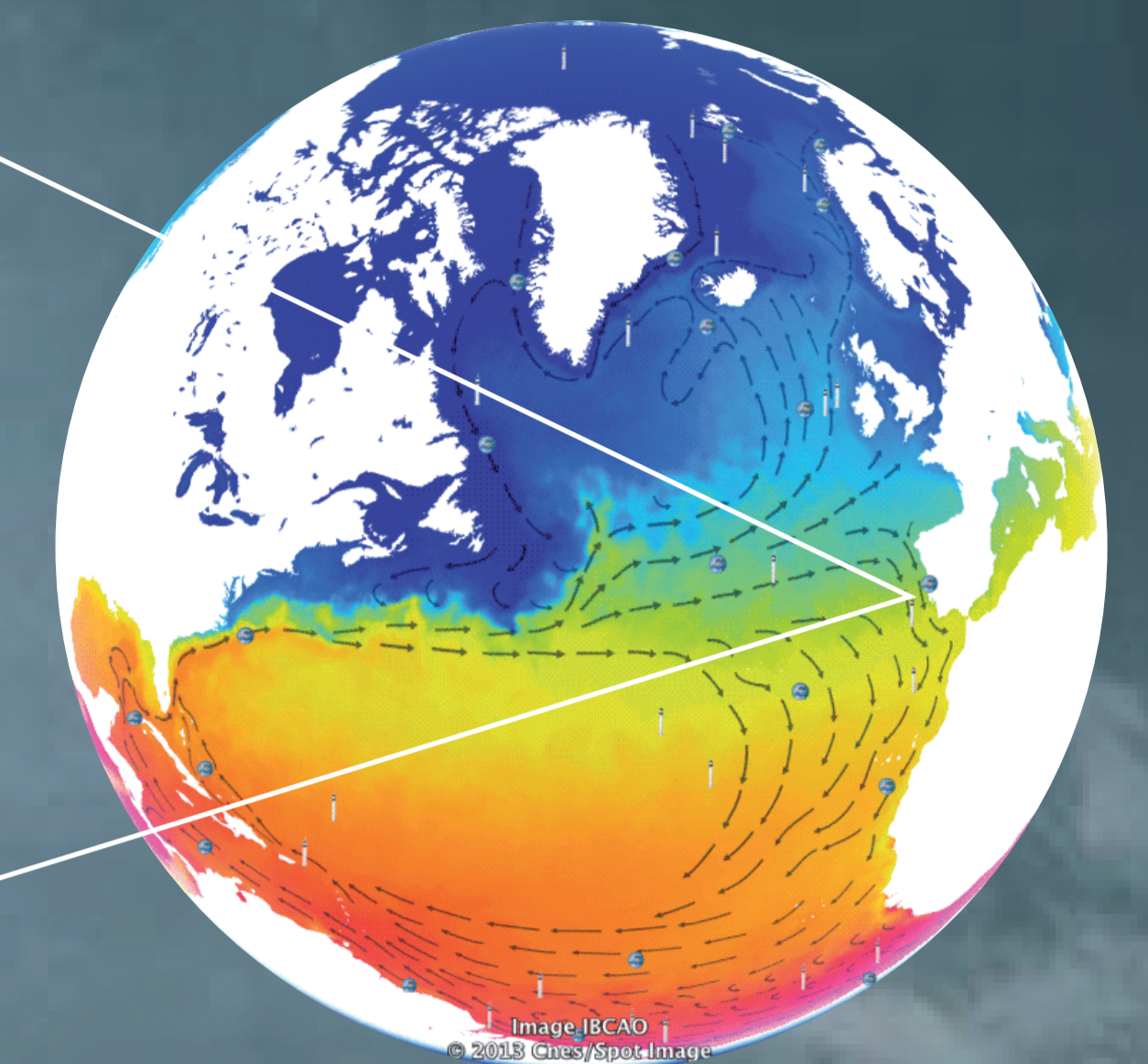
