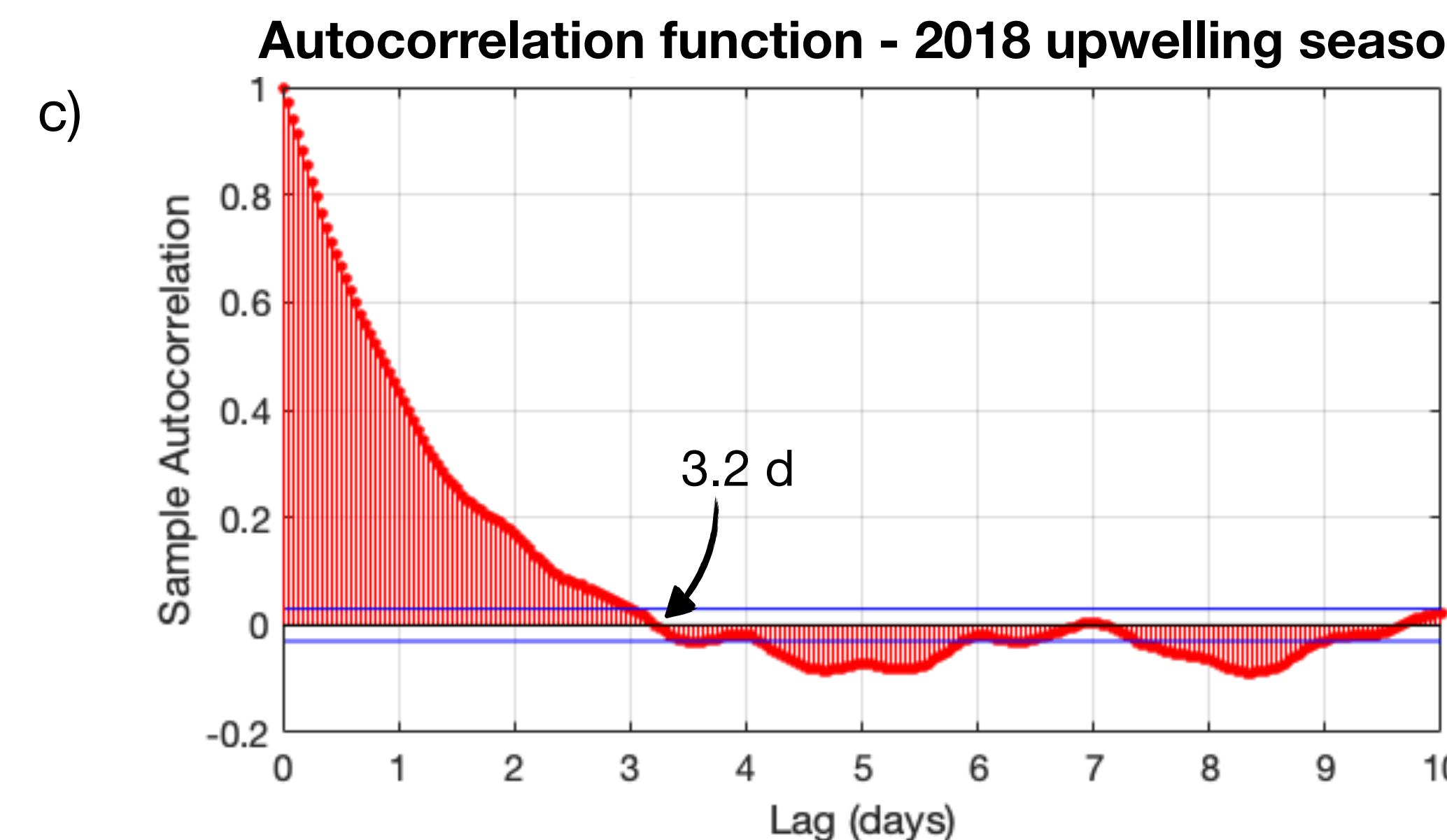
Time-scales



Time-scales



- The e-folding scales
 - Nitrate uptake $\tau_{\text{NO}_3^-} = 1.74 \text{ d}$
 - Chlorophyll accumulation $\tau_{\text{chl}} = 3.80 \text{ d}$
- Wind-decorrelation time-scale during the summer 2018 upwelling season = **3.2 d**



