

developments at BoM

Justin Freeman

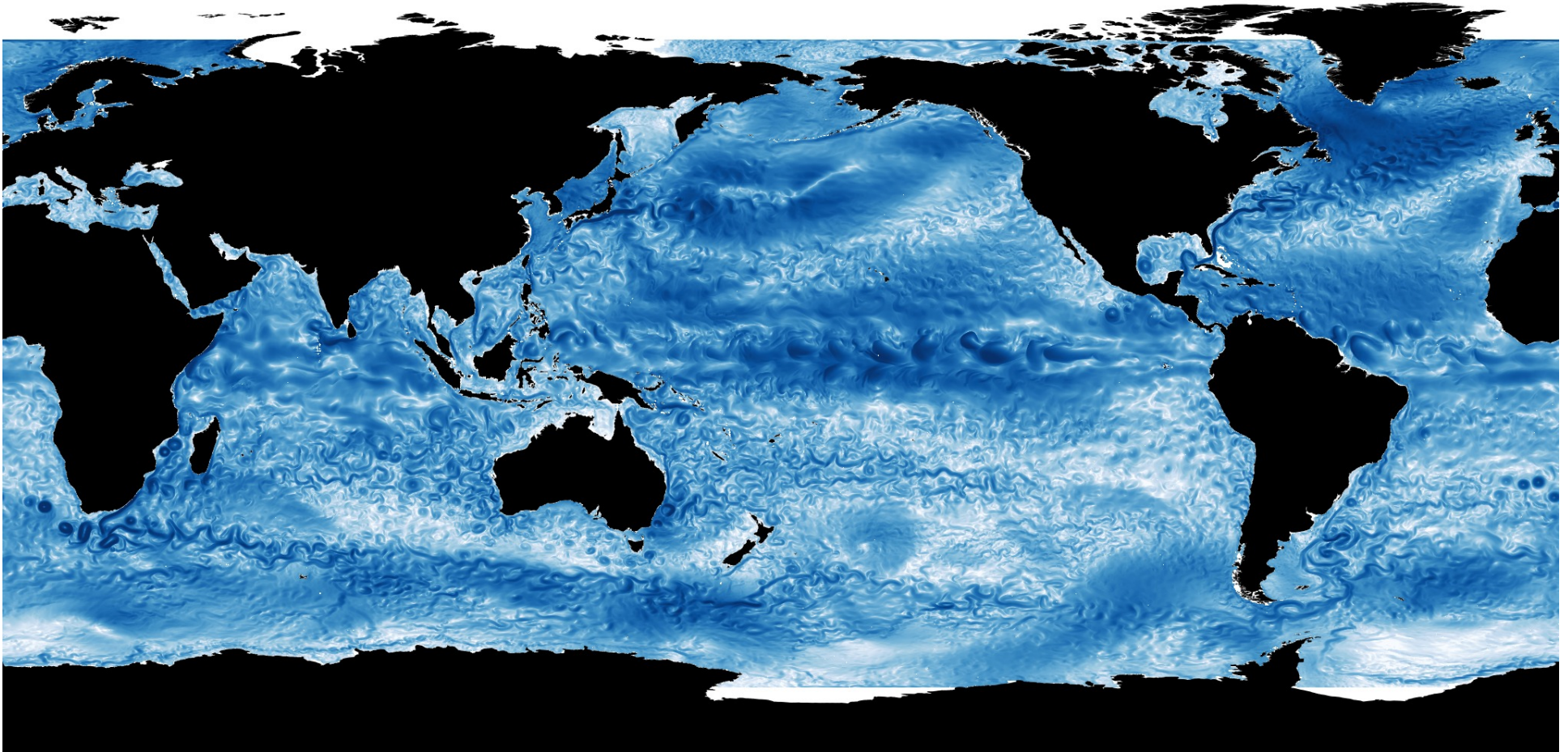
Mirko Velic

Stefan Zieger

Gary Brassington

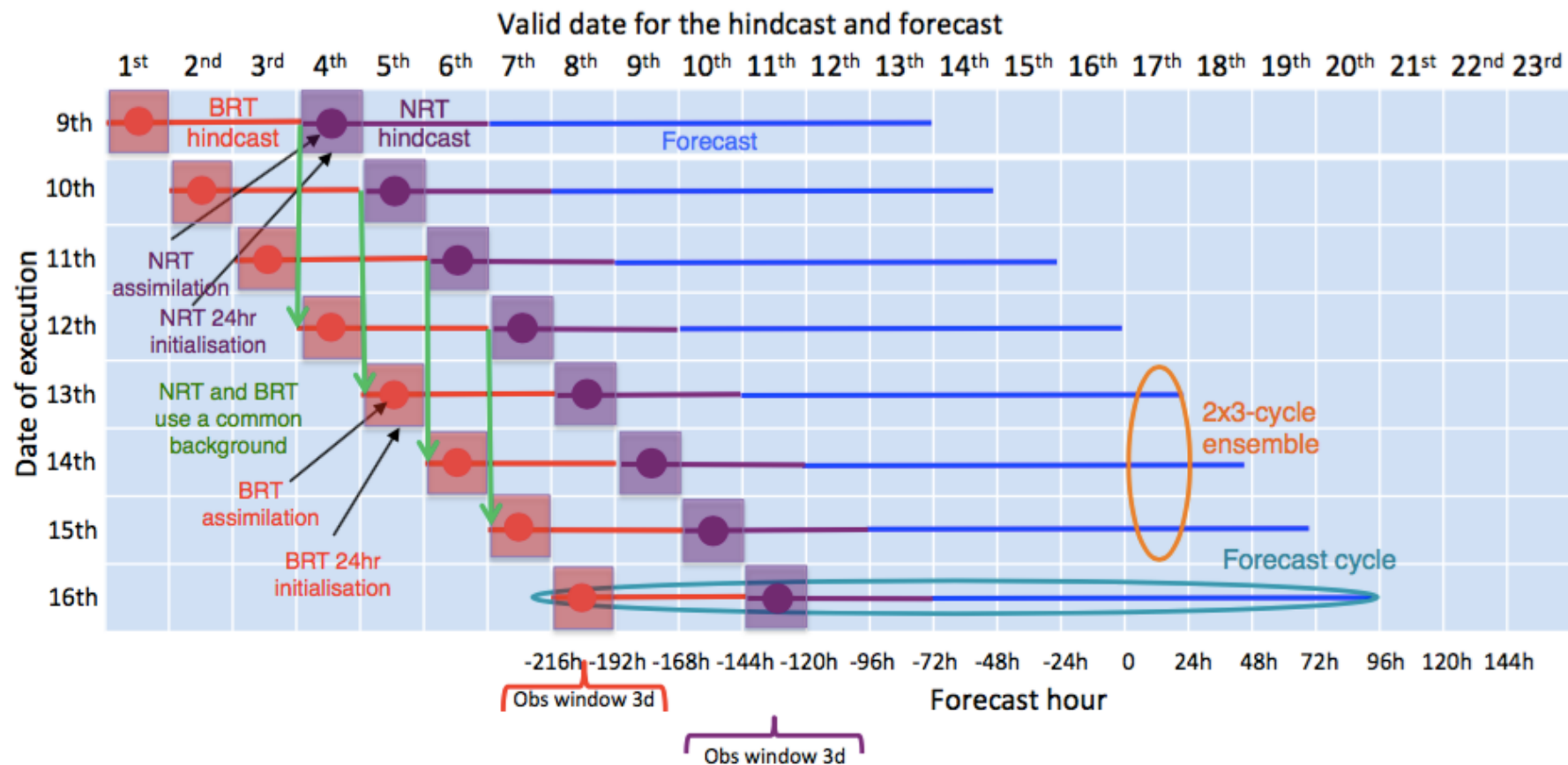
Prasanth Divakaran

2016 OceanMAPS 3.0



MOM4 + enkf-c
0.1° resolution -180° to 180°, -75° to 75°

Operational System



2017

OceanMAPS 3.1

MOM5

enkf-c

0.1° resolution -180° to 180°, -75° to 75°

6 member lagged ensemble (2 runs per day, 3 day cycle)