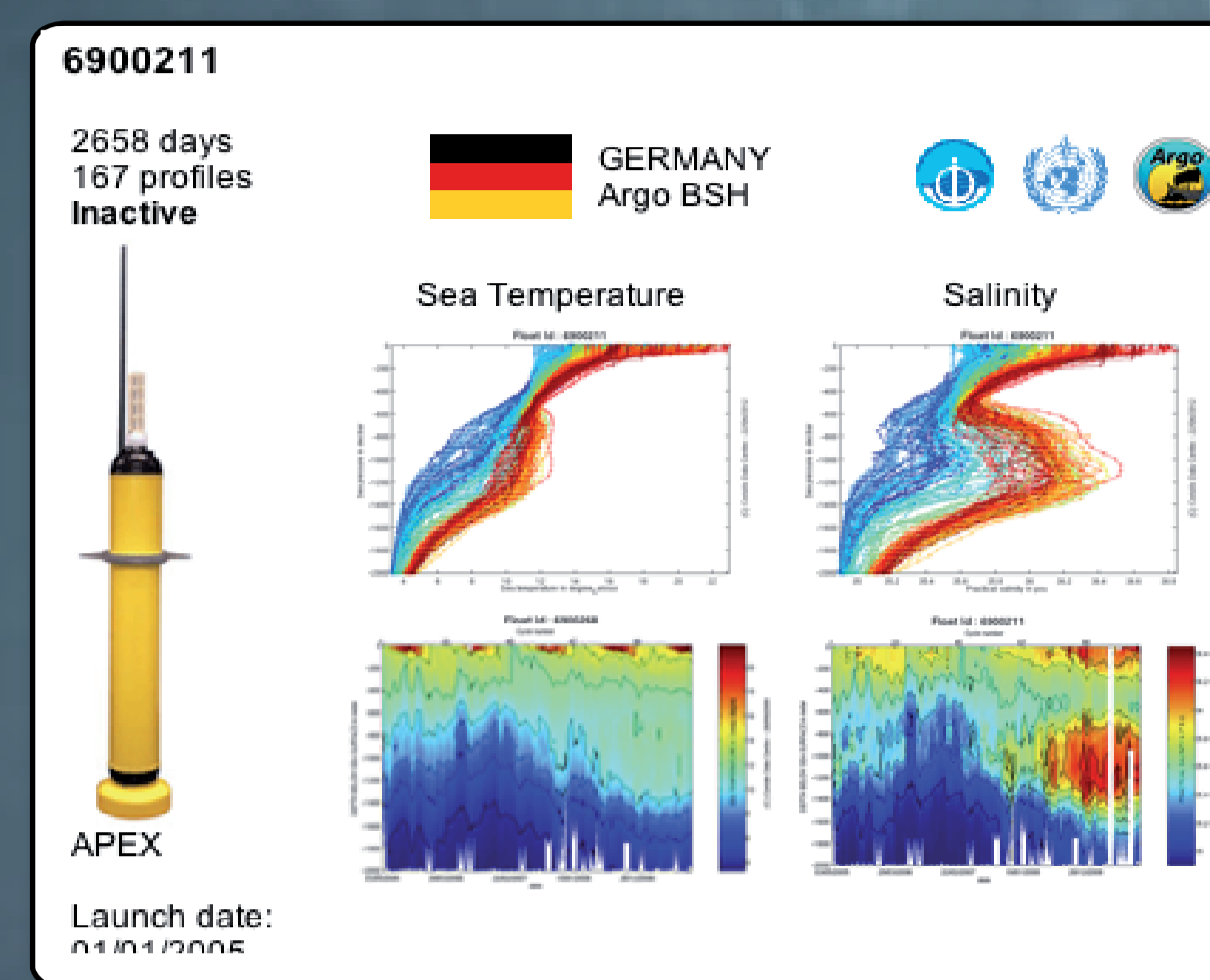


