DUNE RESTORATION TRUST OF NEW ZEALAND

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WAY OUT WEST

Dune Restoration of NZ Annual Conference 2014

11 – 13th March 2014

Fitzroy Surf and Lifesaving Club, New Plymouth

Presentation: Regional Perspectives on the Metocean Climate

Dr Peter McComb, MetOcean

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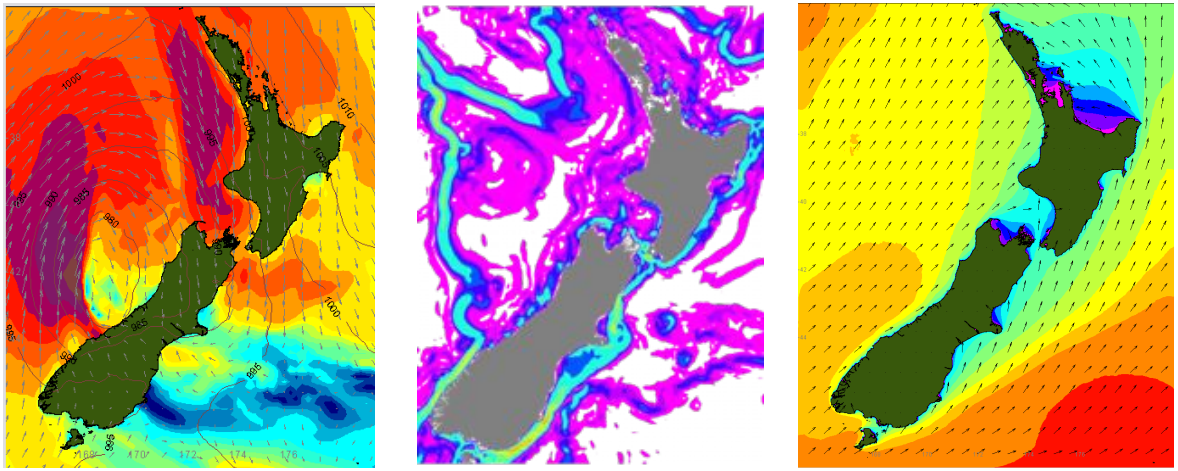
Conference sponsors