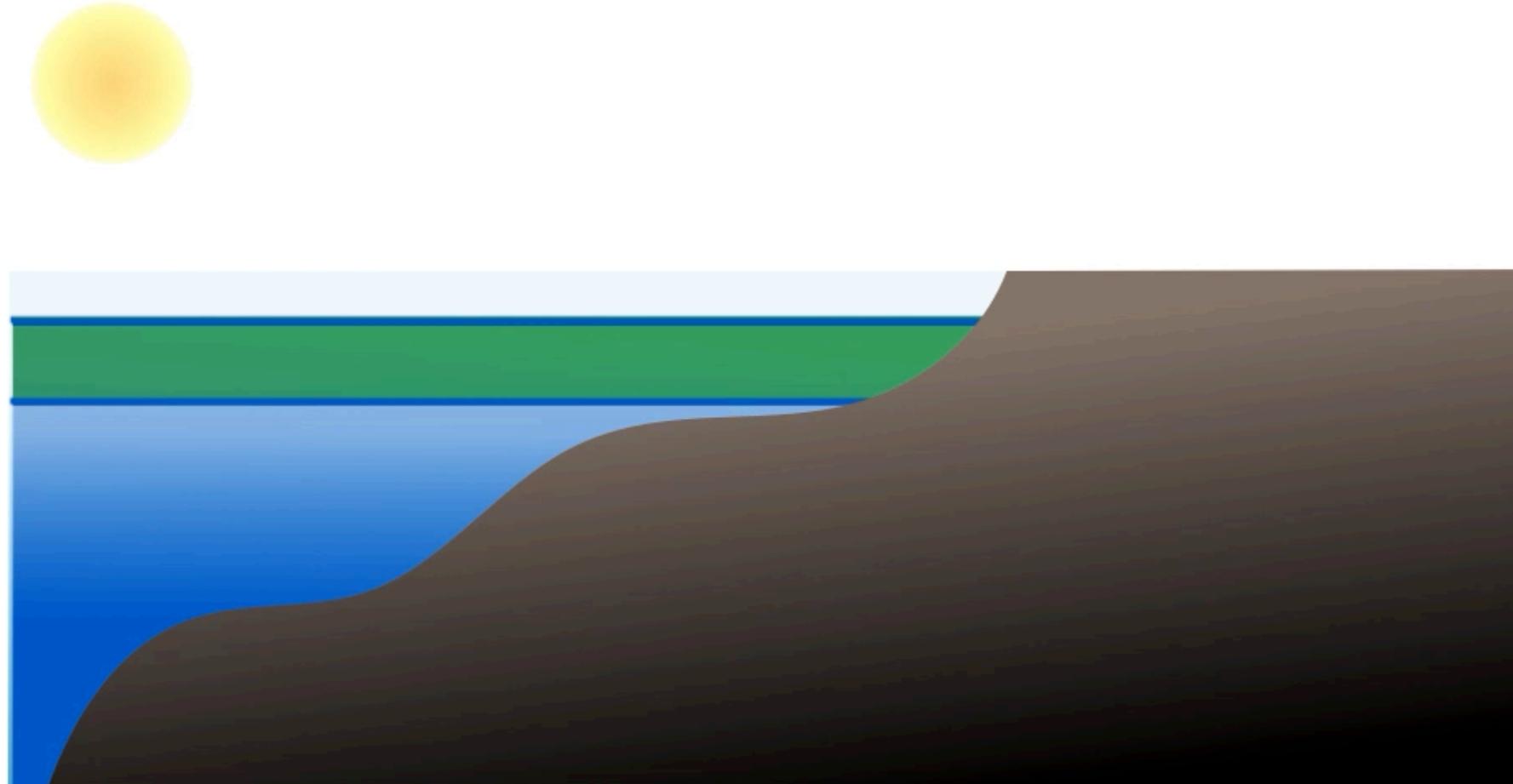
Can phytoplankton bloom in response to these short events?