# The Euro-Argo education web site using Argo data to teach data analysis and marine science

Valborg Byfield<sup>1</sup>, Carolyn Scheurle<sup>2</sup>, John Gould<sup>1</sup>, Emina Mamaca<sup>3</sup>, Brian King<sup>1</sup>  
 1. National Oceanography Centre, Southampton, U.K. 2. Observatoire Océanologique de Villefranche sur Mer, France 3. IFREMER, France

**AIM**  
 Encourage young people to develop data interpretation skills by linking the data to current topics in oceanography, climate science and marine ecology.

The float selection is linked to current topics in oceanography, climate science and marine ecology. Each float has its own page with data, plots, background information and questions to guide data interpretation.



Data from selected floats are used to illustrate the oceanography of different regions.

### Interpreting data from float no.6900211

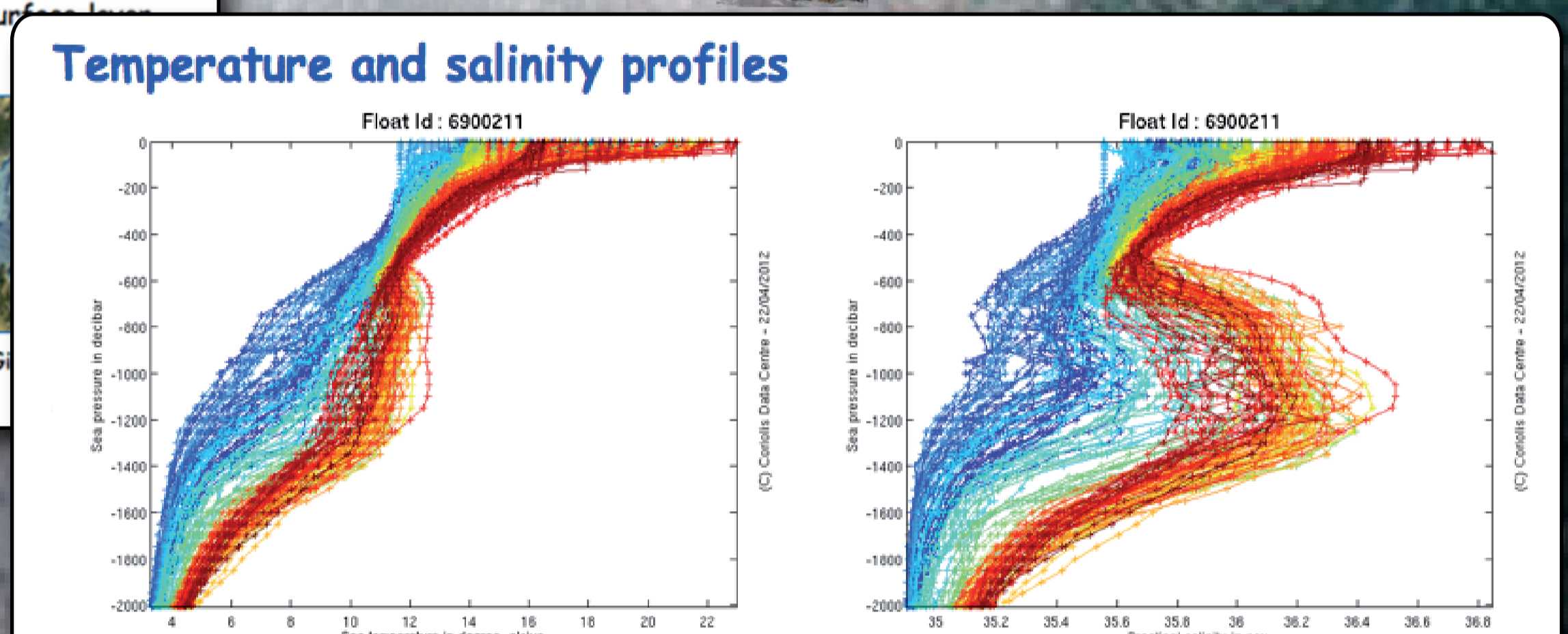
Temperature and salinity profiles Time series plots  
 Using the float data with ocean analysis maps Download the data Comparisons

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This APEX float was launched by German scientists west of Portugal, at 40.8° North, 30.1° West, on the 1st of January 2005. It has recorded a total of 127 profiles, and made its last report on the 5th of September 2010 from 38.1° N, 15.3° W.

If the strait of Gibraltar were closed tomorrow, Mediterranean sea level would fall by about 1m each year! This is because evaporation from the surface is far greater than the input from rain and river flow. To compensate, Atlantic water flows in through the Strait of Gibraltar, and continues eastwards in a surface flow that is about 150m thick.