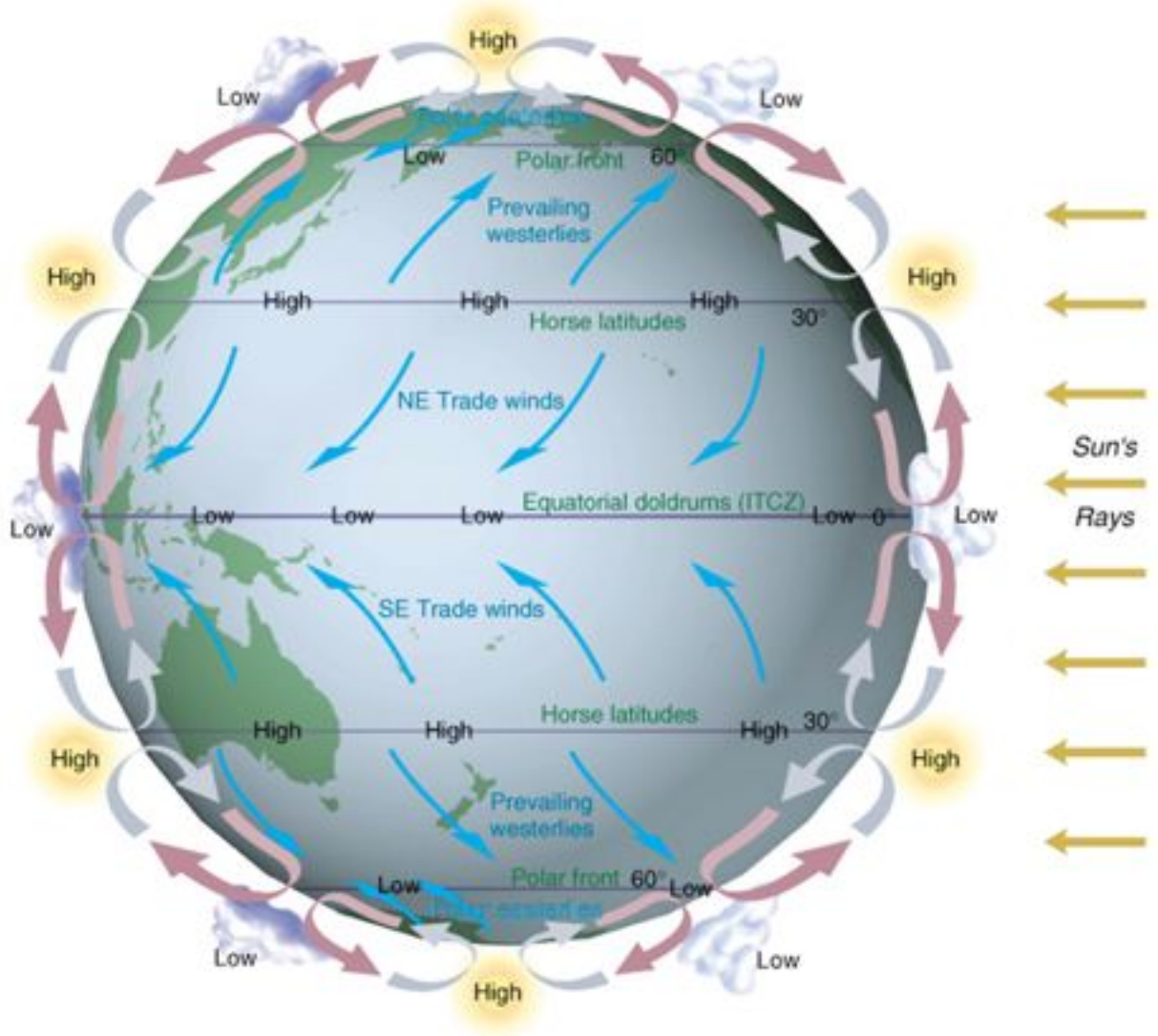
Te Kaunihera-ā-Rohe o Ngāmotu NEW PLYMOUTH DISTRICT COUNCIL newplymouthnz.com

Department of Conservation *Te Papa Atawhai*

Taranaki Regional Council

Characteristic features of long wave energy within ports and harbours on exposed coasts

