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Validating phytoplankton productivity in the EC-Earth global climate model

A case study in the North Atlantic

Koninklijk Nederlands
Meteorologisch Instituut
Ministerie van Infrastructuur en Milieu

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Geo-Energy

- Subsurface CO_2 storage
- Geothermal energy
- Induced seismicity
- Subsurface activities

Center for Isotope Research

- Greenhouse gases
- Aerosols
- Stable isotope applications
- Radiocarbon analysis & dating

Science & Society Group

- Embedment of technology & innovation
- Sustainable energy & local conditions
- Biobased society & biotechnology in Africa

energy ESRIG sustainability

Combustion Technology

- Elementary physical & chemical processes in high temperature energy conversion
- Optical & spectroscopic methods for in-situ analysis
- Development & characterisation of idealised model systems
- Analysis of new fuels (fossil & sustainable)

Center for Environmental Sciences (IVEM)

- Socio-technical systems integration
- System analysis, modelling & simulation
- Biobased systems
- Impact of climate change (analysis)

Ocean Ecosystems

- Global change & microbes
- Fluid mechanics & energetics
- Algal applications
- Marine biomimetics

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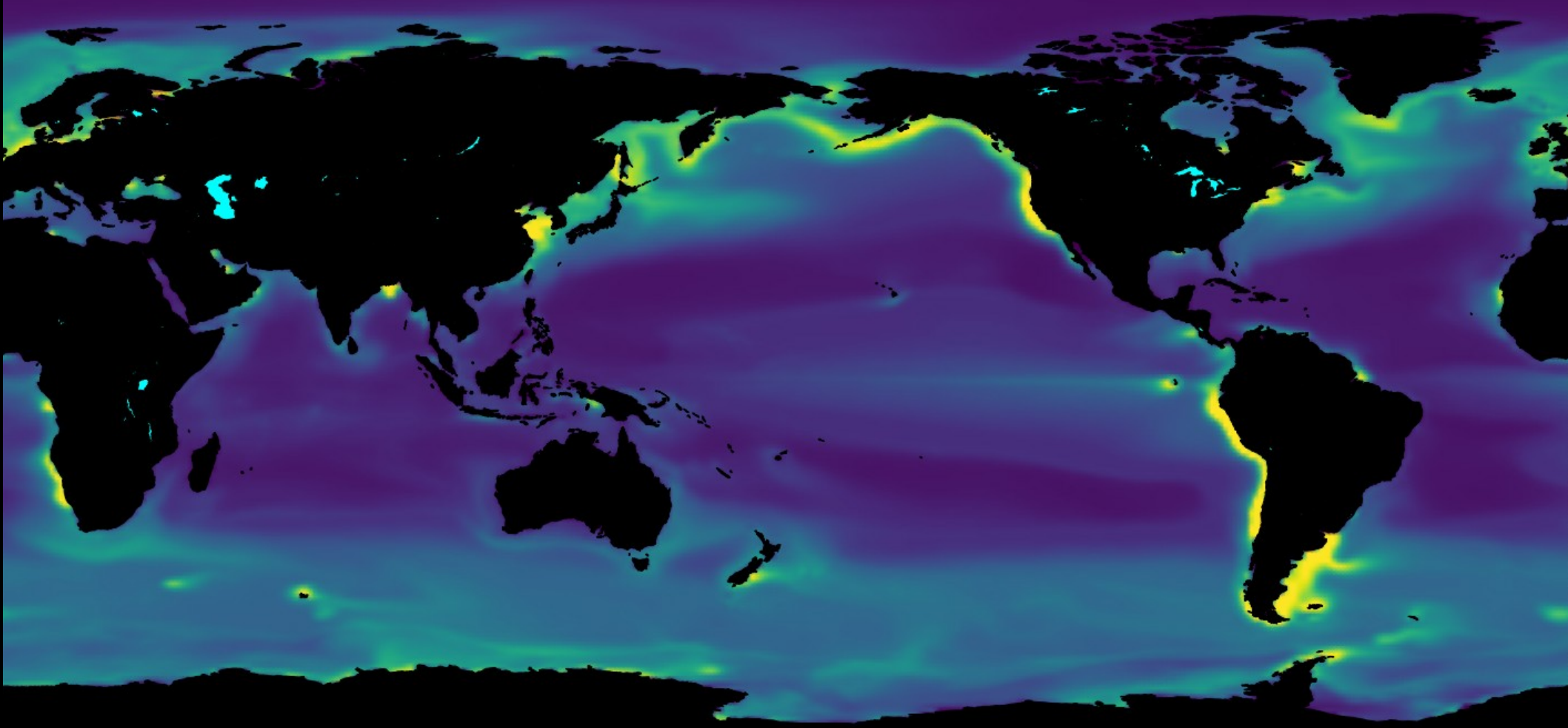

Average annual chlorophyll-a distribution, 2009

50% of photosynthesis

Base of the marine food web

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Falkowski, (2002)
Denman et al., (2007)