Along its way the surface water becomes more and more salty, reaching over 38 psu south of Turkey. During winter this warm, salty water cools and sinks to become Mediterranean Intermediate Water (MIW), which is found at a depth of 150-600 m. MIW is still quite warm (about 14-15 °C), and very salty (about 37-38 psu, compared to the 34-36 psu typical of Atlantic water). It flows slowly back towards the west, and eventually leaves the Mediterranean through the Strait of

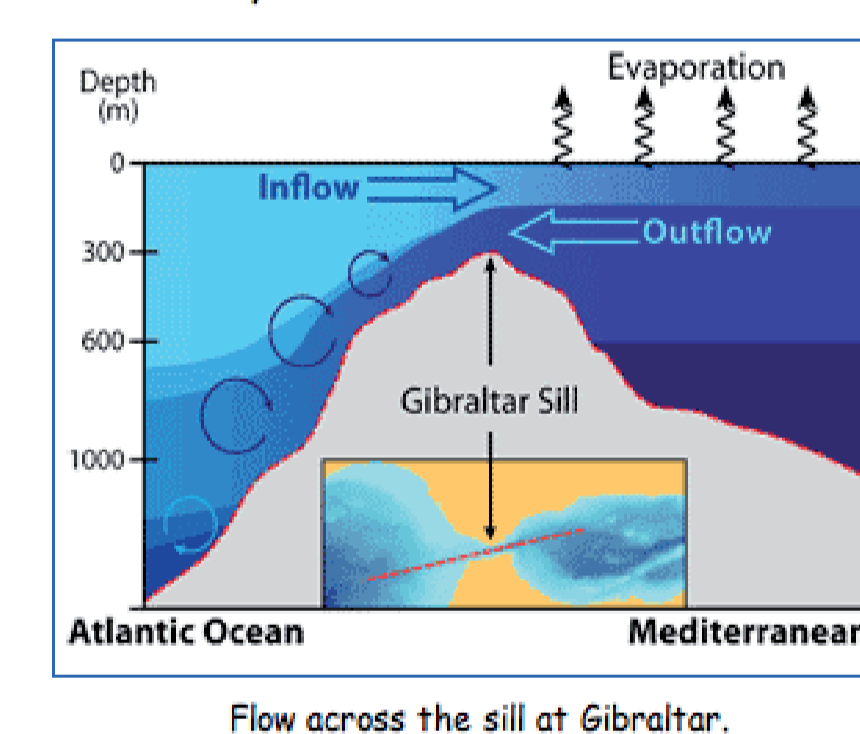


Profiles of temperature (left) and salinity (right) from Argo float 6900211. The profiles show how temperature (T) and salinity (S) change with depth from the surface to 2000m. Early profiles are dark blue, the latest profiles are deep red or brown. Click on the images for larger plots. Source of plots: IFREMER/Coriolis.

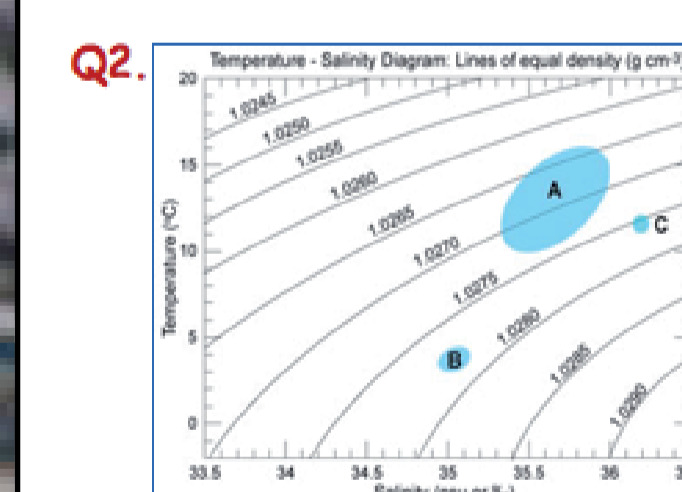
The temperature and particularly the salinity profiles give us some interesting clues about how water moves below the sea surface in the North Atlantic west of Spain.

**Q1.** Look at the T-profiles above. At what depth range do you find the greatest variability? How does this compare with variability at the surface? Why is this surprising? How does the variability in the salinity at this depth compare with the variability in temperature?

**A1.** The greatest temperature variability is found between 600m and 1600m depth. This is also the depth with the greatest variation in salinity. Surprisingly the temperature variability is greater at 600-1600m than at the surface, where heating in the summer and cooling in winter has the greatest impact. Such seasonal effects decrease with depth, as you can see if you look at other floats from similar latitudes.



