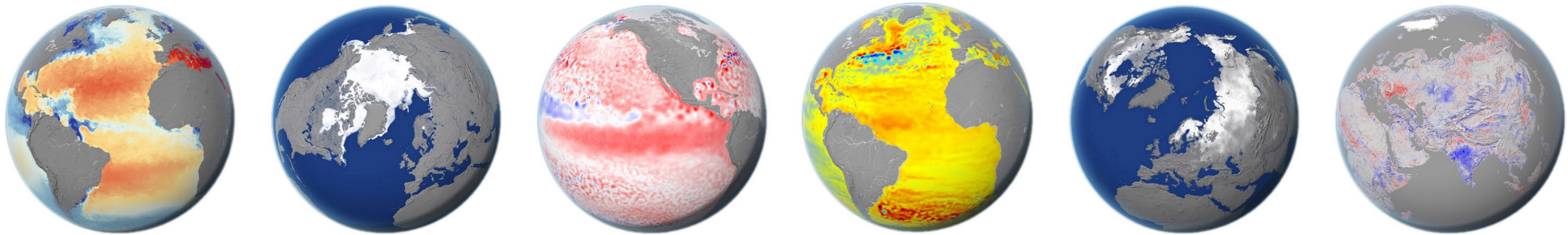


# Communicating Climate Change

Philip Eales, Andrew Wayne, David Jacobs (1), Patrick Mast (2), Suhyb Salama (3), Catherine Fitzsimons (4), Johannes Kaiser (5), Cillia Winkels, Hub Kockelhorn (6), Eirini Politi, Carsten Brockmann (7), Sophie Hebden, Paul Fisher (8)

(1) Planetary Visions Limited [planetaryvisions.com](http://planetaryvisions.com) (2) Ubilabs [ubilabs.com](http://ubilabs.com) (3) ITC [itc.nl](http://itc.nl) (4) NCEO [nceo.ac.uk](http://nceo.ac.uk), University of Liechester (5) DWD [dwd.de](http://dwd.de) (6) Museon-Omniversum [oneplanet.nl](http://oneplanet.nl) (7) Brockmann Consult [brockmann-consult.de](http://brockmann-consult.de) (8) European Space Agency Climate Office [cci.esa.int](http://cci.esa.int)  
email [philip.eales@btinternet.com](mailto:philip.eales@btinternet.com)