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Light

Nutrients

Physics

Link between physics and biology

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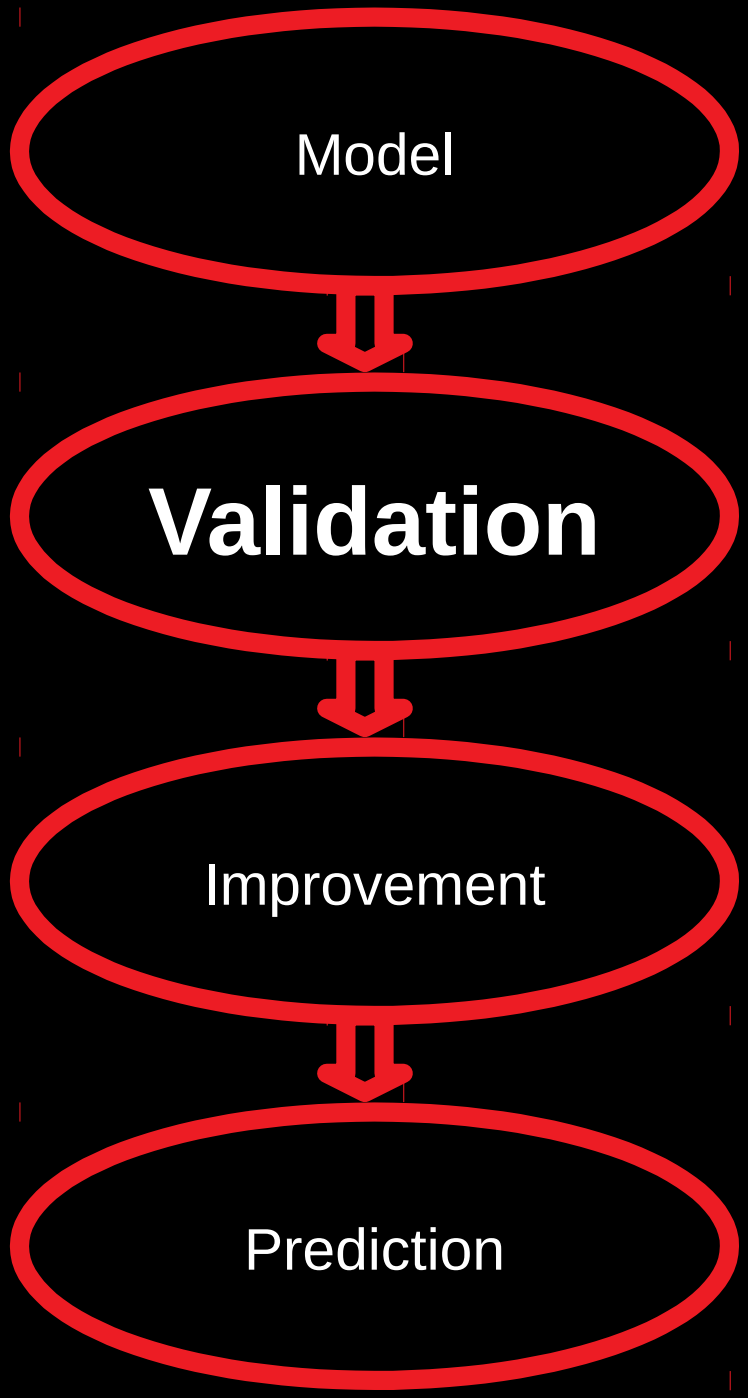

- Weather and climate prediction
- Climate change prediction
- Carbon cycle study