- Phytoplankton responds rapidly (~hours) to the transient exposure of deep, nutrient-rich isopycnals to light during upwelling pulses in the Rías

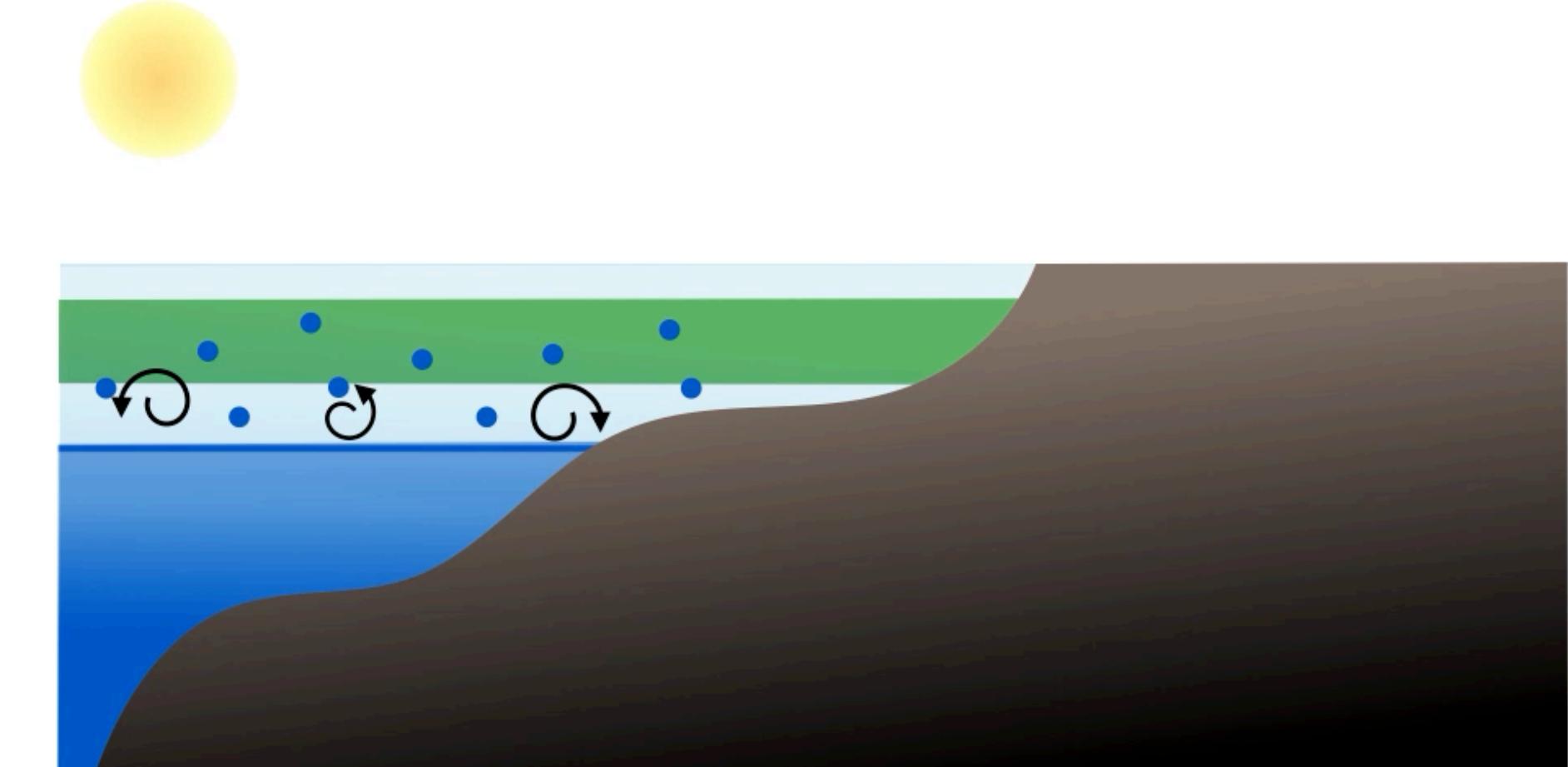
Can phytoplankton bloom in response to these short events?

- Phytoplankton responds rapidly (~hours) to the transient exposure of deep, nutrient-rich isopycnals to light during upwelling pulses in the Rías
- Short-lived phytoplankton blooms, which explain the elevated primary productivity in the region, are thus mainly explained by the adiabatic, reversible upwelling of deep isopycnals, rather than the fertilization of surface waters by diapycnal mixing.

ADIABATIC, REVERSIBLE UPWELLING



DIAPYCNAL MIXING



Acknowledgements

Predoctoral fellowship «Programa de axudas á etapa predoutoral da Xunta de Galicia» (ED481A- 2019/288) from Xunta de Galicia, co-funded by FSE Galicia (2014- 2020) to E. Broullón

XUNTA DE GALICIA



Project REMEDIOS (CTM2016-75451-C2- 1-R) from Spanish Ministry of Economy and Competitiveness to B. Mouriño-Carballido

<http://proyectoremedios.com>

Thank you for your
attention!

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