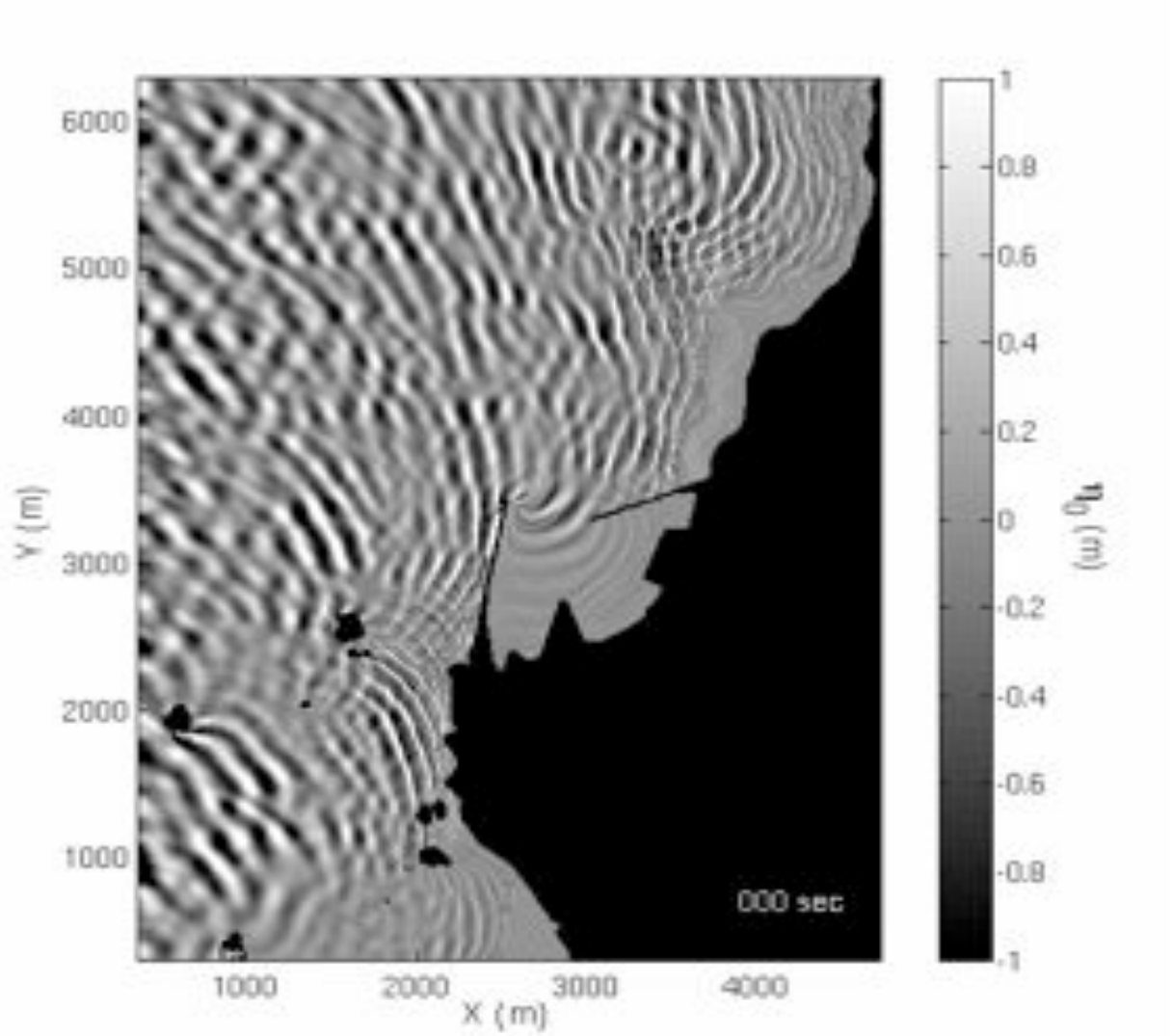



High
Low
Low
Low
Polar front
60°
Prevailing
westerlies
High
High
High
High
High
Horse latitudes
30°
NE Trade winds
Sun's
Rays
Low
Low
Low
Low
Low
Equatorial doldrums (ITCZ)
0°
Low
SE Trade winds
High
High
Horse latitudes
High
30°
High
High
Prevailing
westerlies
Low
Polar front
60°
Low
Low
Low
High

$$\rho\left(\frac{\partial u}{\partial t}+u\frac{\partial u}{\partial x}+v\frac{\partial u}{\partial y}+w\frac{\partial u}{\partial z}\right)=$$
$$\rho g_x-\frac{\partial p}{\partial x}+\frac{\partial}{\partial x}\left[2\mu\frac{\partial u}{\partial x}+\lambda\nabla\cdot\mathbf{V}\right]+\frac{\partial}{\partial y}\left[\mu\left(\frac{\partial u}{\partial y}+\frac{\partial v}{\partial x}\right)\right]+\frac{\partial}{\partial z}\left[\mu\left(\frac{\partial w}{\partial x}+\frac{\partial u}{\partial z}\right)\right]$$

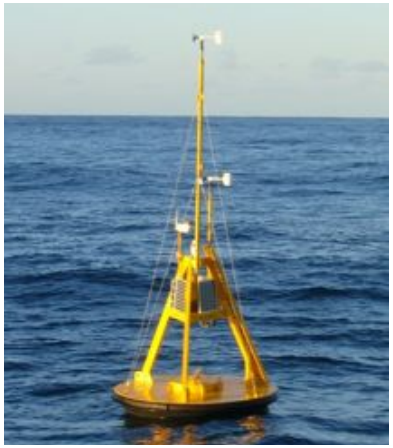
$$\rho\left(\frac{\partial v}{\partial t}+u\frac{\partial v}{\partial x}+v\frac{\partial v}{\partial y}+w\frac{\partial v}{\partial z}\right)=$$
$$\rho g_y-\frac{\partial p}{\partial y}+\frac{\partial}{\partial y}\left[2\mu\frac{\partial v}{\partial y}+\lambda\nabla\cdot\mathbf{V}\right]+\frac{\partial}{\partial z}\left[\mu\left(\frac{\partial v}{\partial z}+\frac{\partial w}{\partial y}\right)\right]+\frac{\partial}{\partial x}\left[\mu\left(\frac{\partial u}{\partial y}+\frac{\partial v}{\partial x}\right)\right]$$