Lack of data for validation

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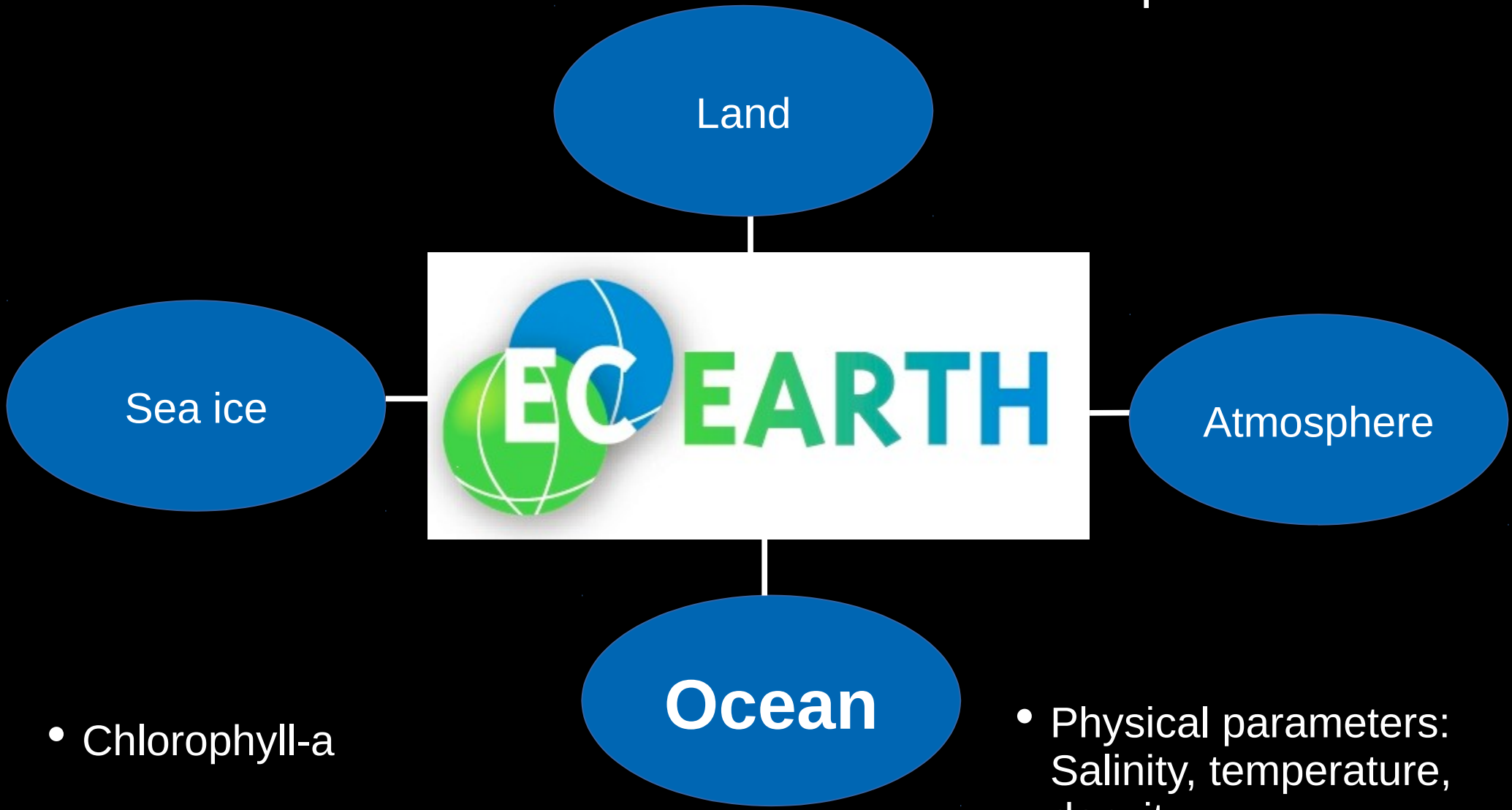
30 institutes

12 European countries



- Chlorophyll-a
- Main nutrients: NO_3 , PO_4 , NH_4

- Physical parameters: Salinity, temperature, density

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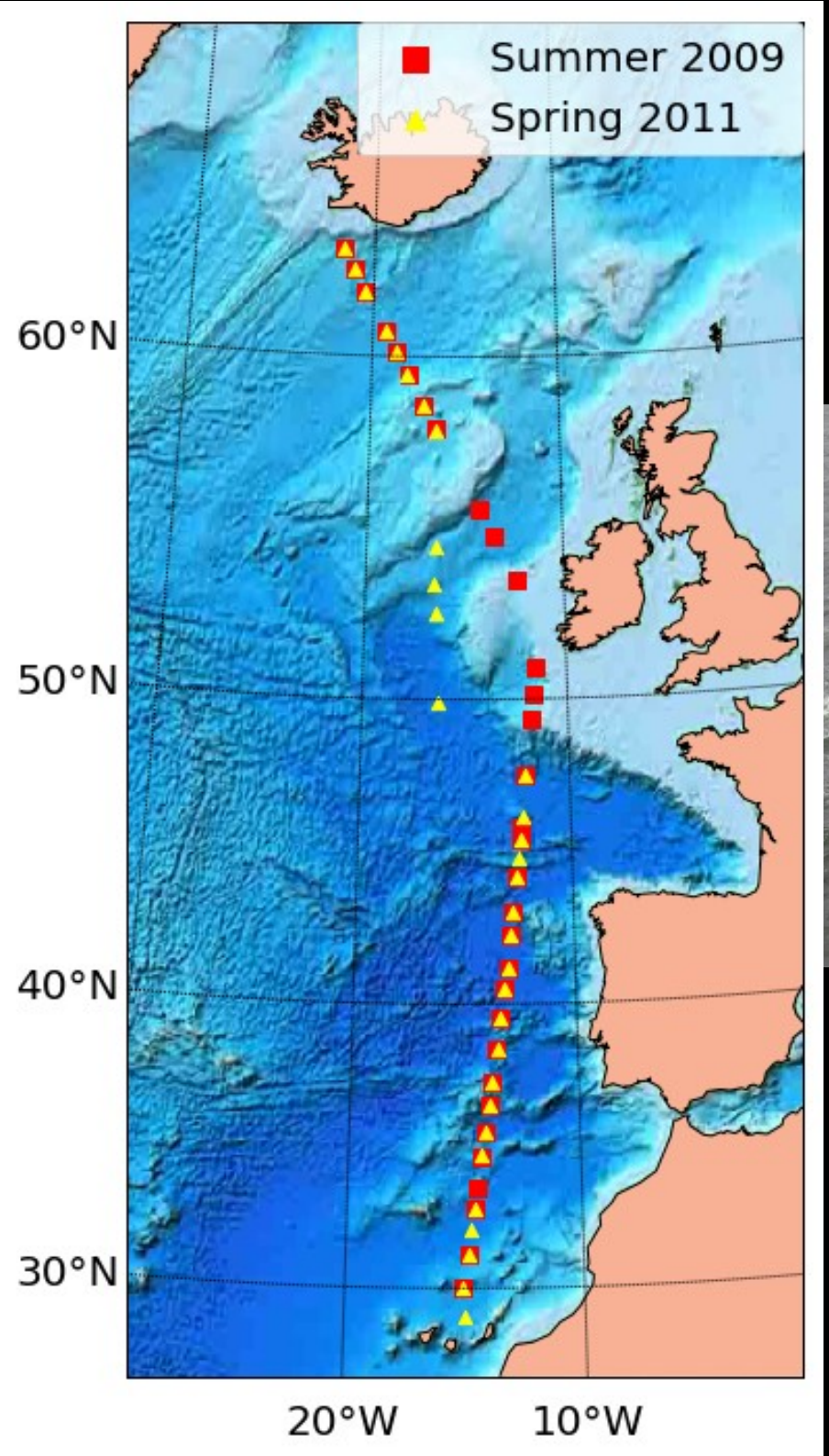