Alignment with reanalysis configuration

MOM5

reproduce current OceanMAPS 3.0 results

MOM4 OFAM configuration mapped to MOM5

Added OceanMAPS 3.0 initialisation code to MOM5

Perform analysis, near real time and forecast runs

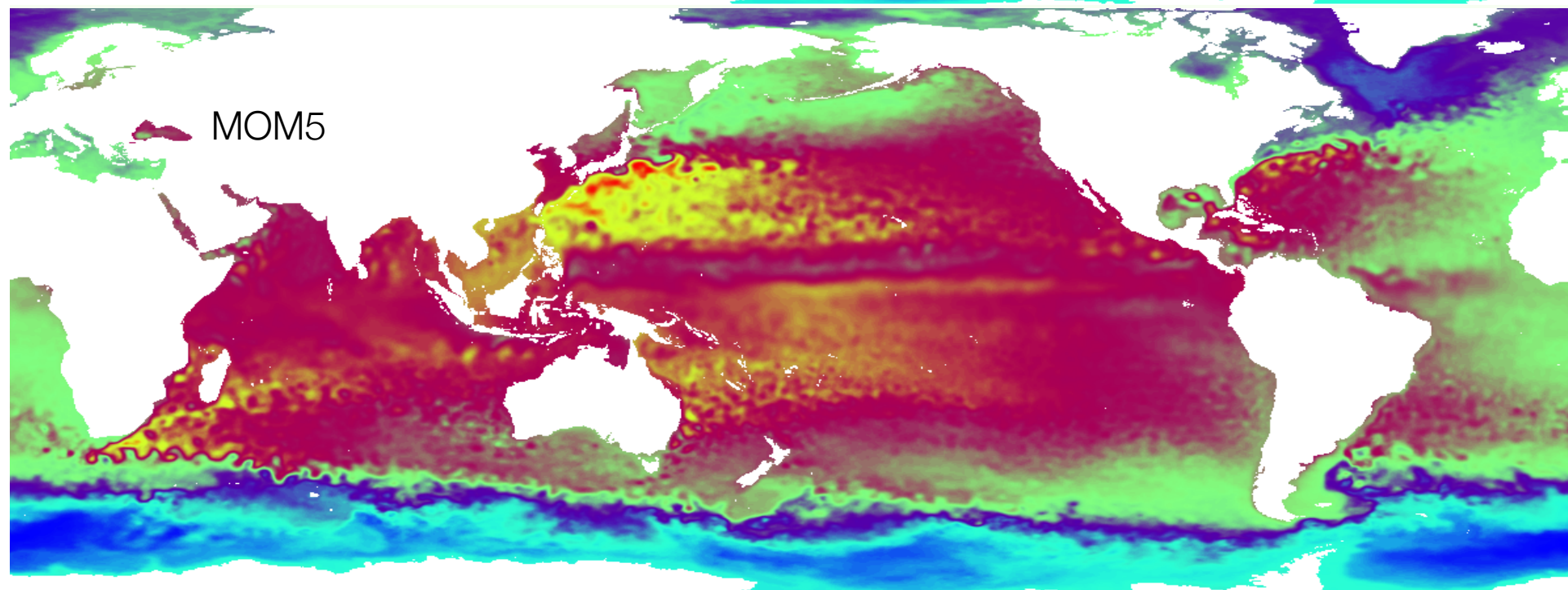
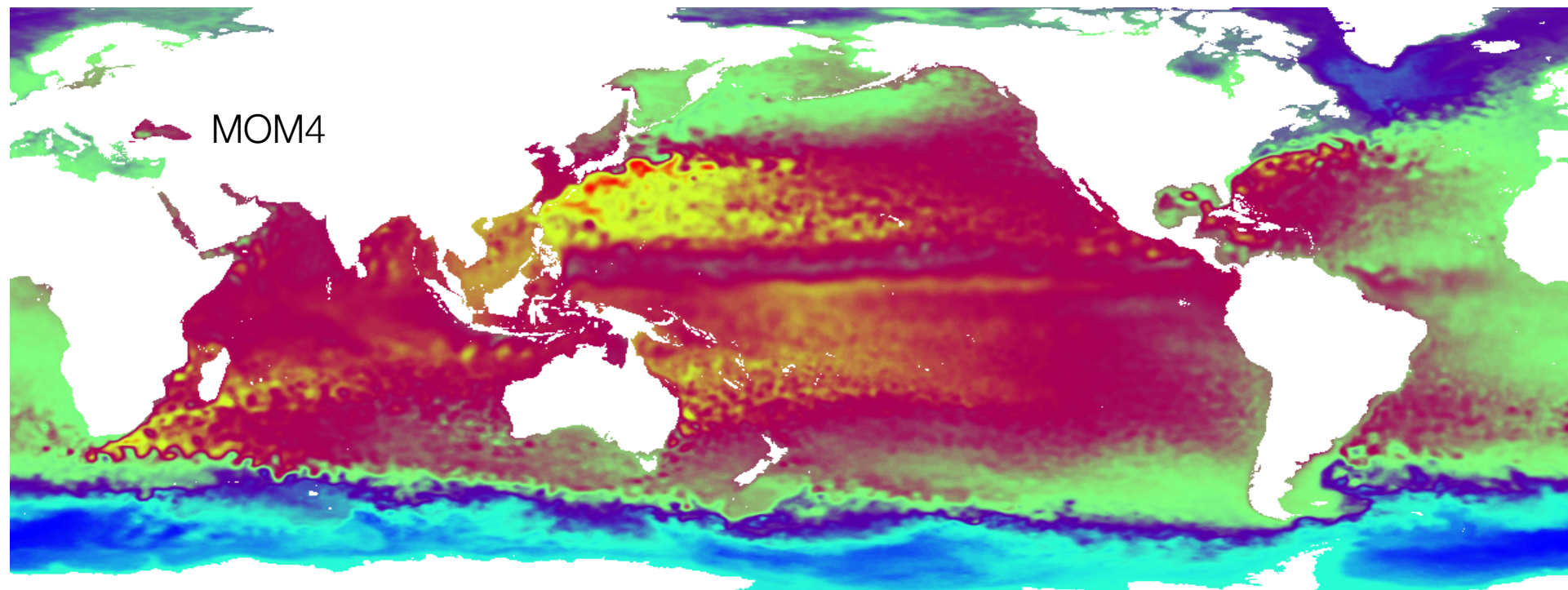
MOM5 vs MOM4 Evaluation Method

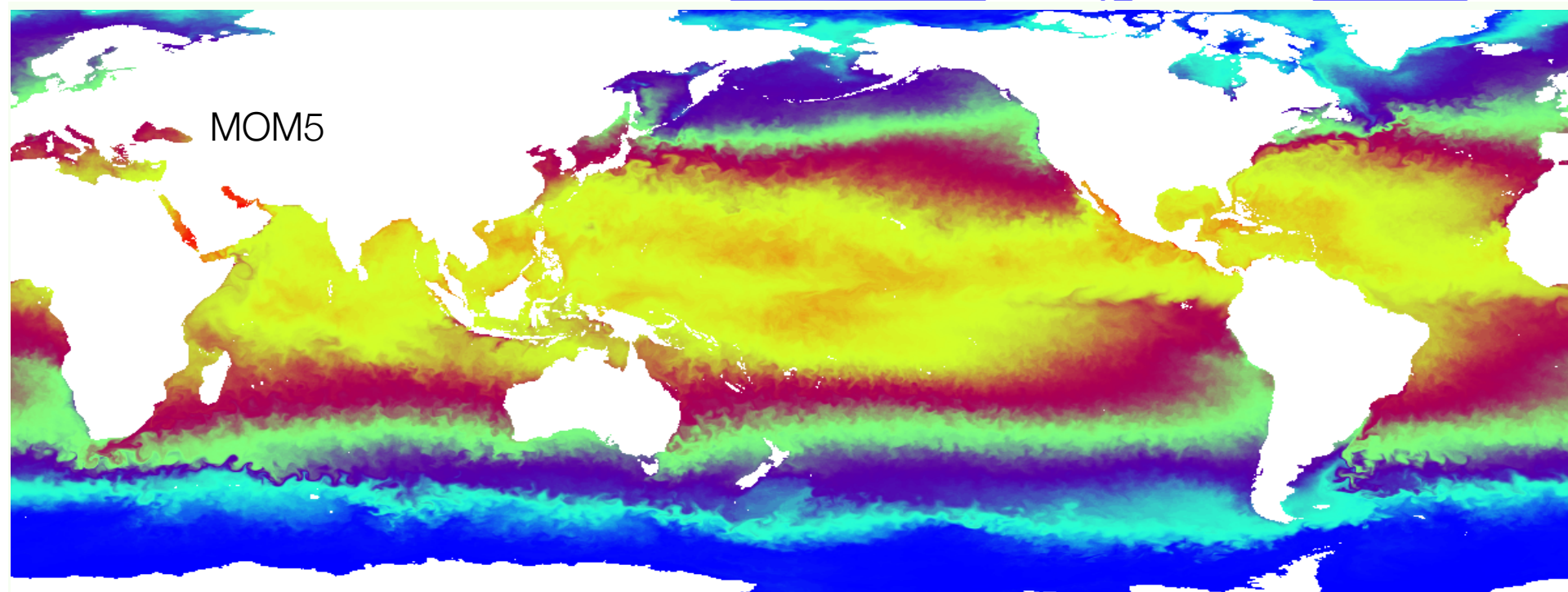
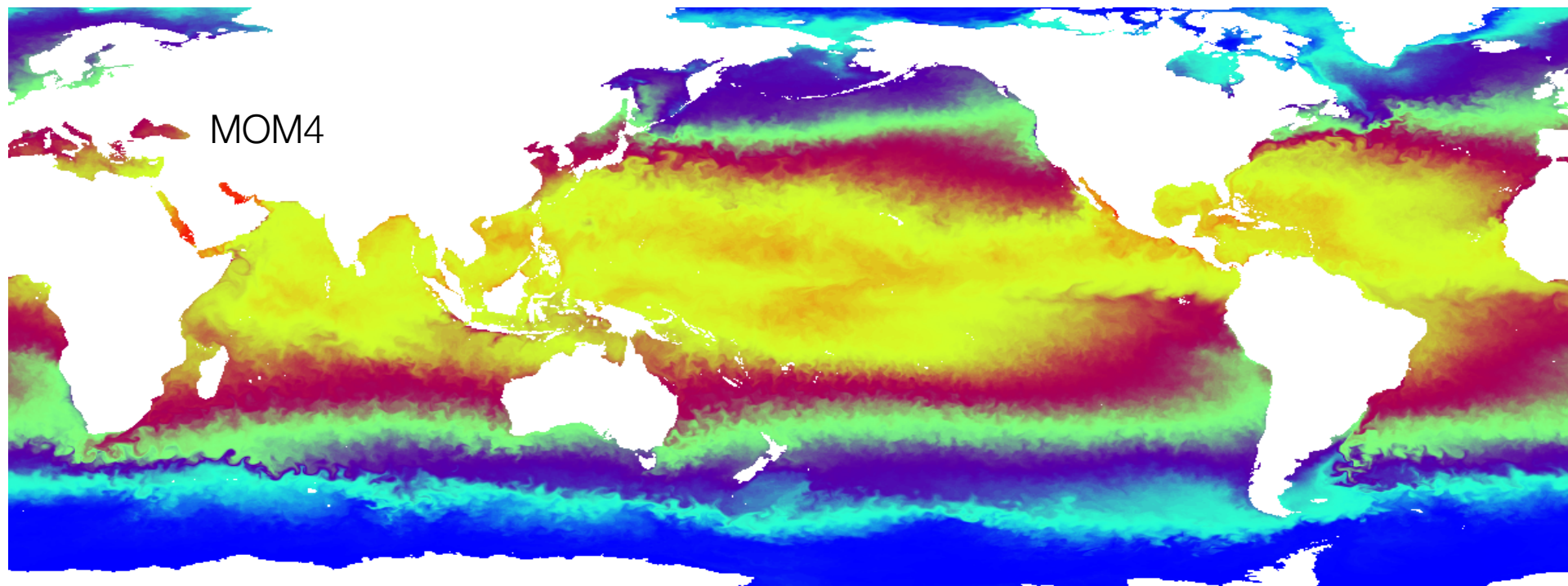
We employ a matrix factorisation method to quantitatively determine the similarity between model outputs

For a given field we determine a set of orthogonal basis functions and singular values

Comparison of the orthogonal basis functions for each model run provide a measure of similarity between the model outputs

We do not expect MOM4 and MOM5 to produce exactly the same result (or should we?)





