# Argonautica

## 20,000 schools over the sea

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Argonautica is an educational project to help young people and their teachers learn more about the ocean and ocean-observing satellites such as Topex/Poseidon and Jason-1. These satellites are helping to further our understanding of the oceans and climate, and to protect the marine environment. The educational aims of Argonautica are broader still, since it seeks to reach a maximum number of schoolchildren in order to raise their awareness of the monitoring of our planet. More than just a project, it is a global initiative seeking to federate "20,000 schools over the sea".

The three watchwords guiding the project are understand, experiment, and exchange:

- Understand: Classes receive a kit called "*A la découverte de la mer par les satellites*" (Discovering the sea by satellite), which provides teaching materials to study the ocean and satellites in more depth.

- Experiment: Operations are conducted every year (see box for 2002-2003 operations) to get pupils working like researchers, by giving them data and maps so that they can develop a truly scientific approach.

- Exchange: The Argonautica project is on a website (www.cnes-edu.org) for distributing digital resources. This website will give participants a forum for discussion and exchange.

The Education & Youth department at the French space agency CNES has a wealth of experience working on this kind of project. The Midi-Pyrénées teacher-training institute in Toulouse (IUFM) is providing teaching input.

### Argo-luth

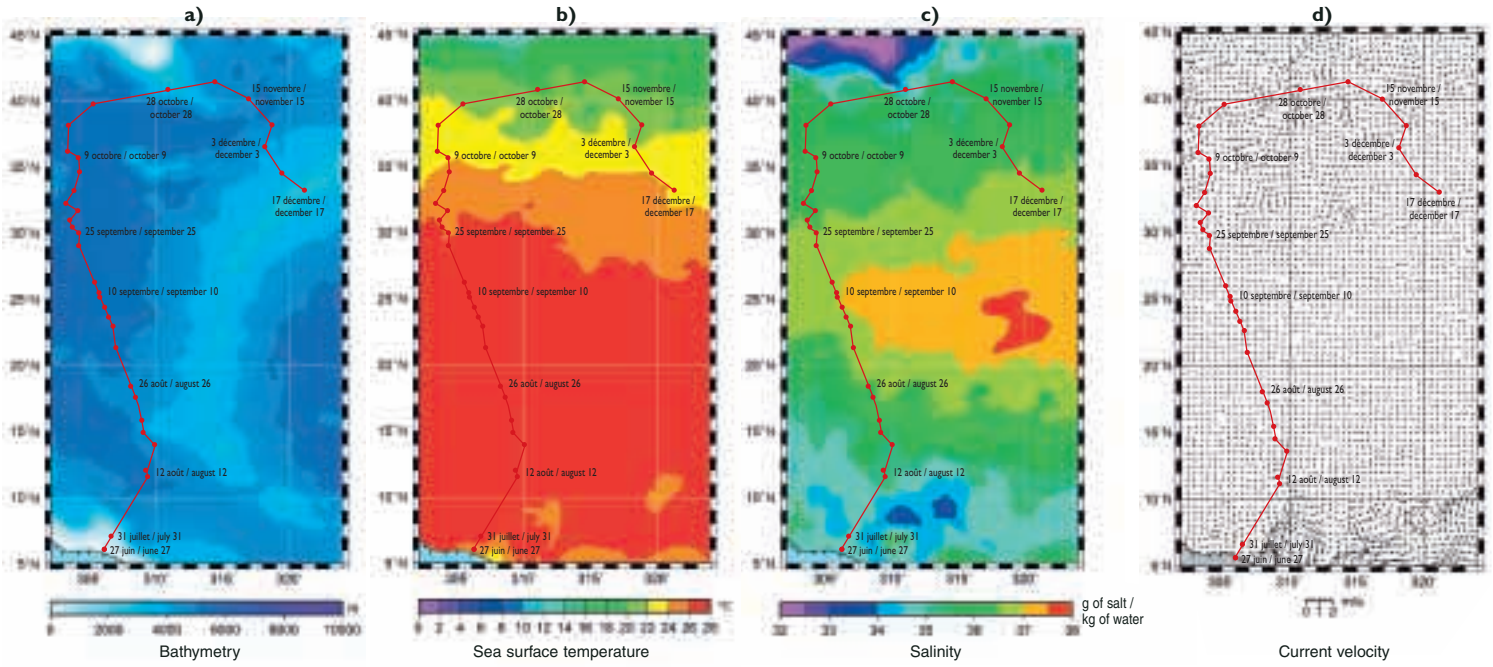
The Argo-luth project is tracking migrating leatherback turtles in the Atlantic Ocean, starting out from Awana-Yalimapo beach in French Guiana. The leatherback turtle is on the verge of extinction. Researchers at CEPE, the laboratory of ecological and physiological energetics at CNRS, the French national scientific research centre, are tracking their movements in order to map migration routes and feeding strategies.