STRATIPHYT cruise

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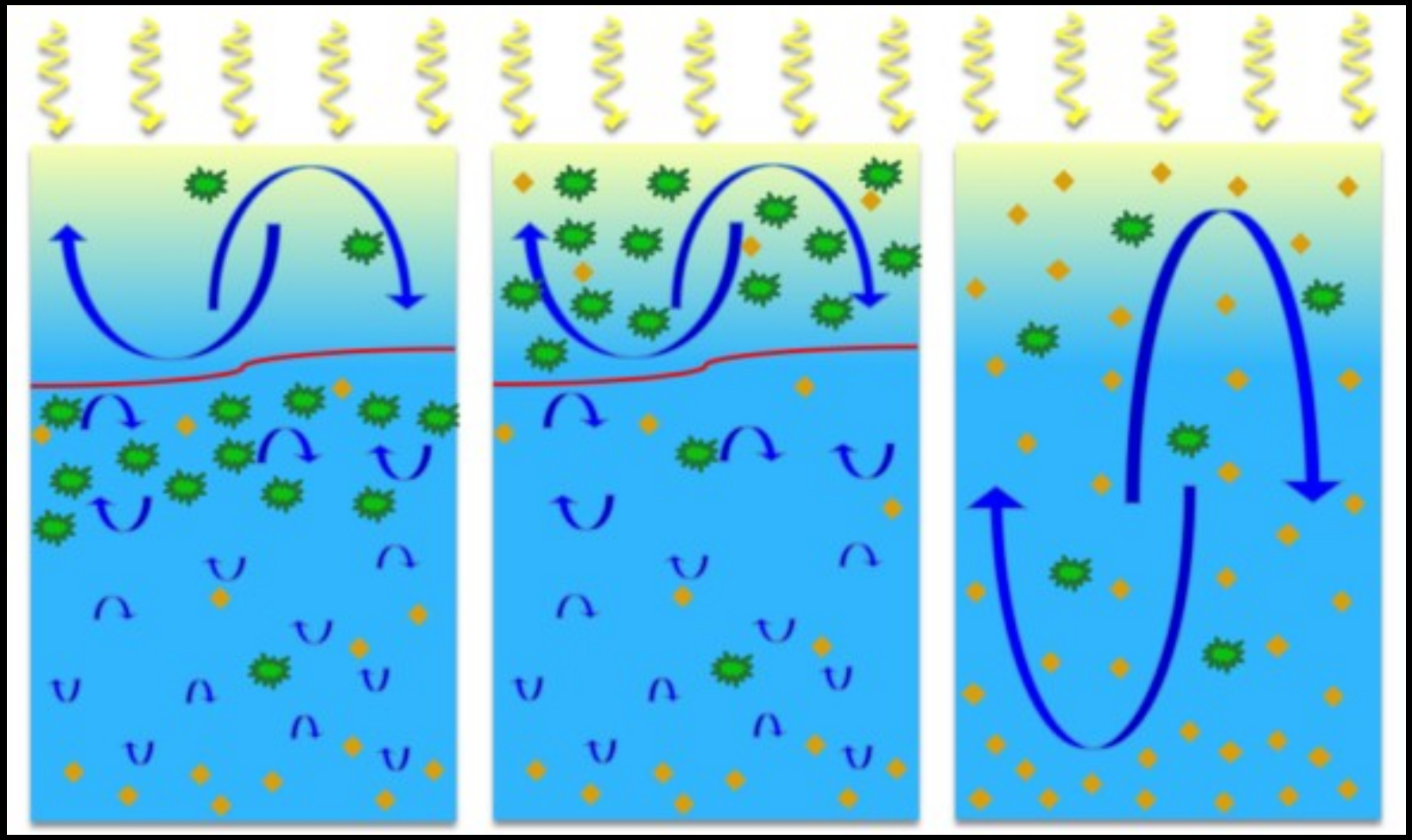
3 phytoplankton growth states