2018/2019

OceanMAPS 4.0

MOM5 + CICE

enkf-c

Increase in ensemble member size (≥ 10)

2020/2021

OceanMAPS 5.0

MOM6/?

CICE/?

WaveWatch/?

Coupled Data Assimilation

AUSWAVE-G

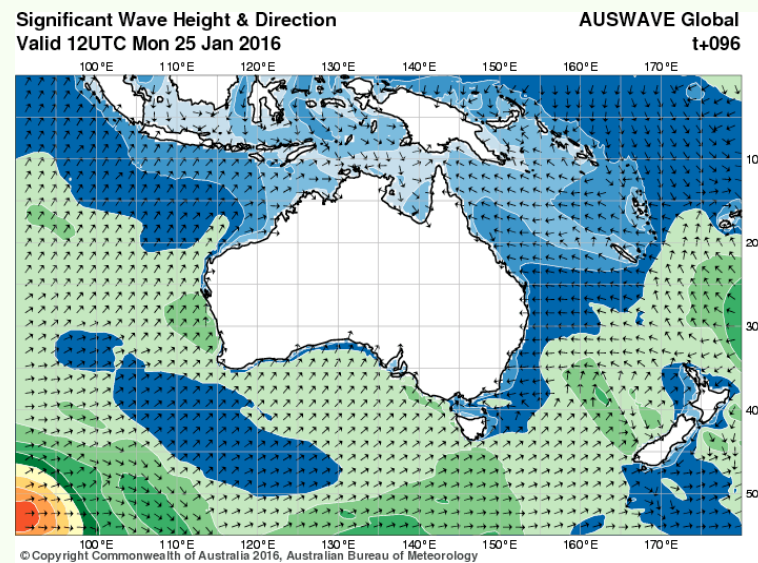
WAVEWATCH III (WW3) v4.18 (2016)

This included the use of a new physical spectral source term package (as used operational at NOAA/NCEP)

Forced by APS2 ACCESS-G surface winds

Spatial resolution 25 km

Forecast length 10 days



Uses sub-grid-scale blocking to resolve small features (i.e. islands, reefs, atolls)

Ice concentration constant for entire forecast period

Ice used as threshold to determine if a grid point is masked as 'land'

Sea Ice WW3

Various grid types (e.g. curvilinear, unstructured, spherical multiple cell)

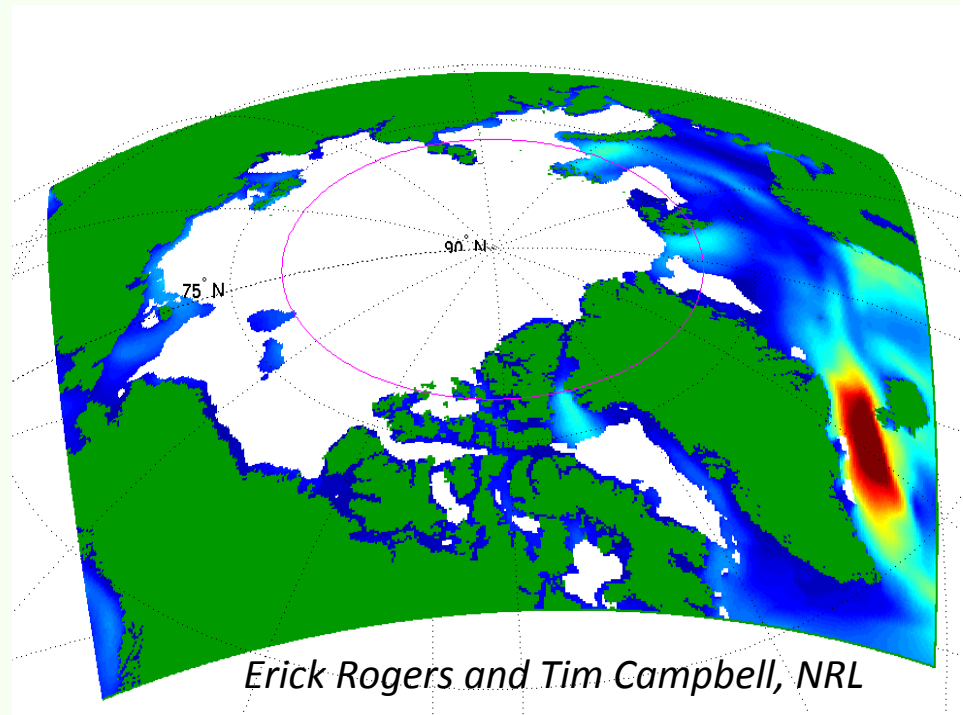
Interfaced with OASIS3-MCT to allow coupling with atmosphere and/or ocean models

Dynamical sub-grid-scale blocking to represent moving icebergs

Sea ice features (up-coming release):

- 4 wave dissipation options

- 2 wave scattering options



Analysis Systems

- <http://130.56.244.252/>
- Web Data Service, Hosted at NCI
- <http://godaie.bom.gov.au:8080/thredds>
- OPeNDAP server, Hosted at BoM

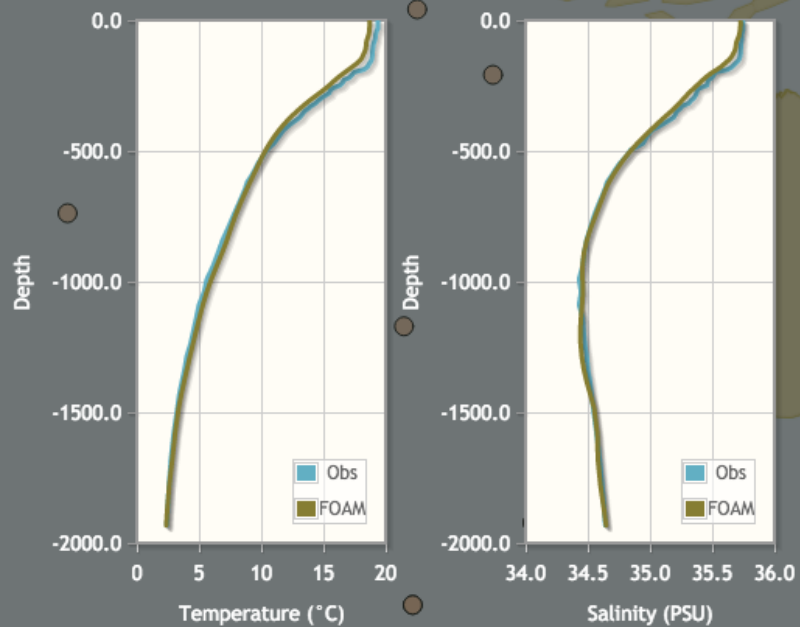
< 20/05/2016 >

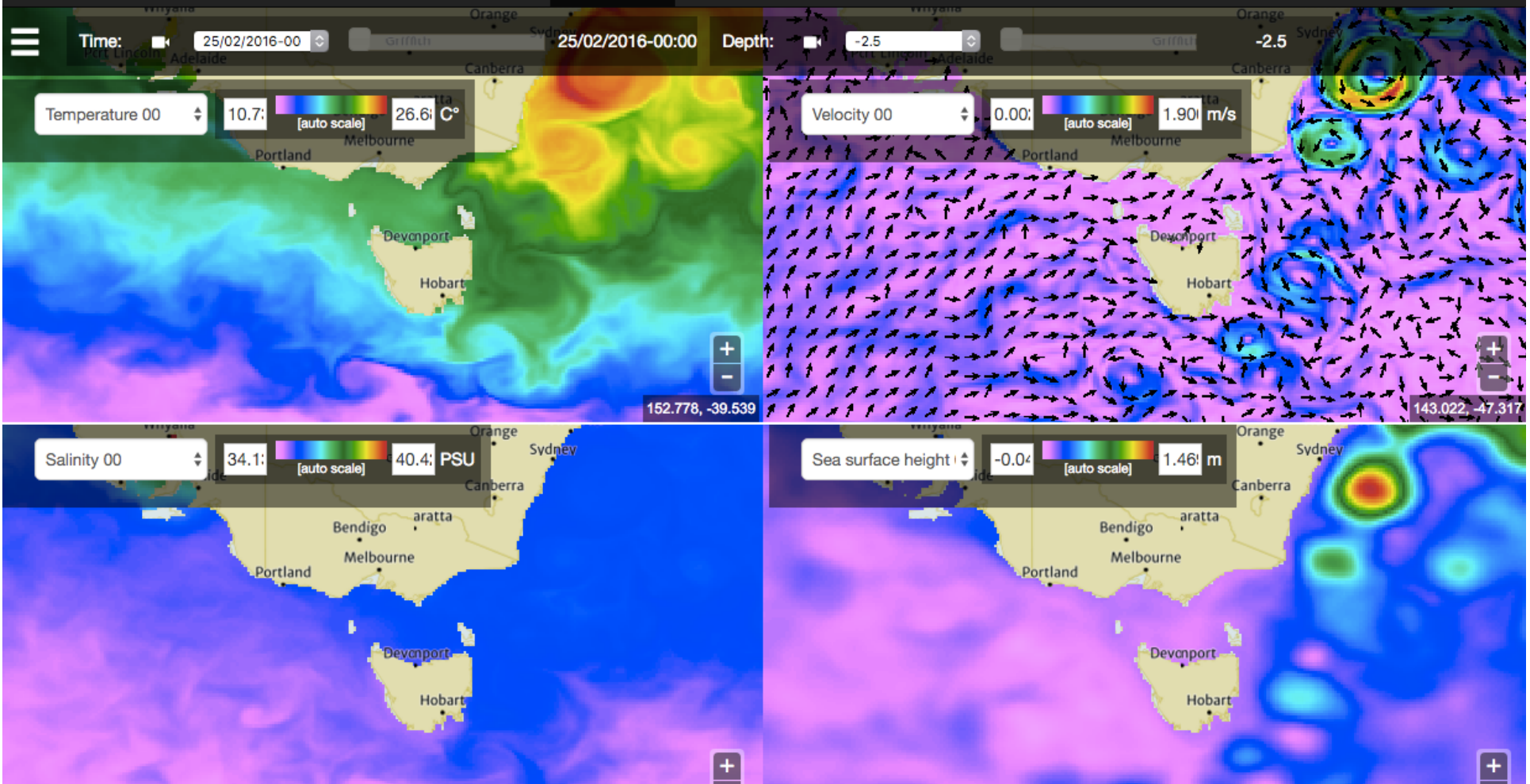
Select region

Point:

Profile

Latitude: -40.729, Longitude: 150.865, ID: 5903934





← → ↻ opendap.bom.gov.au:8080/thredds/catalog/oceanmaps_an_datasets/catalog.html



Catalog http://opendap.bom.gov.au:8080/thredds/catalog/oceanmaps_an_datasets/catalog.html

Dataset	Size	Last Modified
 OceanMAPS analysis datasets		--
 version_1.0/		--
 version_1.0a/		--
 version_1.0b/		--
 version_1.1/		--
 version_2.0/		--
 version_2.1/		--
 version_2.2/		--
 version_2.2.1/		--
 version_3.0/		--

TDS Research Data service at Australian Bureau of Meteorology
THREDDS Data Server [Version 4.2.8 - 20110727.2340] [Documentation](#)

web visualisation service

justin freeman

duan beckett

opengl

custom API + glsl support

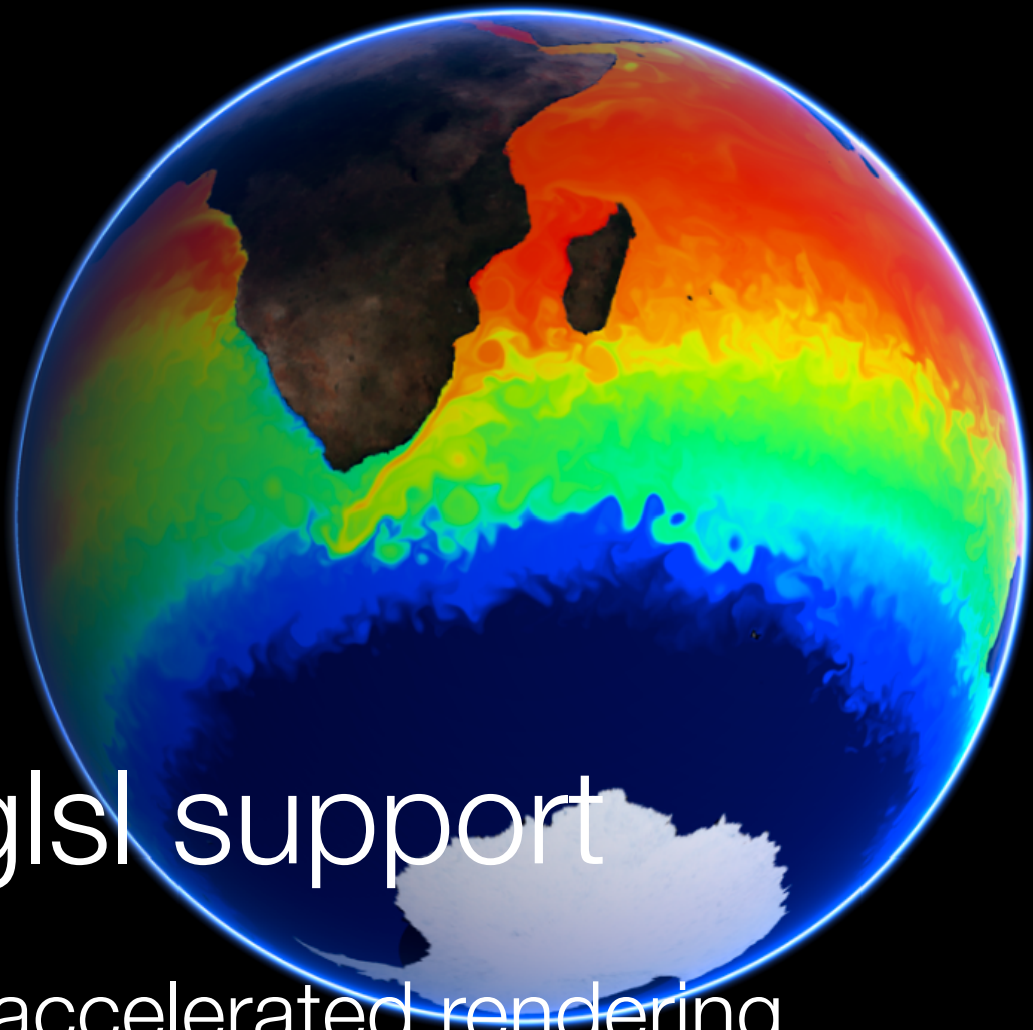
multiple frame buffer objects

windowless, hardware accelerated rendering

real time **H.264** encoding

threaded texture manager

high resolution output (8000x4000 and beyond)