The variation in salinity is even more marked than the variation in temperature. Why is this? The Mediterranean Sea is a warm, dry, area. Each year more water is lost from the sea surface by evaporation than is gained by rainfall or the flow into the Mediterranean from rivers like the Nile. As a result Mediterranean water is saltier and denser than the water from the Atlantic. In the Strait of Gibraltar the Atlantic water flows into the Mediterranean on the surface, while the denser Mediterranean water flows out into the Atlantic below this. **CLOSE**



The Mediterranean outflow across the sill at Gibraltar into the Atlantic explains the higher temperatures and salinities found at depths of 800 - 1300m in these profiles. Yet the Mediterranean water enters the Atlantic across a sill that is only 300m deep. Looking at the T-S-density diagram on the left, can you explain this? How to use T-S-density diagrams Click on the orange float icons to reveal the answers!

### An Argo tour of the ocean

You are here: Home Page > An Argo tour of the ocean

Use the buttons below to change the map on the right to see different views of the global ocean. Click on each map to see a larger version with additional information. The float links to a new page in the 'Argo Tour'.

Sea Surface Temperature and sea ice:  
 March June Sept. Dec.

Ocean circulation:  
 Current variability Dynamic topography Surface currents

Other maps  
 Salinity Jan. Salinity July Bathymetry

Sea Surface Temperature (°C) Sea ice %

March sea surface temperature (SST) and sea ice cover from satellite measurements in 2006-2008. Source: NCC from Met Office OSTIA data.

### Ocean temperatures

Temperatures in the ocean vary a lot less than on land, ranging from about -2 °C, near the polar ice edge to nearly +40 °C in the warmest tropical seas. In contrast land temperatures span almost 150 °C, from a record low of -89.2 °C at Vostok in Antarctica to a heat record of 57.8 °C at Azizia in the Libyan desert.

The difference is due to the high heat capacity of water, which makes the ocean able to absorb or release large amounts of heat without large temperature changes.

The heat capacity of the top 3m of the ocean is equal to that of the entire atmosphere. The ocean acts as a buffer to sharp changes in air temperature, so maritime climates have lower maximum and higher minimum temperatures than inland climates.

Temperatures at 55° North. The plot shows mean monthly temperatures for one inland and two coastal locations with matching winter photos. Can you match the sites A, B and C to locations 1, 2 and 3 on the SST map below?

Links to national education programmes  
 Support Adopt-a-Float programmes by including adopted floats in the float selection

### Using T-S-p diagrams to find seawater density

Temperature - Salinity Diagram: Lines of equal density (kg m<sup>-3</sup>)

Temperature (°C)

Salinity (psu)

Sample A (blue)  
 Temperature (°C): 13.0 Salinity (psu): 35.7

Sample B (red)  
 Temperature (°C): 13.0 Salinity (psu): 35.7

Show samples in T-S space.

## Quizzes & questions

### Data interpretation quiz: Match the temperature to the float track

You are here: Home Page > Argo quizzes and activities > Data interpretation quiz Site map Teachers

For larger images and extra information, click on the thumbnails. For help on oceanography, see Argo Tour of the Ocean (new window).