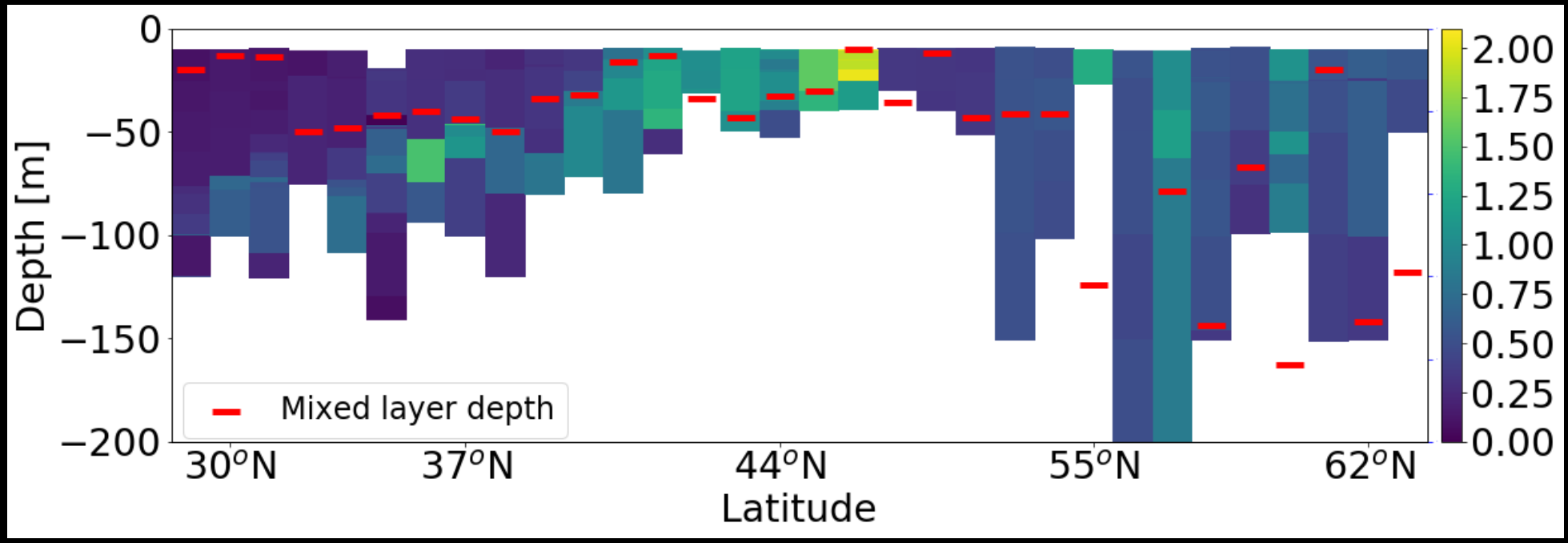


Deep Surface Mixed

Spring 2011

chl-a concentration [mg/m³]