$$\rho\left(\frac{\partial w}{\partial t}+u\frac{\partial w}{\partial x}+v\frac{\partial w}{\partial y}+w\frac{\partial w}{\partial z}\right)=$$
$$\rho g_z-\frac{\partial p}{\partial z}+\frac{\partial}{\partial z}\left[2\mu\frac{\partial w}{\partial z}+\lambda\nabla\cdot\mathbf{V}\right]+\frac{\partial}{\partial x}\left[\mu\left(\frac{\partial w}{\partial x}+\frac{\partial u}{\partial z}\right)\right]+\frac{\partial}{\partial y}\left[\mu\left(\frac{\partial v}{\partial z}+\frac{\partial w}{\partial y}\right)\right]$$

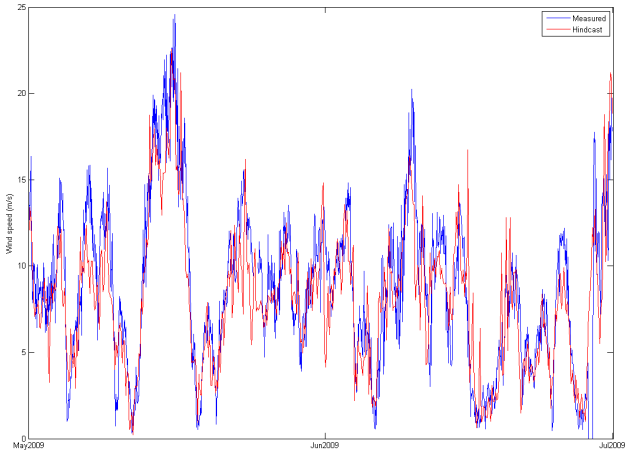

6000
5000
4000
3000
2000
1000
Y (m)
1000
2000
3000
4000
X (m)
000 sec
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1

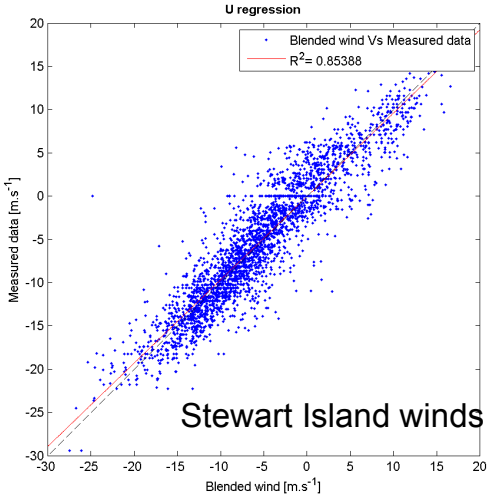
The oceanography of NZ is complex, highly variable and often very energetic. Characterisation of the site-specific metocean conditions is often very important.

We now have a 35-year high quality database of waves, winds and currents to analyse. Data are hourly at 5-12 km resolution from 1979-2013.