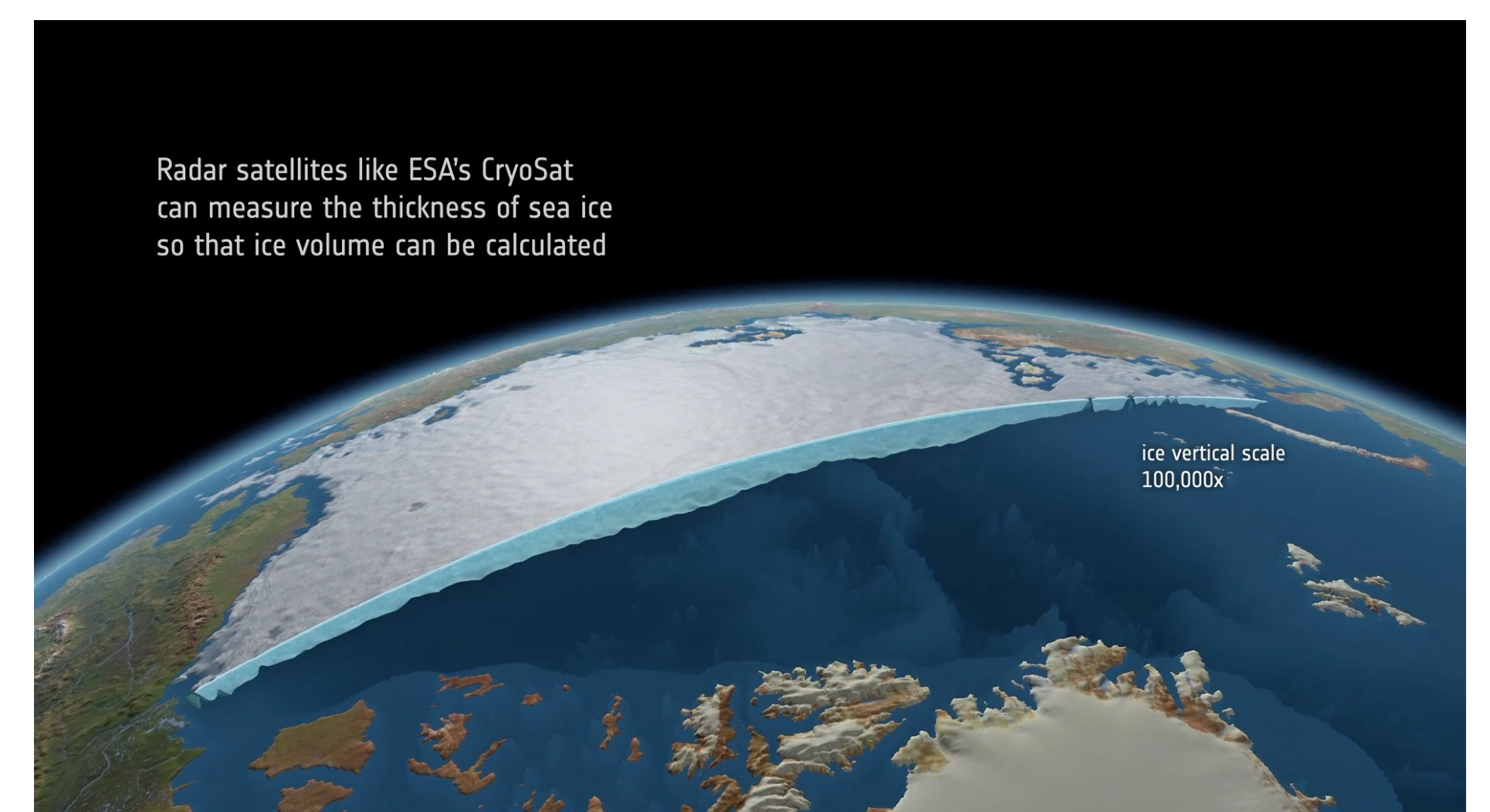
## Introduction

As part of a coordinated knowledge exchange activity, data visualisation techniques have been combined with computer graphics and engaging storytelling to communicate the work of ESA's Climate Change Initiative (CCI) to the public, policy makers and students. The CCI is developing 22 key datasets – essential climate variables (ECVs) – based on the best available Earth observation technologies, to help climate modelers understand changes to the Earth's climate. In the first phase of the project a prototype visualisation tool was developed for desktop computers and a digital book app was completed for iPad and Android tablets. In the current phase a web app has been developed to simplify deployment and update, and to reach a wider audience, the visualisation products have been tailored for use in formal education settings, and content has been translated from English to four other languages (French, German, Spanish, Dutch).