Cruise



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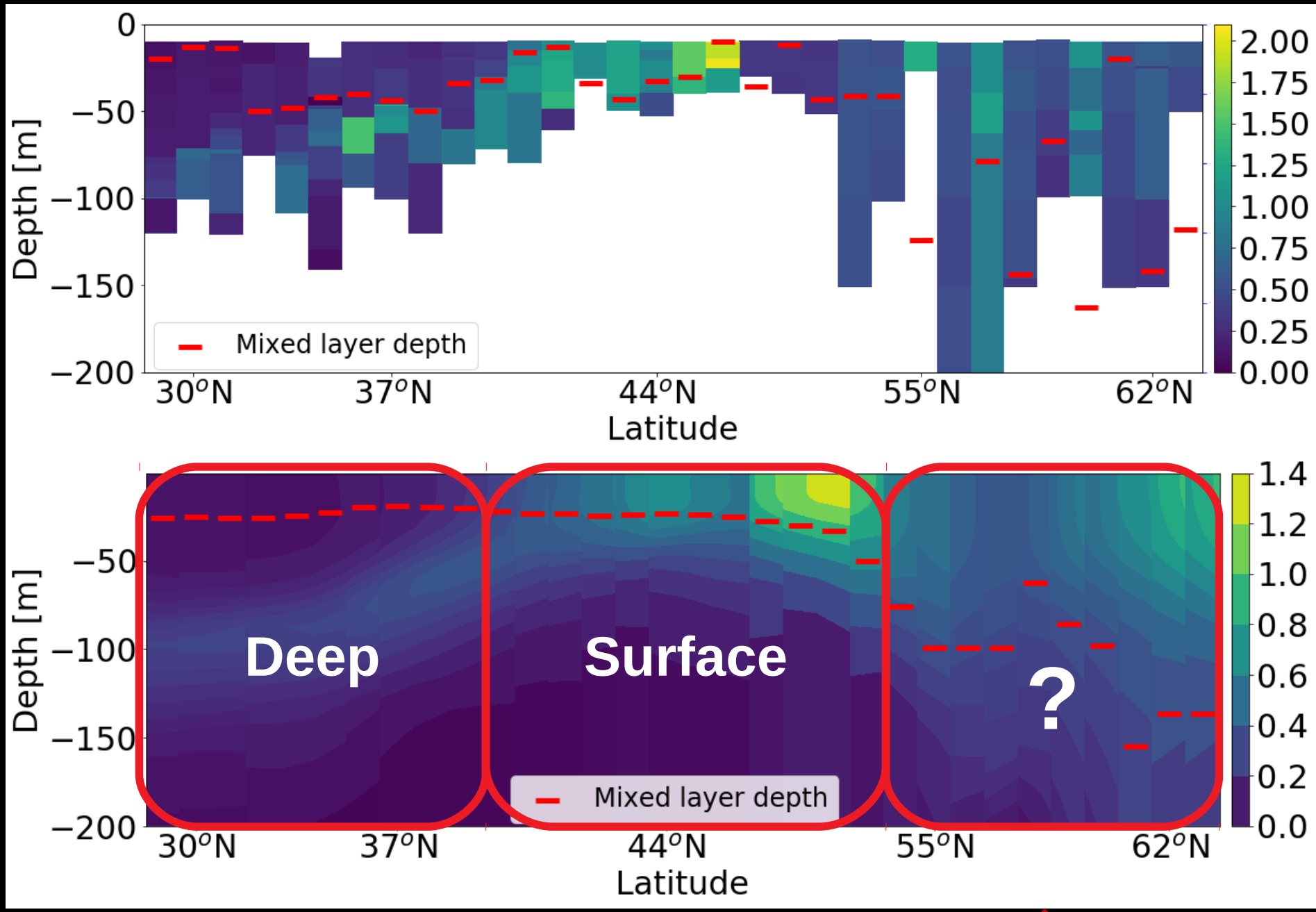
Spring 2011

chl-a concentration [mg/m³]

Cruise

Model



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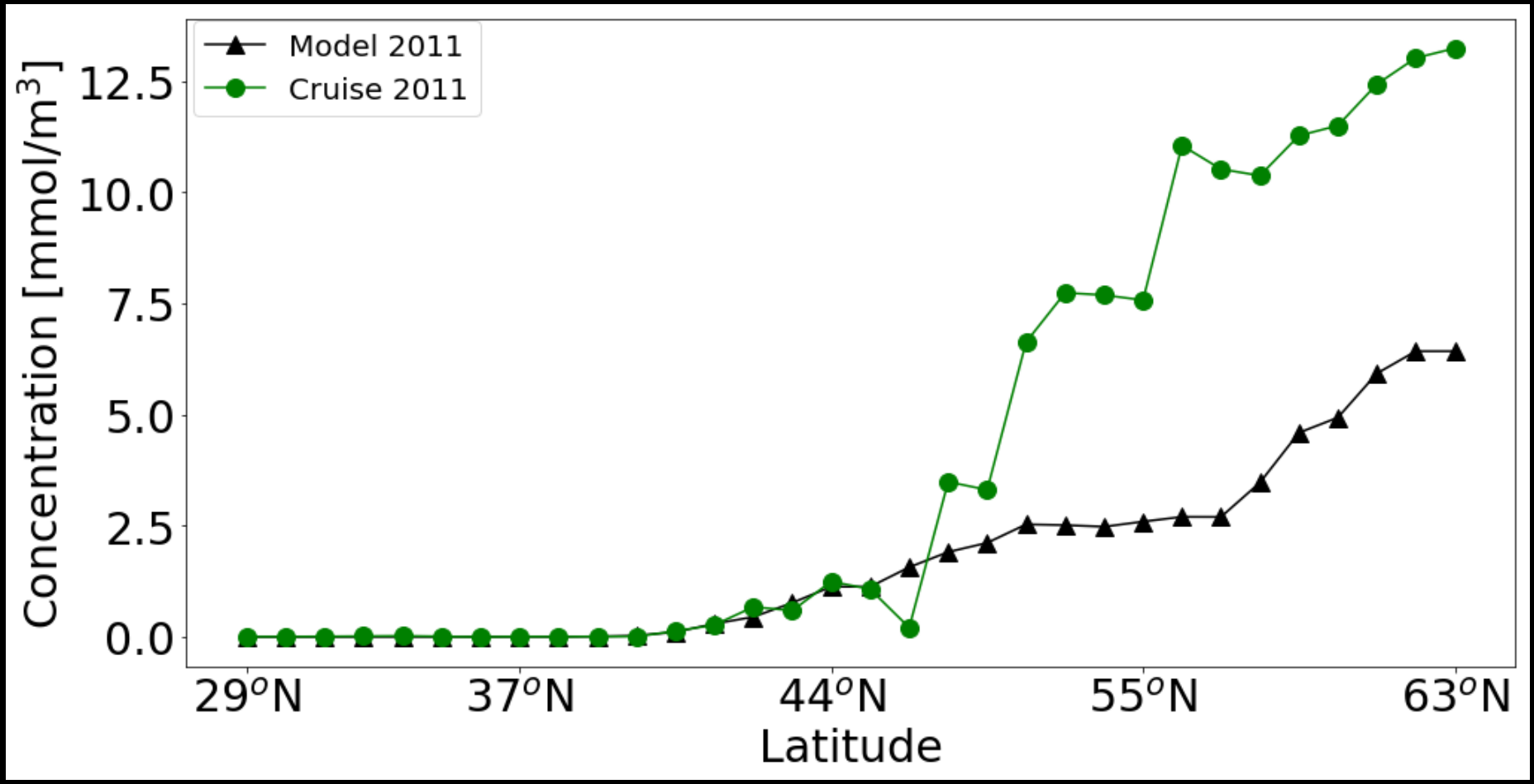
Spring 2011