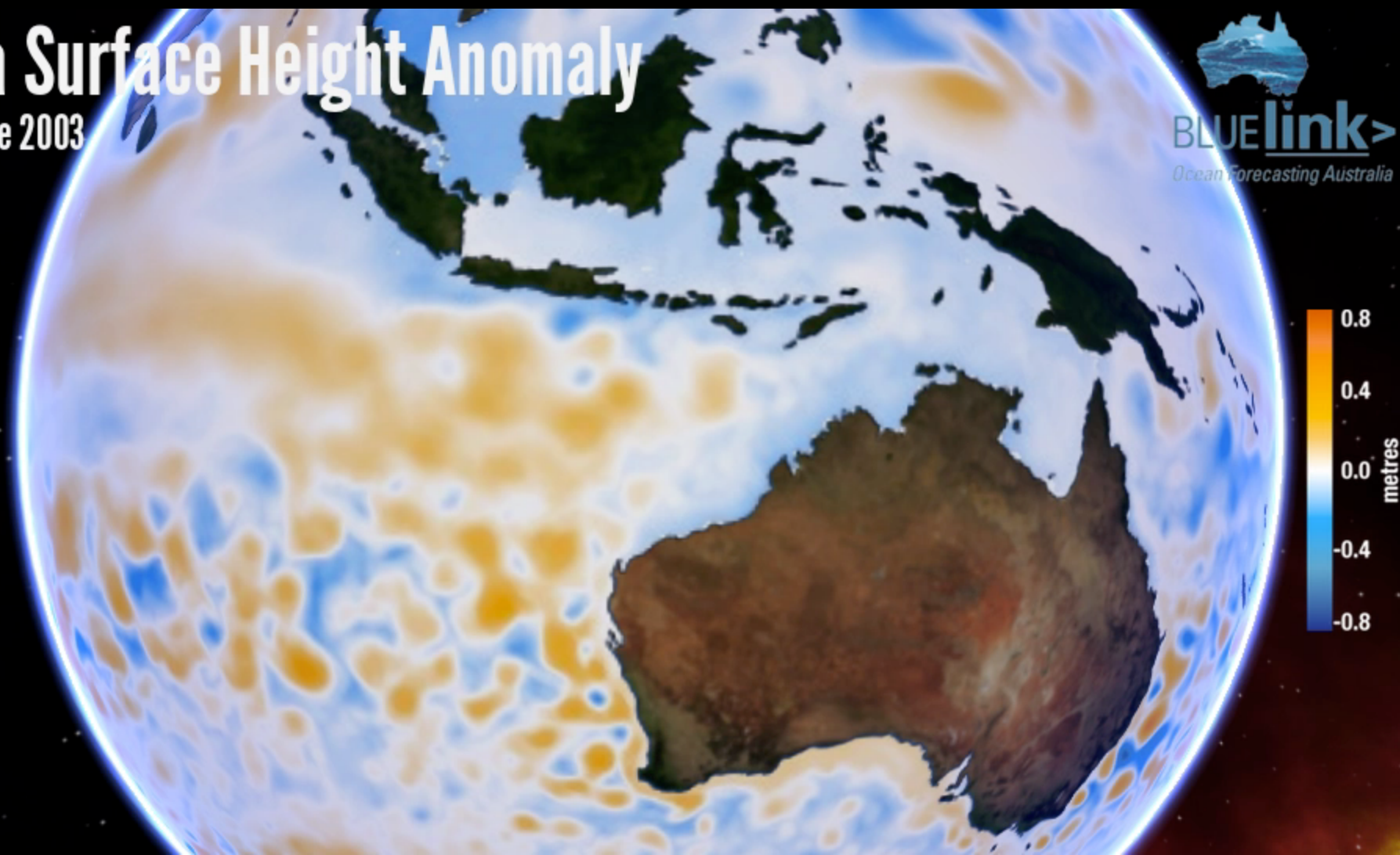
Sea Surface Height Anomaly

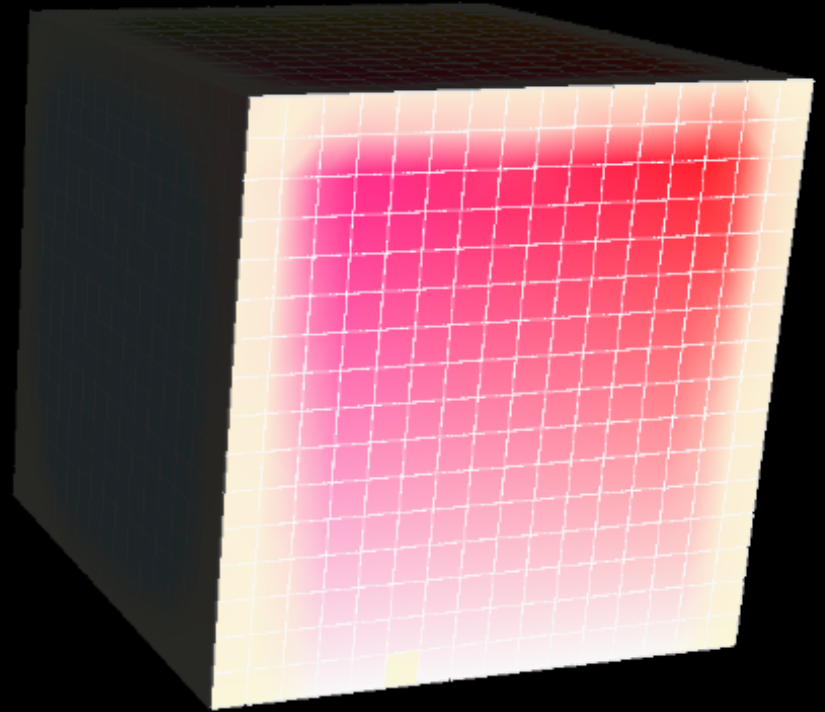
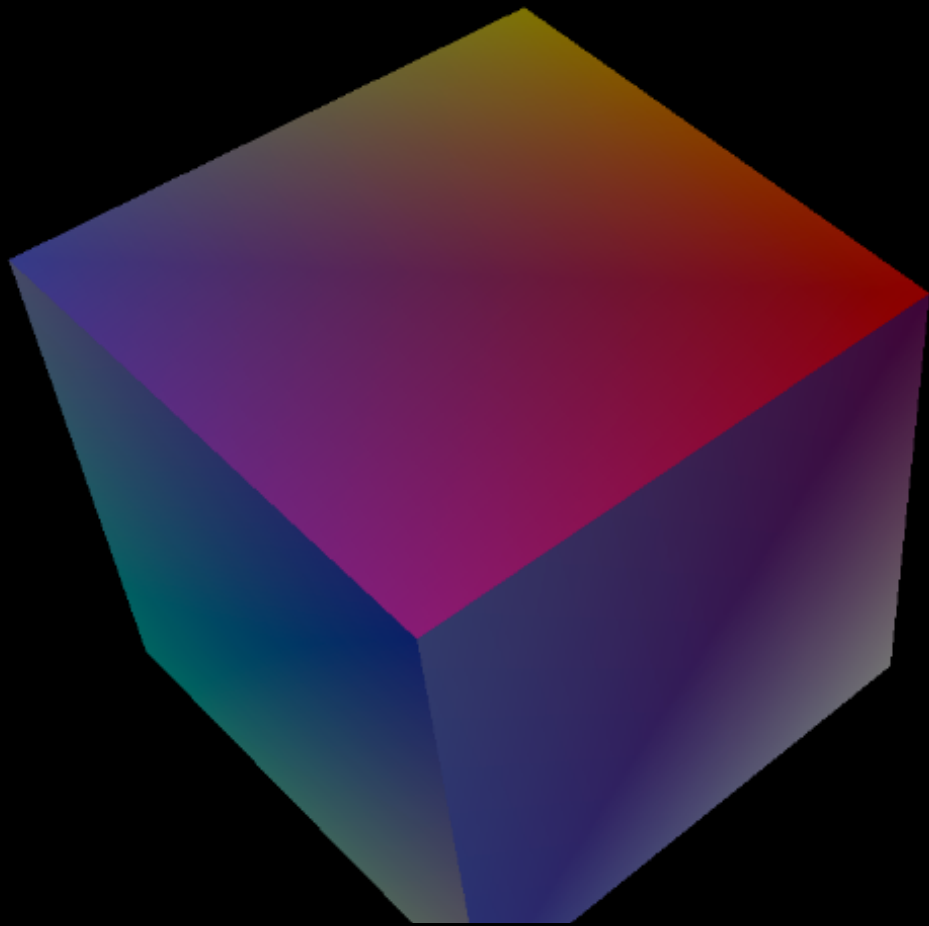
30 June 2003



BLUElink>

Ocean Forecasting Australia





webgl

javascript API for 3D and 2D graphics
provides hardware accelerated 3D in compatible browsers
OpenGL ES 2.0

```
scene = new THREE.Scene();  
camera = new THREE.PerspectiveCamera(45, window.innerWidth / window.innerHeight, 0.1, 1000);  
  
renderer = new THREE.WebGLRenderer({antialias: true});  
renderer.setSize(window.innerWidth, window.innerHeight);  
renderer.setClearColorHex(0x000000, 1);  
renderer.sortObjects = false;
```

threejs.org

javascript library for 3D

supports HTML5 canvas, SVG and webgl

threejs.org

visualization service

implement a webgl UI

+cross platform

+cross browser

fast opengl rendering on web server

high quality output

engagement with large data products

enable creativity and *encourage* exploration



flight

jillong.bom.gov.au/flight



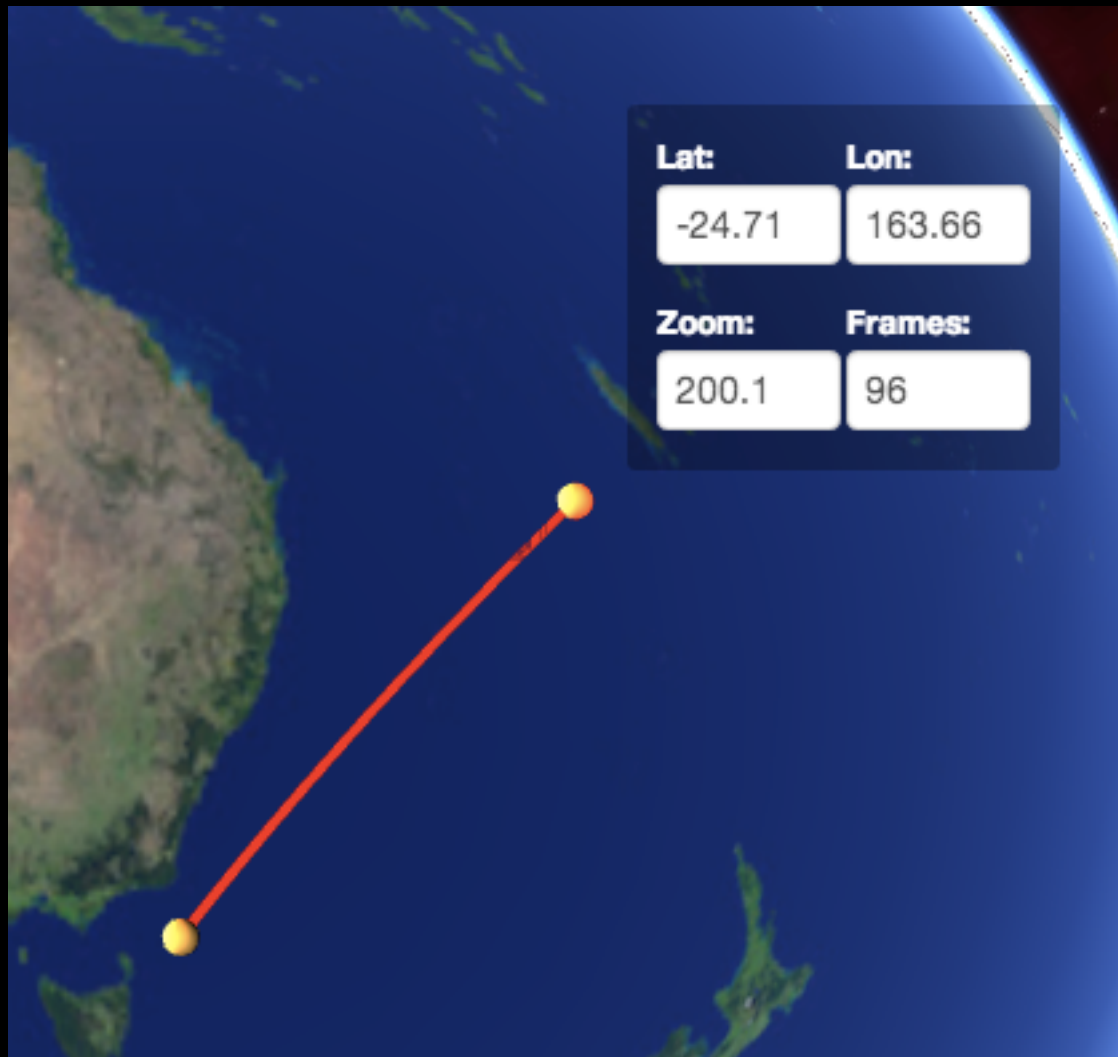
user interface



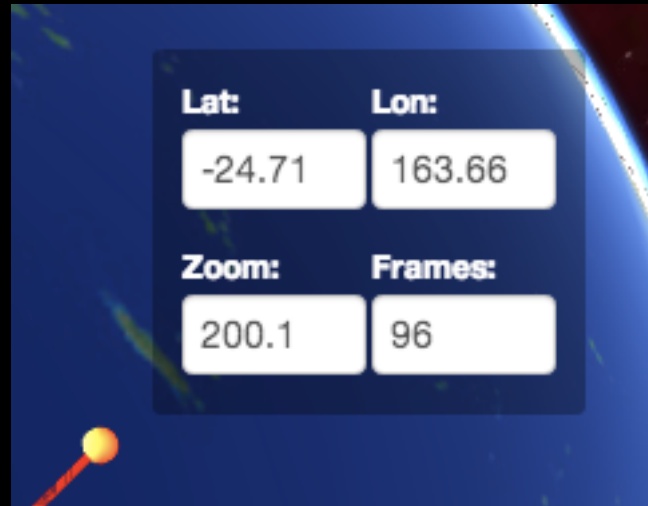
double click to add a control point



right click to delete a control point



select and drag a control point



double click a control point to edit properties



preview camera flight path in the browser

Flight details

[reset]

Select parameter

✓ Please Select

OFAM 3

Sea surface temperature

Sea surface salinity

Sea surface temperature anomaly

Sea surface salinity anomaly

Sea surface velocity

Sea surface height anomaly

Create

select field

select date

Flight details [reset]

Select parameter:

Please Select

Start date:

01/01/2000

◀ Jan ▶ 2000 ▶

Su	Mo	Tu	We	Th	Fr	Sa
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

Done

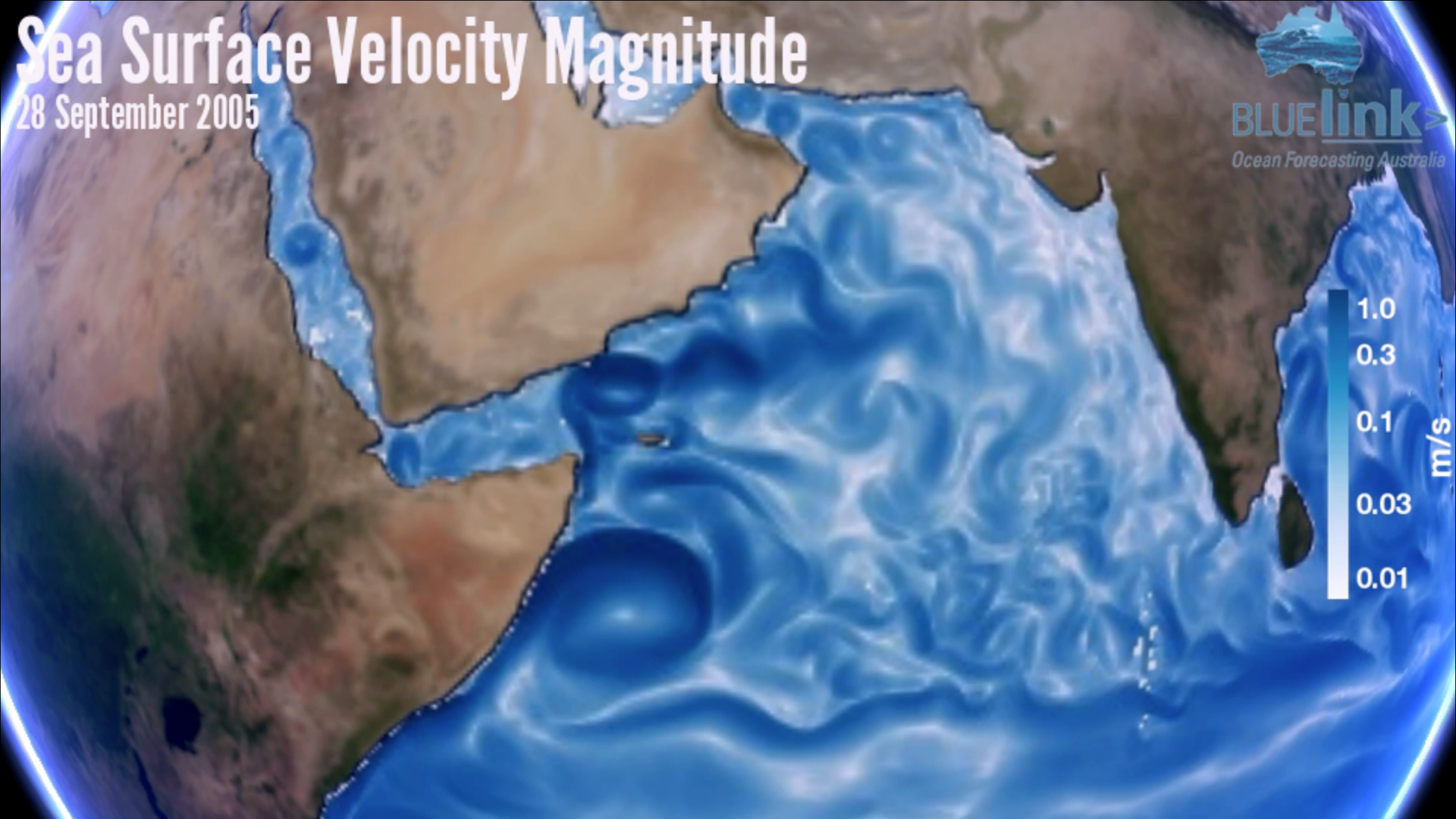
Movie created



Play movie

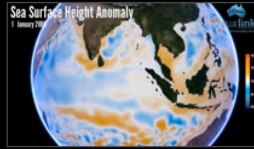
Close

create



+titles +logos +colorbars

GALLERY



Sea surface height anomaly

From 01/01/2000 to 24/09/2004
 Filesize: 67.8MB, Length: 01:12
 Last modified: 07/06/2013 01:37

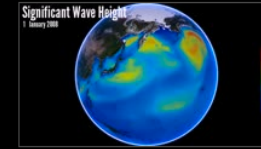
[Download »](#) [▶](#) [🔗](#) [📄](#) [🗑️](#)



Sea surface salinity

From 01/01/2000 to 08/11/2000
 Filesize: 12.2MB, Length: 00:13
 Last modified: 04/06/2013 02:20

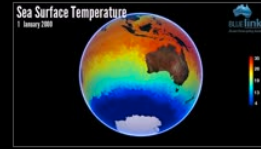
[Download »](#) [▶](#) [🔗](#) [📄](#) [🗑️](#)



Significant wave height

From 01/01/2008 to 12/05/2015
 Filesize: 93.5MB, Length: 01:52
 Last modified: 03/06/2013 10:58

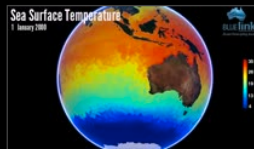
[Download »](#) [▶](#) [🔗](#) [📄](#) [🗑️](#)



Sea surface temperature

From 01/01/2000 to 11/01/2000
 Filesize: 362.3KB, Length: 00:00
 Last modified: 03/06/2013 04:54

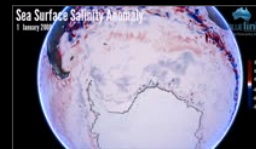
[Download »](#) [▶](#) [🔗](#) [📄](#) [🗑️](#)



Sea surface temperature

From 01/01/2000 to 06/04/2000
 Filesize: 3.8MB, Length: 00:04
 Last modified: 03/06/2013 04:50

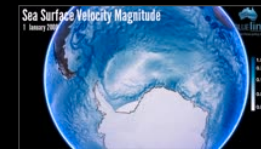
[Download »](#) [▶](#) [🔗](#) [📄](#) [🗑️](#)



Sea surface salinity anomaly

From 01/01/2000 to 31/12/2010
 Filesize: 162.2MB, Length: 02:47
 Last modified: 03/06/2013 04:32

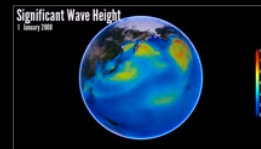
[Download »](#) [▶](#) [🔗](#) [📄](#) [🗑️](#)



Sea surface velocity

From 01/01/2000 to 31/12/2010
 Filesize: 162.2MB, Length: 02:47
 Last modified: 03/06/2013 04:12

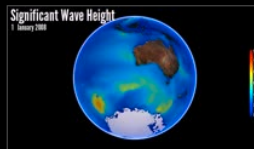
[Download »](#) [▶](#) [🔗](#) [📄](#) [🗑️](#)



Significant wave height

From 01/01/2008 to 17/01/2014
 Filesize: 79.9MB, Length: 01:32
 Last modified: 02/06/2013 11:25

[Download »](#) [▶](#) [🔗](#) [📄](#) [🗑️](#)



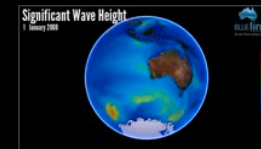
Significant wave height

From 01/01/2008 to 11/07/2008
 Filesize: 6.6MB, Length: 00:08
 Last modified: 02/06/2013 11:01



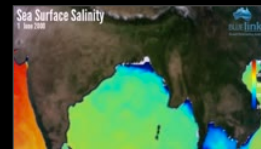
Sea surface salinity anomaly

From 01/01/2008 to 29/08/2009
 Filesize: 22.8MB, Length: 00:25
 Last modified: 02/06/2013 01:02



Significant wave height

From 01/01/2008 to 14/05/2010
 Filesize: 26.2MB, Length: 00:36
 Last modified: 31/05/2013 02:35



Sea surface salinity

From 01/06/2000 to 05/09/2000
 Filesize: 1.9MB, Length: 00:04
 Last modified: 28/05/2013 09:22