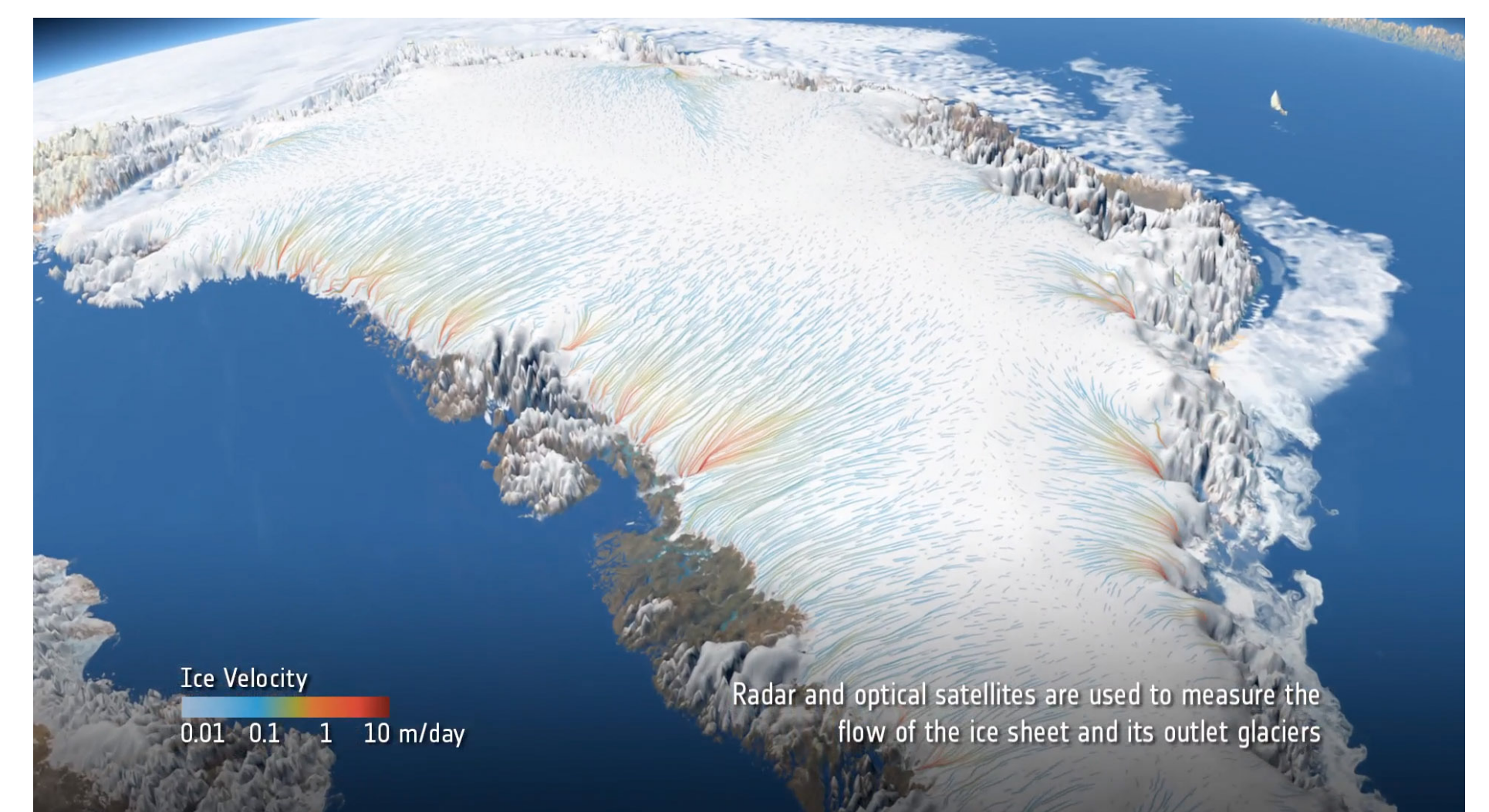
## Graphics and Animations

In addition to the interactive data visualisation in the app, a collection of 2D maps, 3D computer graphics and simple linear animations has been produced for each ECV, for use in print, on the web, in exhibitions and broadcast. Five complex 3-minute animations were produced from a shortlist of 10, adding to the 10 animations produced in the first phase of the project. In both the app and the animations care was taken to follow best practice for scientific data visualisation and science communication, including the use of intuitive and distinct colour schemes, and the consideration of colour-impaired viewers [3,4]. In the animations, the CCI's global climate data products were supplemented by computer graphic representations of microscopic processes, such as aerosols seeding cloud formation, and with conceptual illustrations of, for example, the carbon budget and the volume of ice Earth loses each year.

app, compared with 2 minutes typically expected for an interactive exhibit, game or video. Visitors indicated that they were interested and engaged, happy and self-assured with the application. The results indicate that *Climate from Space* could be of use in a science museum setting with some modifications (eg, less dense information).