Surface NO_3 concentration



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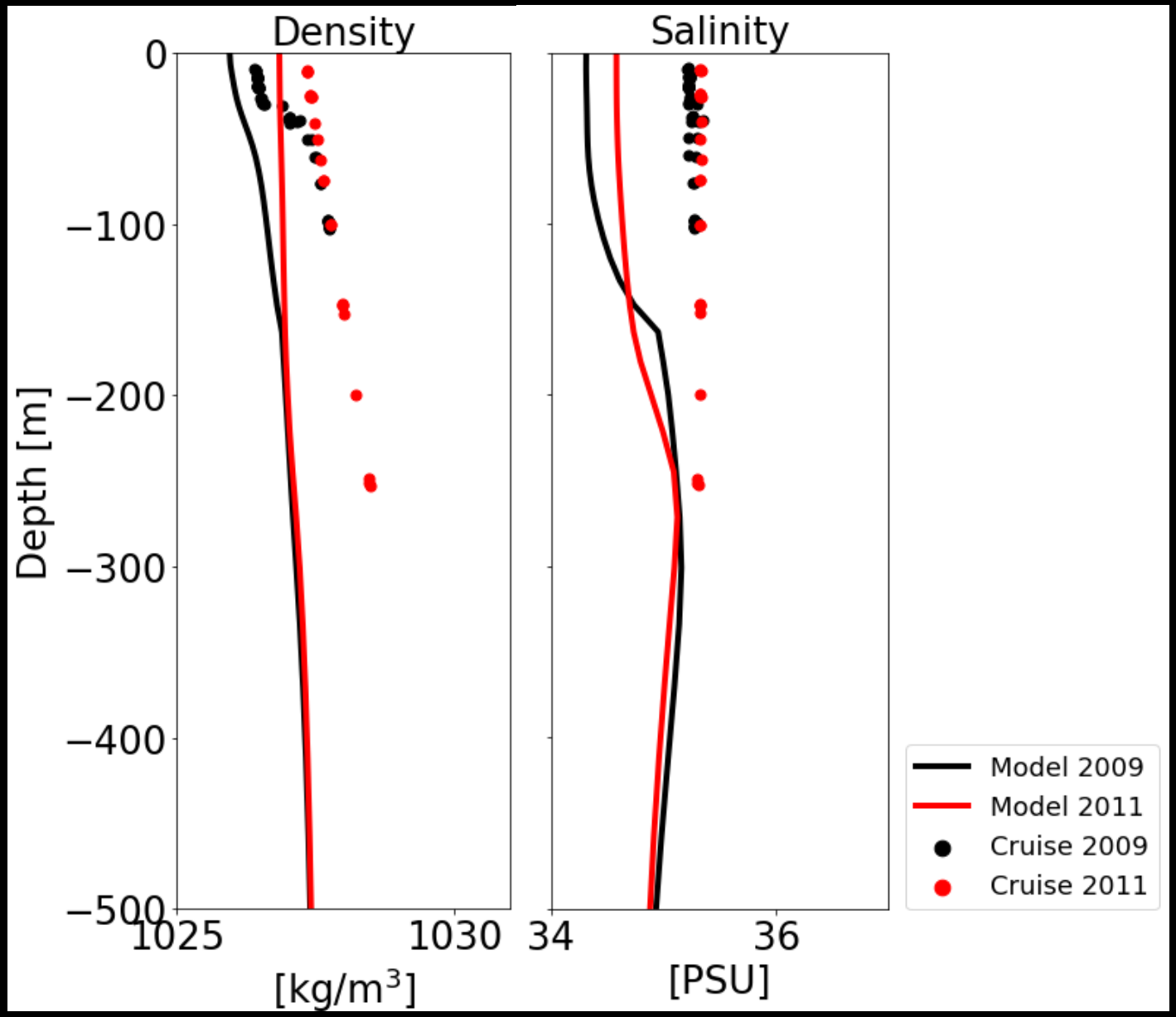
Station 30 (near Iceland)