Temperature time series 1 Temperature time series 2 Temperature time series 3

Float track A Float track B Float track C

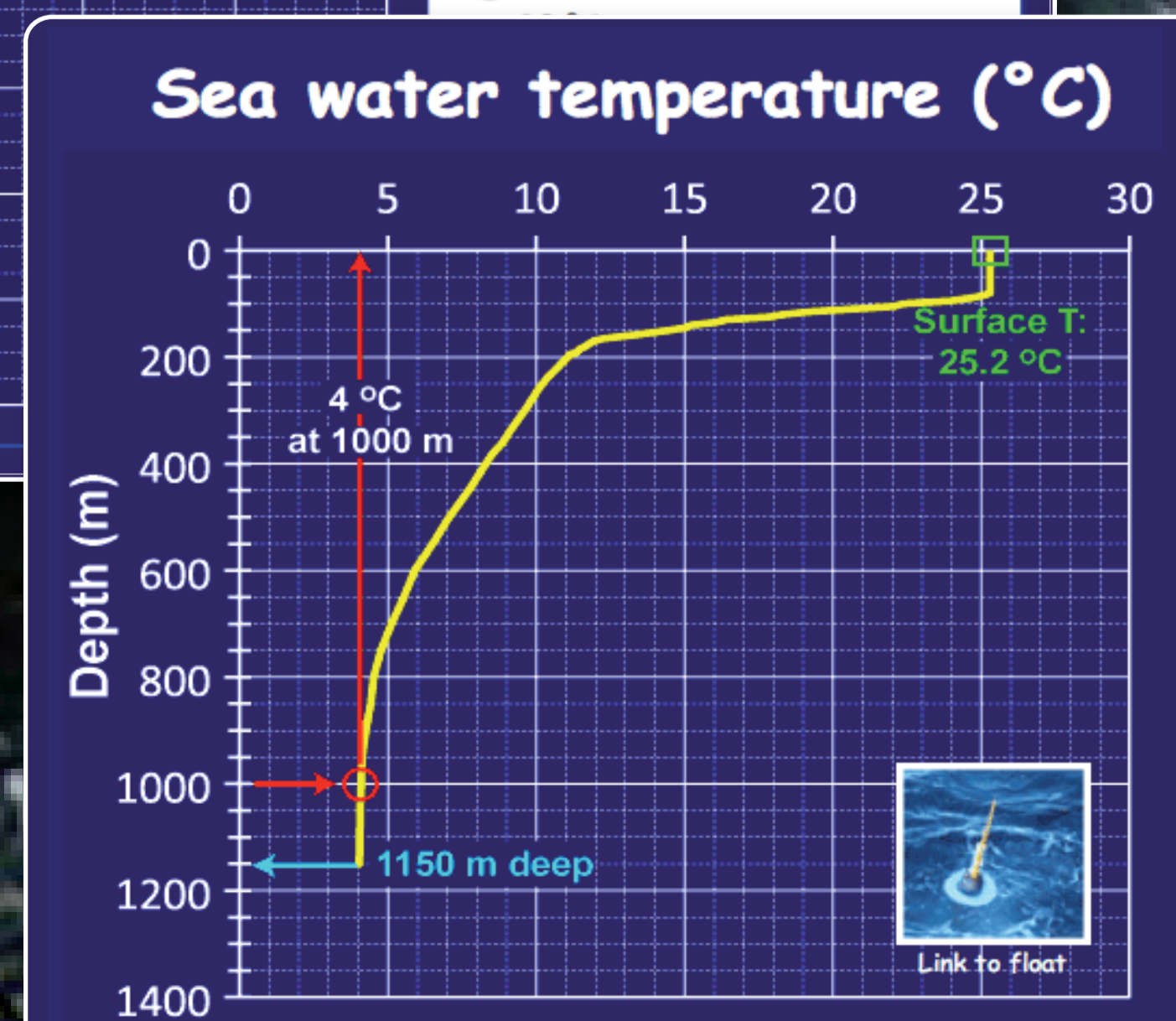
### Sea water temperature (°C) Question No. 2

How deep did the Argo float measure?

150 m  
 1400 m  
 1150 m

What is the temperature at the sea surface?

25.2 °C  
 4.2 °C



### Time series of temperature and salinity

Float Id : 6900211 Cycle number

Sea pressure in decibar

Sea temperature in degree Celsius

Practical salinity in psu

Time series of temperature (left) and salinity (right) from Argo float 6900211. The sections show all the temperature (T) and salinity (S) profiles measured by the float during its life-time side by side. Each profile is represented by a very thin column where deep red is the highest values and deep blue the lowest. The colour bars on the right relate the colours to actual data values. Profile numbers are given along the top of the plot, with corresponding measurement dates along the bottom. Click on the images for larger plots. Source of plots: IFREMER/Coriolis.

The Mercator analysis map shows that the Mediterranean water does not spread evenly out across the Atlantic, but is patchy with changes in salinity even over a short distance. This patchiness is also evident in the salinity section above (right).

**Meddies**  
 As the warm, salty Mediterranean water flows out across the Atlantic, eddies pinch off and drift southwestward. These lenses of warm, salty water rotate in a clockwise (anticyclonic) direction and are called 'Meddies'.

Ocean salinity at 1000m.