Animation stills: sea ice thickness cross-section



Streamlines computed from Greenland Ice Sheet flow velocity data



Annual global ice loss represented as a 10km-high ice cube towering over central London

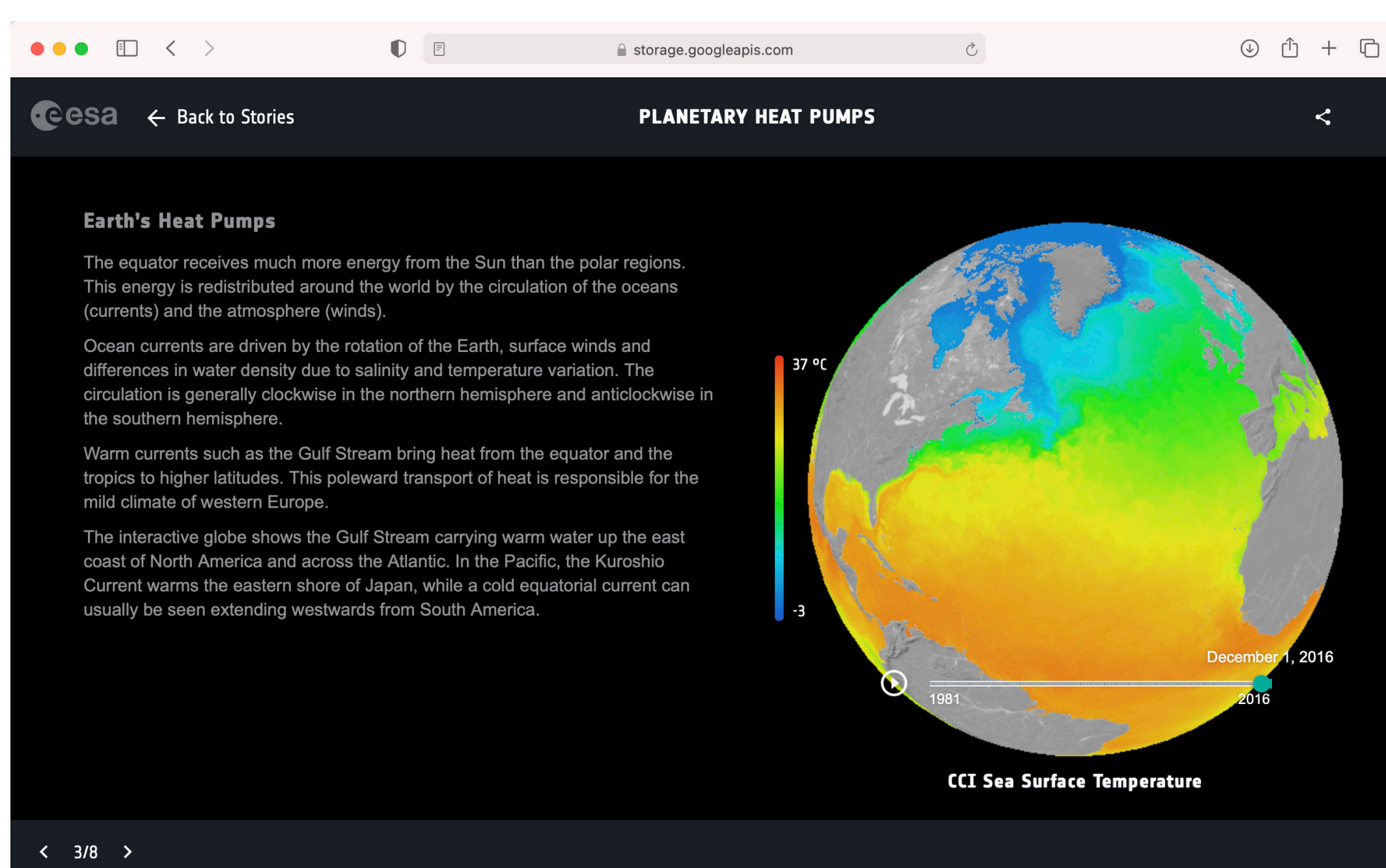
## Further Work

Future work in education will look at the development of presentation slide decks for each Education Resource Pack, more web content and climate news stories aimed at younger people. *Climate from Space* could benefit from tighter integration between the data viewer and the stories in the app, improving the quality of time sequence playback, and making the app, stories and graphics more suitable for use in the museum sector, including on custom display hardware such as touch-tables and spherical displays.

## References

- [1] Hollmann, R. et al (2013). The ESA Climate Change Initiative: Satellite Data Records for Essential Climate Variables, *Bull. American Meteorological Society* **94**, 1541-1552
- [2] Dahlstrom, M. F. (2014). Using Narratives and Storytelling to Communicate Science with Nonexpert Audiences, *Proc. National Academy of Sciences* **111** (Supplement 4) 13614-13620
- [3] Rogowitz, B. & Treinish, L.A. (1998). Data Visualization: the End of the Rainbow, *IEEE Spectrum* **35** (12), 52-59
- [4] Phipps, M. & Rowe, S. (2010). Seeing Satellite Data, *Public Understanding of Science* **19** (3) 311-321

Education Resource Packs have been developed for 10 climate topics at primary and secondary school levels and made available in 5 languages



Climate from Space app: the interactive data viewer shows a sea surface temperature time sequence on a virtual globe within a story

## Climate from Space App

*Climate from Space* is a web application for data visualisation and storytelling. It lets users explore 22 key measures of climate through space and time. Users can interact with over 40 years of change in global climate data on a 3D globe or 2D map, discovering for themselves patterns, relationships, climate events and trends. A library of engaging and richly illustrated stories puts the climate data into context. A narrative approach was