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Conclusion Run 1

Winter mixing problems:

Cruise	Model
Deep mixing	Shallow mixing
Enough nutrients	Less nutrients
Less light	Enough light
Correct timing and correct concentrations	Wrong timing and lower concentrations

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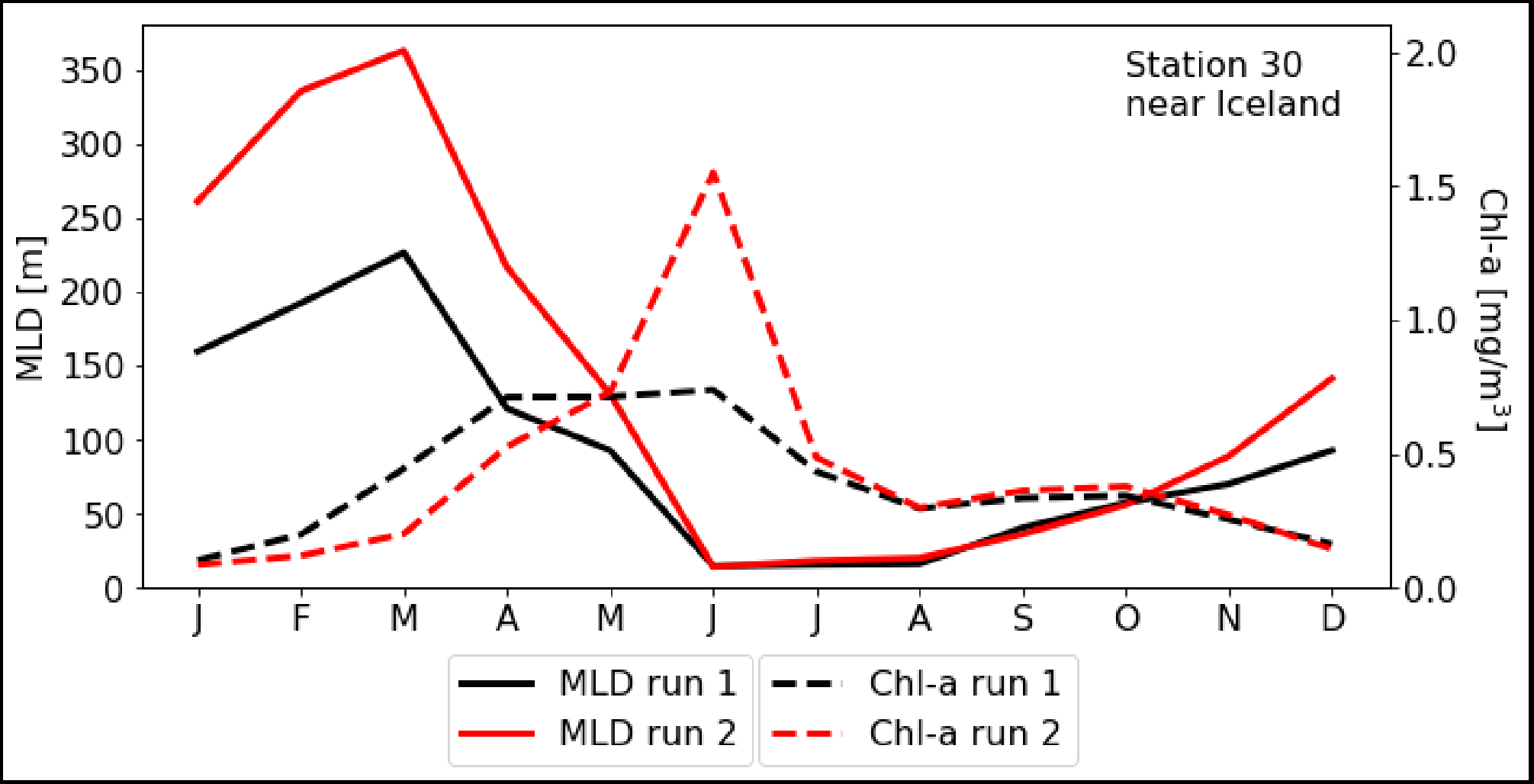
Run 2

Station 30 (near Iceland)



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General Conclusions

Aim

Validation of EC-Earth with field data from the NE Atlantic

Conclusions

Run 1: Good predictions in the South – Deep winter mixing problems in the North

Run 2: A step in the right direction

Future

Datasets that cover the entire year

More validation in high latitudes

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Thank you!

Denman, K.L., G. Brasseur, A. Chidthaisong, P. Ciais, P.M. Cox, R.E. Dickinson, D. Hauglustaine, C. Heinze, E. Holland, D. Jacob, U. Lohmann, S Ramachandran, P.L. da Silva Dias, S.C. Wofsy and X. Zhang, 2007: Couplings Between Changes in the Climate System and Biogeochemistry. In: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M.Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA

Falkowski, P. G., 2002. The Ocean's Invisible Forest. Scientific American

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