play, edit, copy and delete from the gallery

development

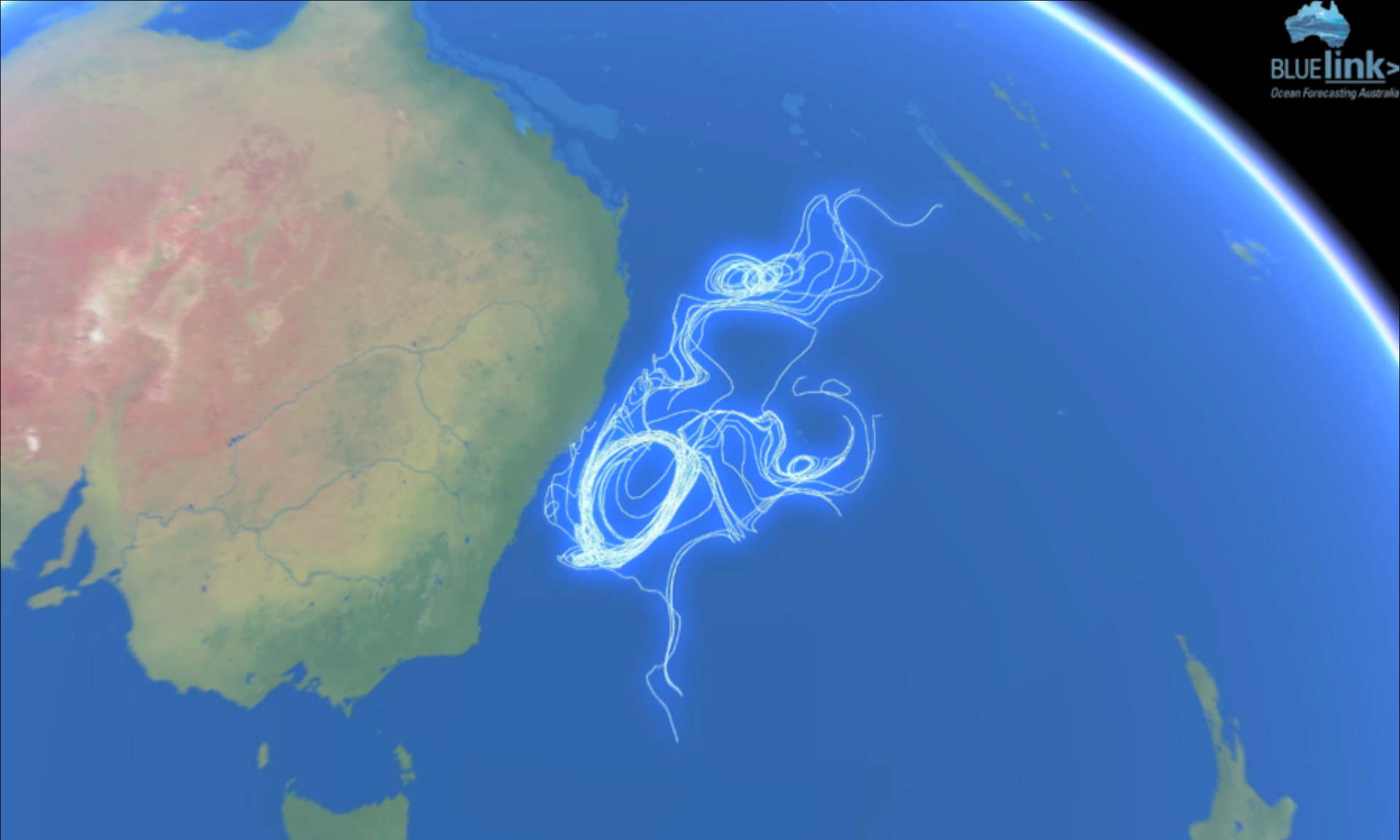
- + data sets

- + renderers

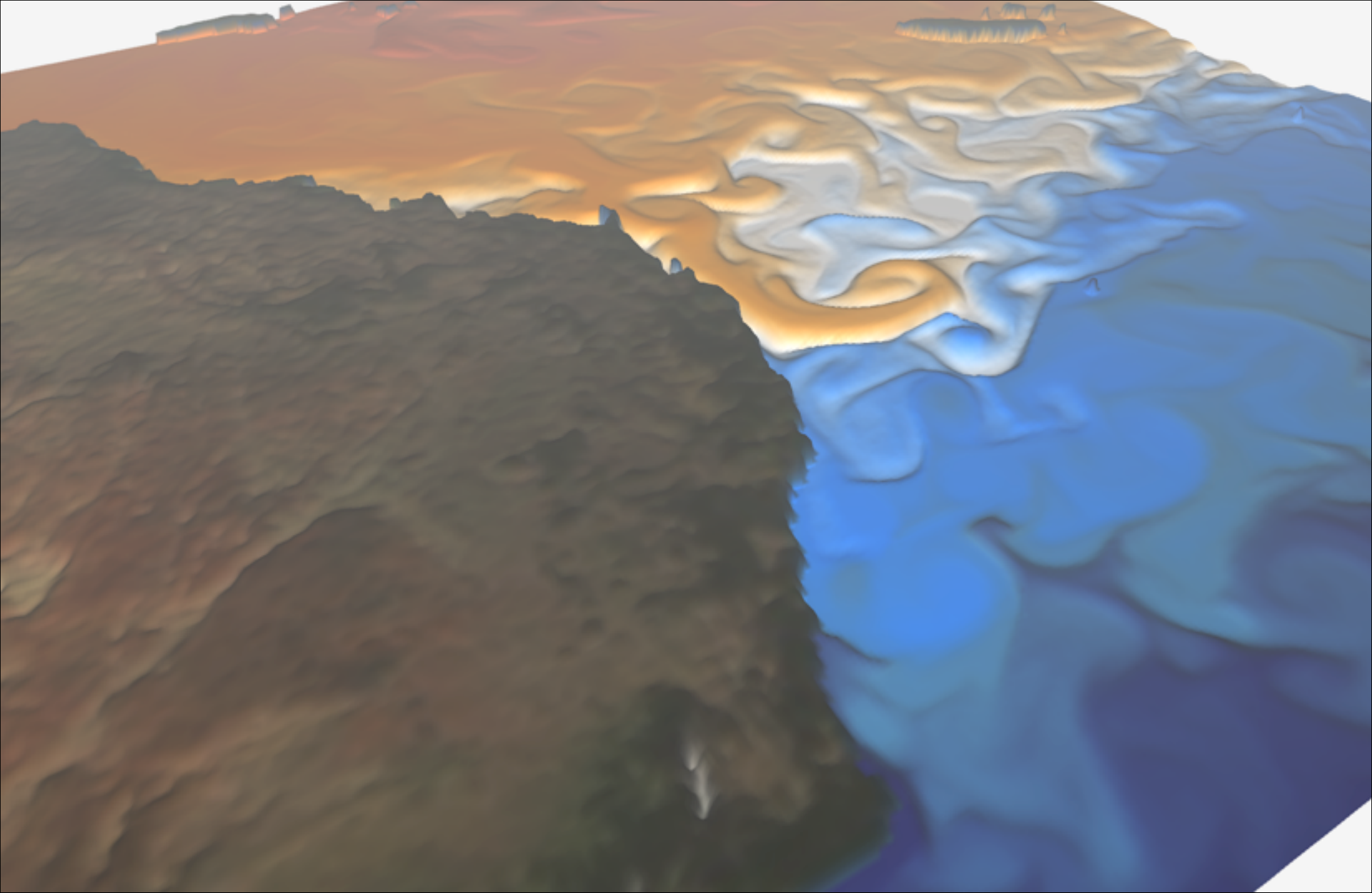
server side processing

improve UI

demo

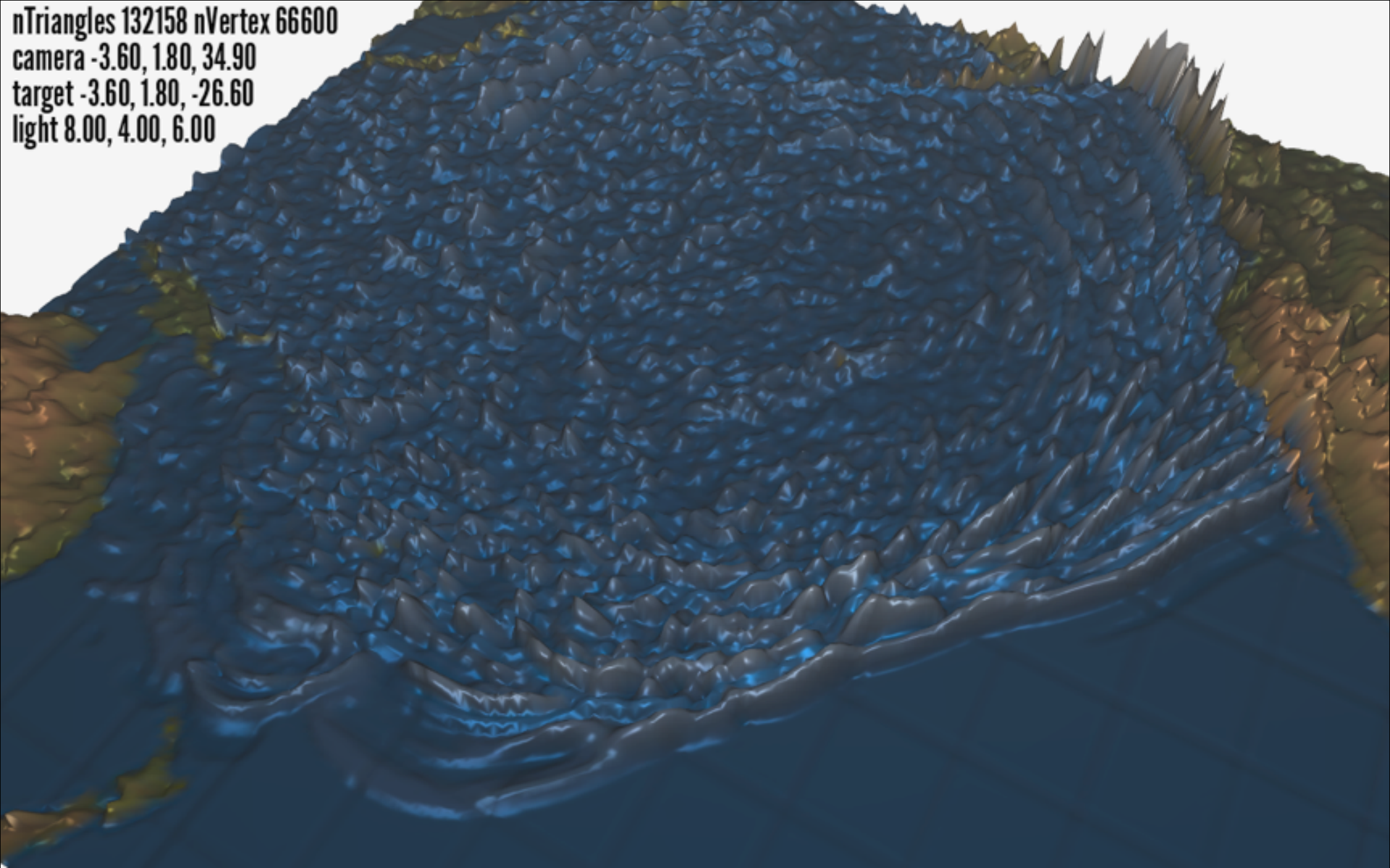


advection



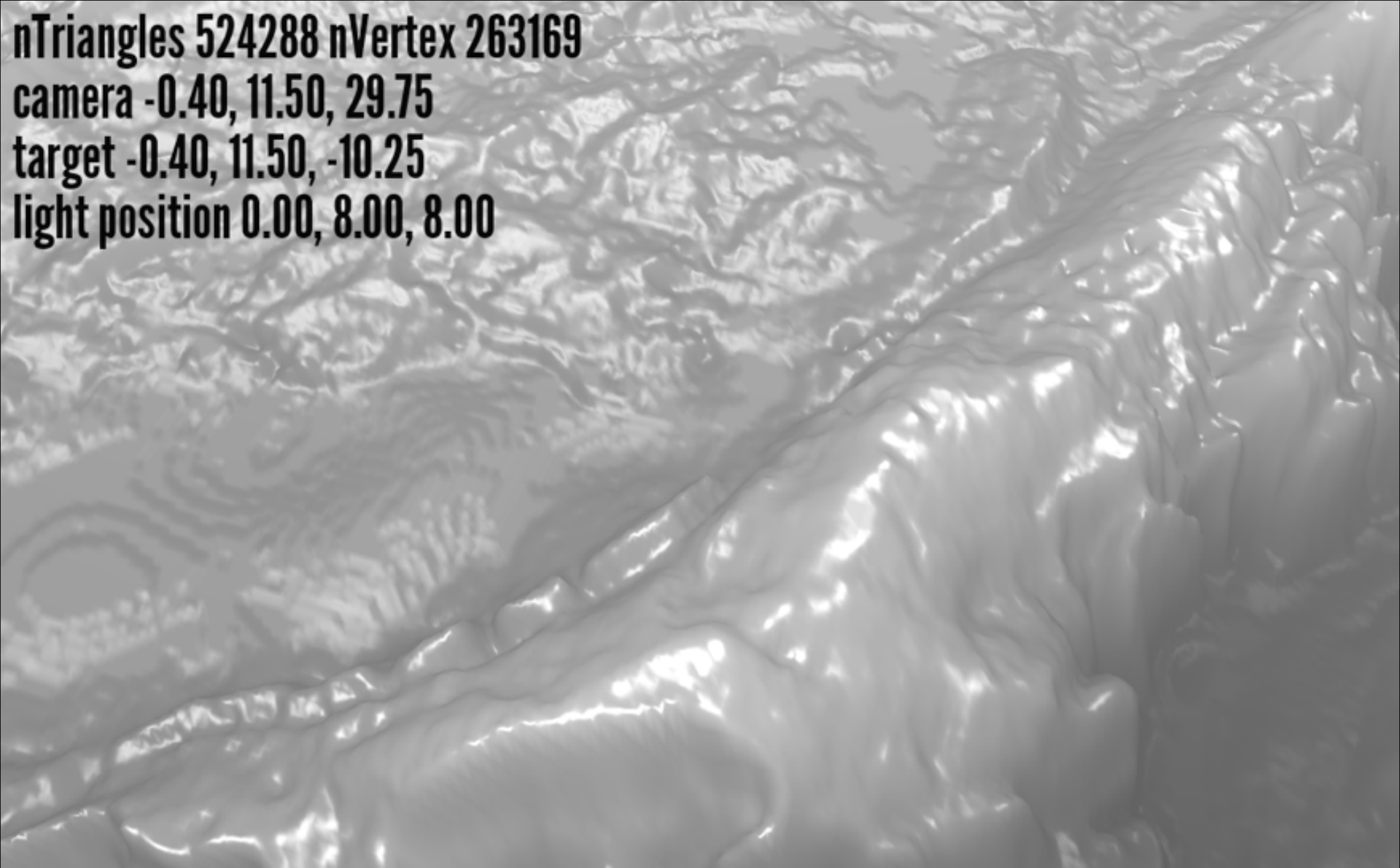
regional

nTriangles 132158 nVertex 66600
camera -3.60, 1.80, 34.90
target -3.60, 1.80, -26.60
light 8.00, 4.00, 6.00



