

Argo and the Australian Curriculum: Science

Argo can be incorporated into classroom learning in many areas of the Australian Science Curriculum. How the Argo program fits into the Science curriculum is highlighted in the table below under the main curriculum headings: “*Science Understanding*” and “*Science as a Human Endeavour*”. Argo is not only directly relevant to the *Earth and Space Sciences* through its measurement of the global oceans but also to the *Biological Sciences* by explaining the ecosystem and environment in which humans, plants and animals live. Argo is also a fun, interesting and practical way to illustrate how real-world scientific data is used by scientists and the community, what scientific research is, the significance of this research and how it is applied to help us understand the oceans and climate.

[Link to Argo development and equipment](#) [Link to Argo research – physical conditions of oceans](#) [Link to Argo research – significance of findings/why we research oceans](#)

Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Science Understanding								
Biological sciences								
		<p>Living things, including plants and animals, depend on each other and the environment to survive.</p> <p>Argo floats tell us information about the ocean, i.e. how warm or cold it is and how salty it is. Many animals like penguins and seals are adapted to live in very cold places like Antarctica. We understand more about their environment by using technology like Argo floats to measure the global oceans all the way to the ice.</p>		<p>The growth and survival of living things are affected by the physical conditions of their environment.</p> <p>Argo floats help us to track ocean temperatures. With climate change, the East Australian Current is extending further south over time, bringing warm-water fish, lobsters and sea urchins from Victoria and NSW as far south as Tasmania. This is changing the ecology of these southern marine ecosystems.</p>	<p>Interactions between organisms can be described in terms of food chains and food webs; human activity can affect these interactions.</p> <p>Marine species have evolved with particular thermal tolerances, i.e. they have a preferred temperature range in which to live. In a future warmer world, this will impact on the ability of marine life to thrive and survive. When the ocean temperatures change, so will the species that can live there. This will</p>		<p>Ecosystems consist of communities of interdependent organisms and abiotic components of the environment; matter and energy flow through these systems.</p> <p>Higher levels of carbon dioxide and a warmer ocean means the ocean will become more acidic. Many small planktonic organisms that form the base of the food chain (like coccolithophorids and diatoms) may no longer be able to build their shells and survive.</p>	

					have flow-on effects on the whole ecosystem and the food web.		This will impact food webs and ecosystems.	
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Earth and space sciences

<p>Earth's resources, including water, are used in a variety of ways. Argo floats are telling us important information about climate and the global hydrological cycle. Argo data shows us that over the past 50 years the earth's water cycle is 'ramping' up, i.e. wet areas are getting wetter and dry areas are getting drier.</p>		<p>Earth's surface changes over time as a result of natural processes and human activity. Human induced climate change is causing the earth to warm. 93% of the extra heat is going into the earth's oceans. Argo floats are measuring the ocean temperatures and we can see that the ocean is warming, particularly in the Southern Ocean.</p>		<p>Sudden geological changes or extreme weather conditions can affect Earth's surface. Some Argo floats have special sensors that can measure rainfall and by measuring near the surface can be used to track monsoons in the tropical oceans.</p>	<p>Water is an important resource that cycles through the environment. Argo floats measure salinity of the ocean which tells us about the earth's water budget. Ocean regions with high evaporation are getting saltier (e.g. the Atlantic Ocean) and regions with high precipitation are getting fresher (e.g. close to Antarctica)</p>		<p>Global systems, including the carbon cycle, rely on interactions involving the biosphere, lithosphere, hydrosphere and atmosphere. Argo floats can now measure other ocean properties like pH and nitrate which tells us about the ocean carbon cycle and also bio-geochemical sensors that can tell us how much plankton (plant life) is in the water.</p>
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Science as a Human Endeavour

Nature and Development of Science

<p>Science involves asking questions about, and describing changes in, objects and events. Argo floats are a</p>	<p>Science involves making predictions and describing patterns and relationships. Argo observations are used to validate global climate models and make better predictions about future climate.</p>	<p>Science involves testing predictions by gathering data and using evidence to develop explanations of events and phenomena. Important contributions to the advancement of science have been made by people from a range of cultures.</p>	<p>Scientific knowledge changes as new evidence becomes available, and some scientific discoveries have significantly changed people's understanding of the world. Science knowledge can develop through collaboration and connecting ideas across the disciplines of science.</p>	<p>Scientific understanding, including models and theories, are contestable and are refined over time through a process of review by the scientific community. Advances in scientific understanding often rely on developments in technology and technological advances</p>
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<p>relatively new technology that over the past 15 years has revolutionised the study of the oceans. Argo data is used by scientist around the world to study ocean circulation, the global water cycle and climate.</p>		<p>Argo is an international program with scientists in over 30 countries cooperating to deploy floats and share and understand the data.</p>	<p>Data from global Argo floats is freely and publically available over the web to anyone who wants to download it and use it. Comparing data from Argo floats to historical observations made from ships has significantly increased our understanding of the oceans.</p>	<p>are often linked to scientific discoveries.</p> <p>Technological developments and advances mean we are now starting to deploy new tougher Argo floats in the ice around Antarctica, and are also sending floats deeper than 2 km – all the way to the sea floor.</p>
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Use and influence of science

		<p>Science knowledge helps people to understand the effect of their actions.</p> <p>Argo floats tell us how the ocean circulation and the climate is changing, this data and information will be vital in helping us to determine what the effects of climate change will be moving into the future.</p>	<p>Science and technology contribute to finding solutions to a range of contemporary issues; these solutions may impact on other areas of society and involve ethical considerations.</p> <p>Science understanding influences the development of practices in areas of human activity such as industry, agriculture and marine and terrestrial resource management.</p> <p>People use understanding and skills from across the disciplines of science in their occupations.</p> <p>Argo data is used by a cross-section of society, it helps farmers by providing better climate and seasonal forecasting, and it is used in by the fishing and shipping industries to provide better information about ocean currents and temperature.</p>	<p>Advances in science and emerging sciences and technologies can significantly affect people's lives, including generating new career opportunities.</p> <p>The values and needs of contemporary society can influence the focus of scientific research.</p> <p>Argo floats are a new technology (15 years old) and along with satellite data are providing the first global snapshot of the oceans on regular time scales. This new data set is opening up many new areas of research into ocean circulation and climate for the next generation of oceanographers, marine biologists and resource managers.</p>
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Science Inquiry Skills may be applied at a range of year levels for many possible experimental topics. For example: salinity testing from a range of water samples; temperature testing from a range of local sites; use of real Argo data for analysis. Argo floats can be tracked using Google Earth and classrooms can 'adopt' a float and follow its progress in the oceans. For information about how to add an Argo layer to Google earth visit: http://www.argo.ucsd.edu/Argo_GE.html

Sustainability Cross-curriculum priority

Argo research allows shared information across a range of local and global communities to better understand oceans and global ecosystem processes. This contributes significantly to the ability to protect the oceans and global systems. Argo data helps build an understanding of the biosphere as a dynamic system providing conditions that

sustain life on earth. Argo is a significant contributor to scientific understanding and science inquiry processes and a strong example of a technology that can help students appreciate how people forecast change and plan the actions necessary to shape a more sustainable future.