A better understanding of the turtle's migration routes and habits will help us to protect them more effectively from the dangers of fishing and pollution.

Understanding the turtle's migration routes, conducting experiments using real location data and ocean charts, and working with scientists are the three chief motivations of the Argo-luth project.

To this end, every year in June and July researchers fit out a few leatherback turtles with an Argos transmitter on Awala-Yalimapo beach in French Guiana, where the turtles come ashore to lay their eggs. This year we will be studying the migration route of a turtle named Maëlie, who was fitted with a

Argonautica is an educational project that proposes an innovative working environment and new ways of using satellite data. The mantra guiding the project is: *understand, experiment*, and *exchange*. The first of these three watchwords focuses on treating kids like researchers, the second on making practical experiments the golden rule of science teaching, and the third on making science meaningful to young people. Argonautica provides a framework for science teaching in school based on the theme of oceanography, climate, and tracking of animals like the leatherback turtle.




**Leatherback turtle Maëlie's trajectory overlayed on bathymetry charts (a) surface temperature (b), salinity (c), and surface currents (d) outputs from the Mercator ocean model, here for October 24, 2001**

### Operations during 2002/2003

*Argo-Banquise*
Schoolchildren are taking part in analysis of data gathered by the drifting buoys released in the transpolar drift by Jean-Louis Etienne at the end of his Arctic polar ice cap mission. The buoys' are being tracked by the Argos system.

*Argo-luth*
Classes are studying the migration of leatherback turtles in the Atlantic Ocean from French Guiana, comparing migration routes with temperature, salinity, current, and sea surface height outputs from the Mercator numerical ocean model.

*Argo-pôle*
Pupils will study marine wildlife and ocean and atmospheric variations measured by satellite in the Antarctic, using animal tracking data (albatross and penguins) and drifting buoy data.

*Argo-expé*
Classes will help to build a drifting buoy that will be released at sea from an ocean research vessel and tracked by Argos.

transmitter in June 2001 and is still sending information about her position.

The results of scientific research show that leatherback turtles swim great distances during migration and do not migrate in any particular direction. Now, we need to analyze these results by comparing them with the turtle's feeding maps, bathymetry data, marine currents, and deep and surface ocean fields (CNES-CEPE partnership).

Our primary educational objective is to get pupils working like researchers with real data. They track the migrating leatherback turtles by downloading location data over the Internet and then plotting their positions on maps. They make comparisons by overlaying trajectories on bathymetry charts or surface temperature, salinity, and sea surface height outputs from the Mercator ocean model. In 2002, we produced temperature, salinity, surface current, and sea surface height maps in Maëlie's migration zone from six months of observations between June and December.

Pupils will adopt a scientific approach to their work, observing, defining a problem, formulating hypotheses to solve it, establishing an experimental procedure, recording results, reaching conclusions, and repeating the process until the problem has been solved.

For example, a question we might seek to answer is: "What relationships are there between leatherback turtles and the ocean?" This will involve studying each ocean map and dataset separately, understanding spatial and temporal variations, and overlaying trajectories on maps of physical parameters.

### Other example questions:

- Does bathymetry influence the leatherback turtle's migration routes?
- Do surface currents influence the trajectory and direction of movement of the leatherback turtle in the Atlantic Ocean?
- How does surface temperature vary from one month of observation to another?
- Since surface temperature varies according to the season, could it be a key element determining the leatherback turtle's migration routes?
- Does surface salinity vary in space and time?
- Could salinity throughout the year be a key element determining the leatherback turtle's migration routes and feeding strategies?

From a scientific and experimental point of view, pupils will perform experiments in an aquarium to highlight specific physical ocean conditions. They will learn about modeling concepts used to understand phenomena and to study how they respond when a single parameter is varied at a time.