taken [2], rooted in human experience, with the focus not so much on the data, but on telling "Earth system stories". The data are related to components of the Earth system, such as the carbon cycle and the water cycle, and to the challenges facing society due to climate change. *Climate from Space* can be accessed with any browser at [cfs.climate.esa.int](http://cfs.climate.esa.int). Since its launch, the app has received 44,702 unique page views, with an average visit duration of 7 min 14 sec for new visitors.



Presented at the  
ESA Living Planet Symposium,  
Bonn, 23-27 May 2022

Computer graphic rendering of a lab flask showing how much of the carbon budget is left for a global warming of 1.5°C above the pre-industrial era, from the animation 'Counting Carbon'

Land surface carbon flux from ESA's Regional Carbon Cycle Analysis and Processes project

## Education

The visualisation products have been tailored for use in formal educational settings. A curriculum analysis was conducted across 5 ESA member states, spanning education levels from primary to tertiary, and used to match the project's story and animation content to climate topics in the curricula. Ten stories were selected from 30 proposed for development as Education Resource Packs, with 4 at primary level and 6 at secondary level. These include lesson plans with links to the web app and animations, student worksheets and games. They have been downloaded 1,200 times up to April 2022, suggesting around 36,000 students have used them. At the tertiary level, a 2-week summer school was run in 2021 and a MOOC in 2022.

## Museums

ESA and the UK Space Agency have used the software and graphics products in their own exhibition spaces and in public events such as the annual UN climate summits. The *Climate from Space* software has also been exhibited in museum settings, at the Centre for Alternative Technology in Wales and at the Museon-Omniversum in The Hague, Netherlands. Here the app was evaluated, with visitors invited to complete questionnaires, while museum staff observed them navigating the app. Visitors spent between 3 and 15 minutes browsing the