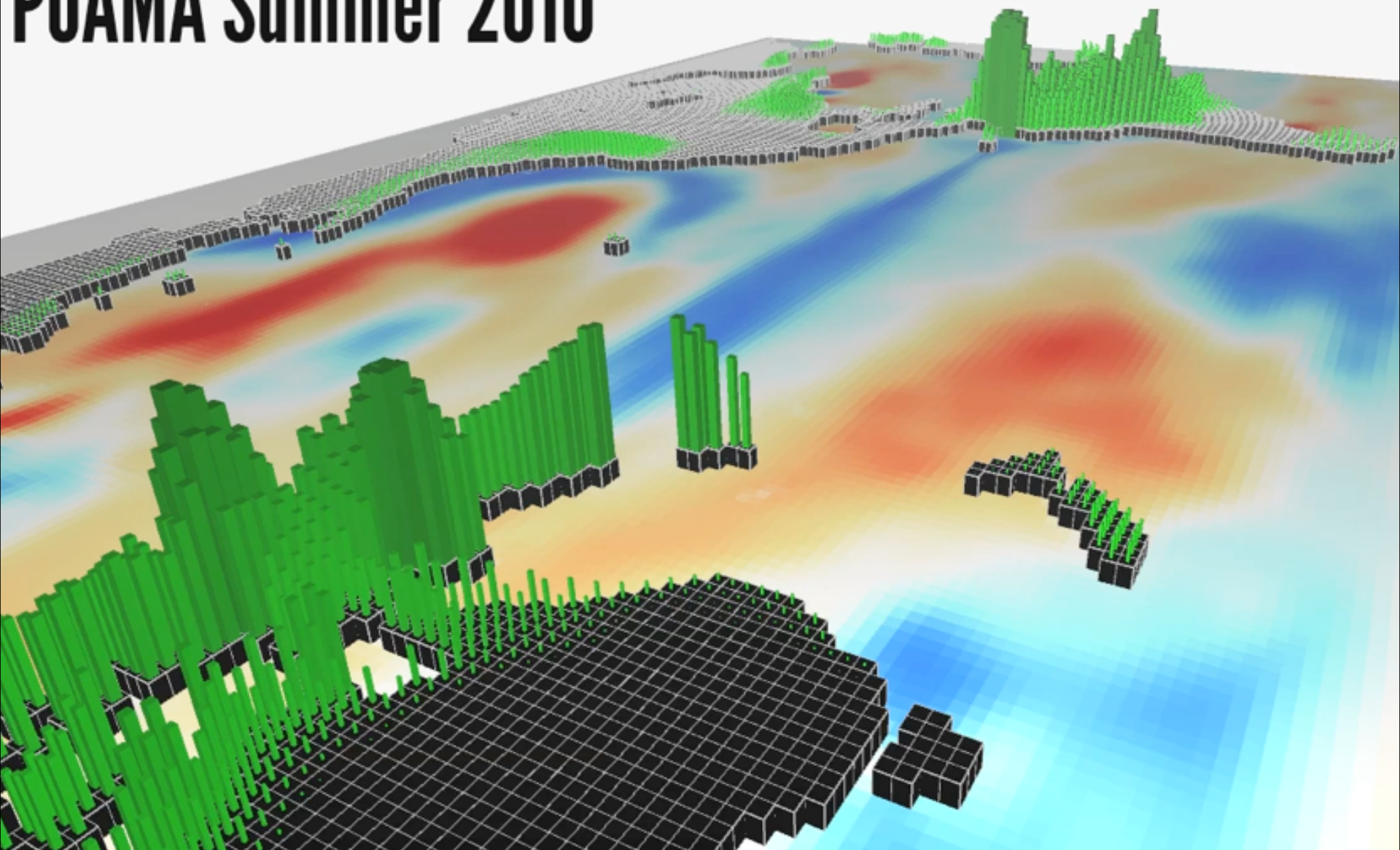
tsunami

nTriangles 524288 nVertex 263169
camera -0.40, 11.50, 29.75
target -0.40, 11.50, -10.25
light position 0.00, 8.00, 8.00

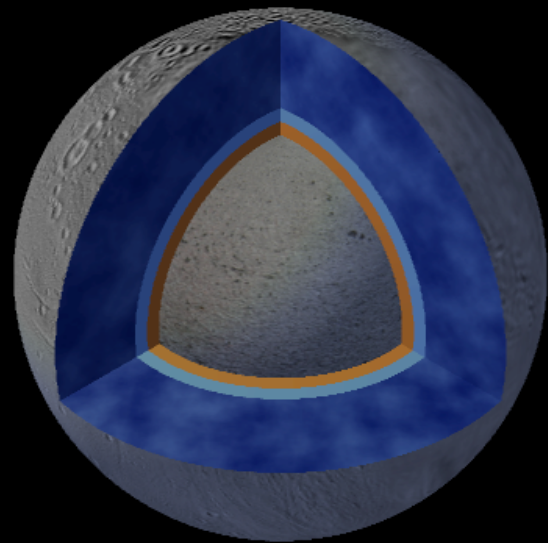
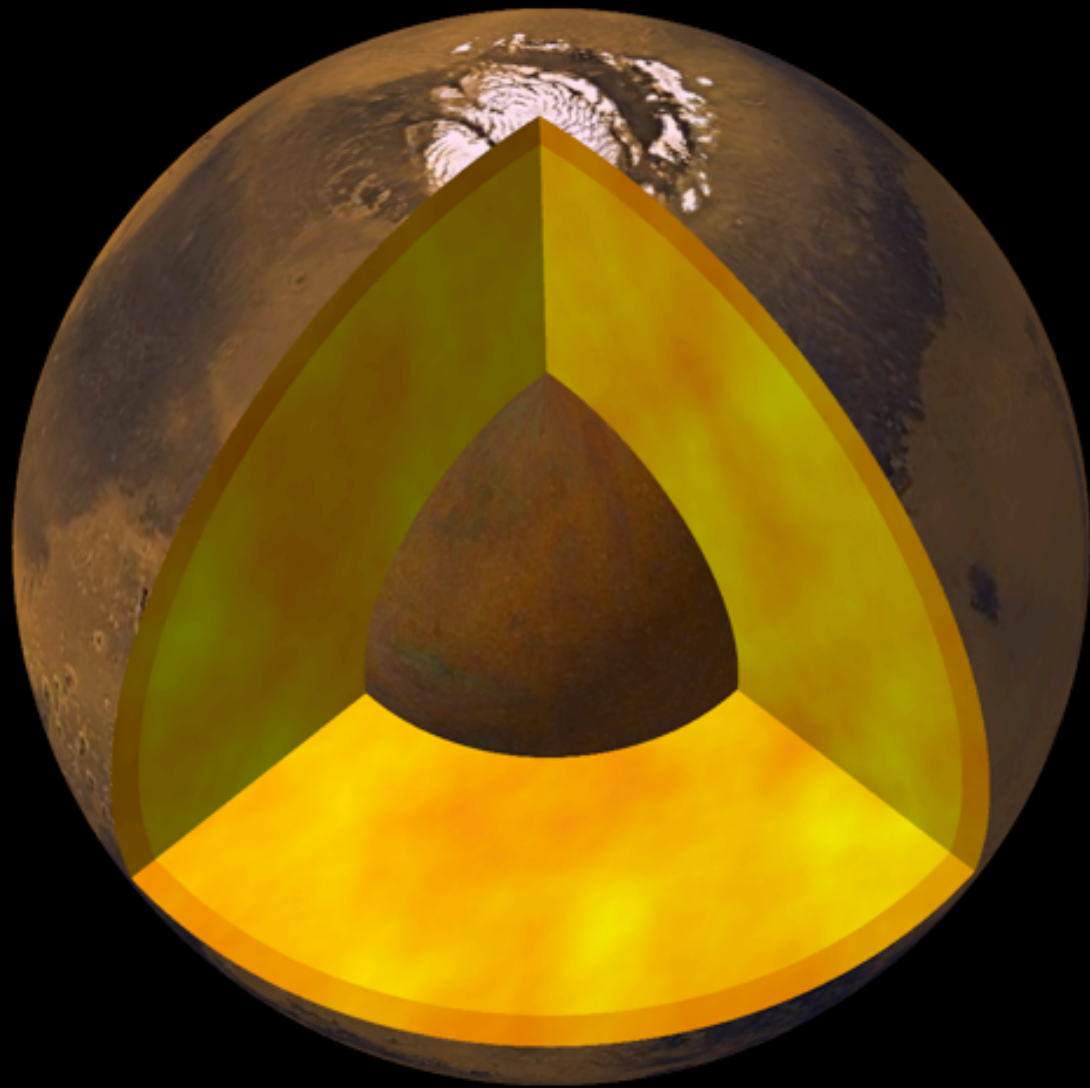


bathymetry

POAMA Summer 2010



seasonal



boolean geometry



video textures

godaebom.gov.au/eview_africa/globe