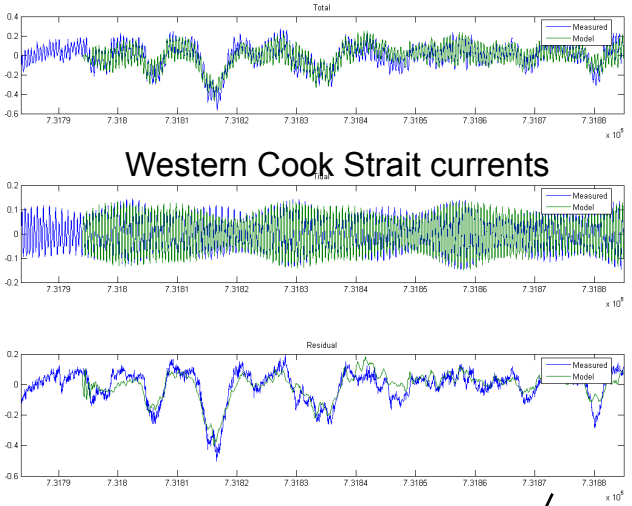


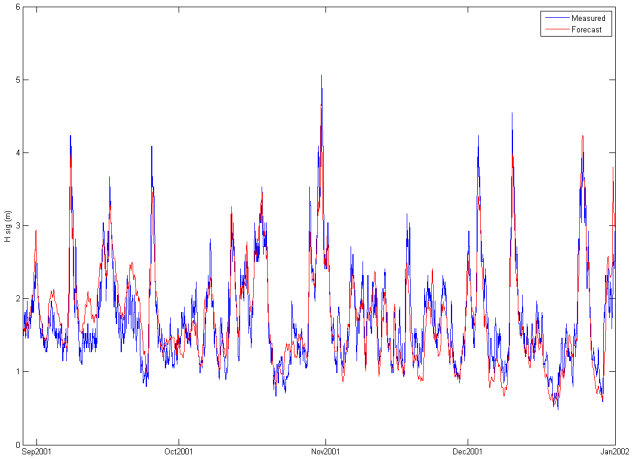
Validation

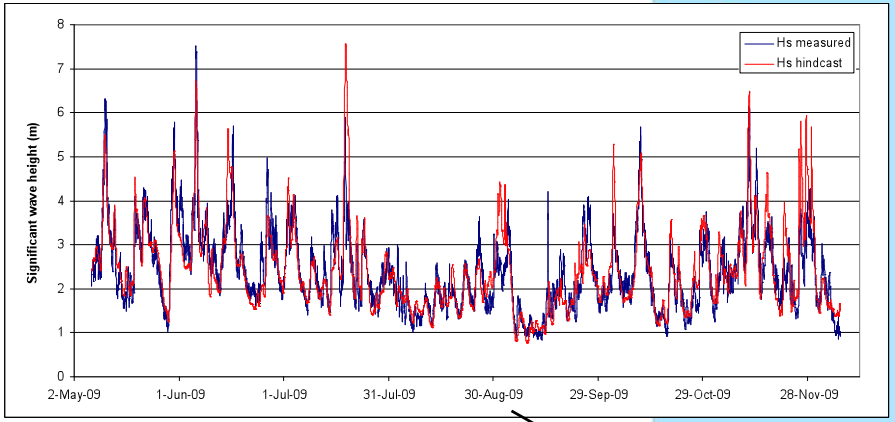




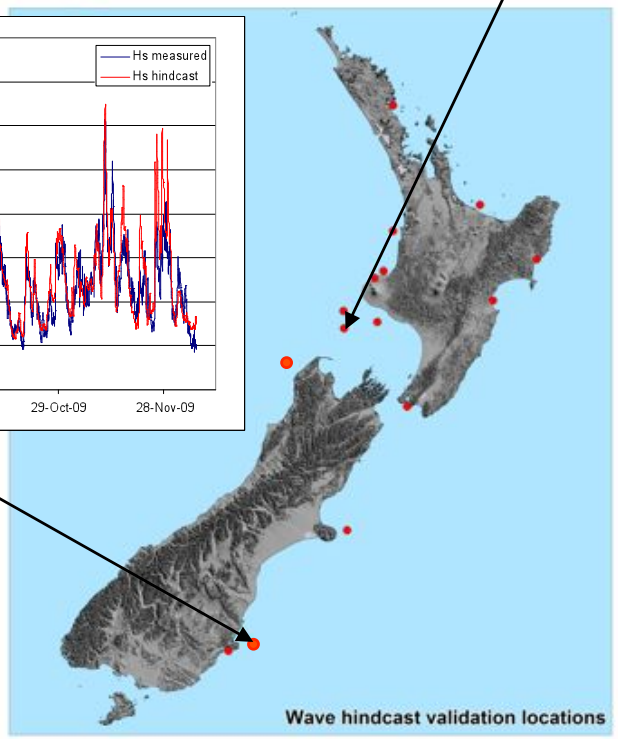
Stewart Island winds



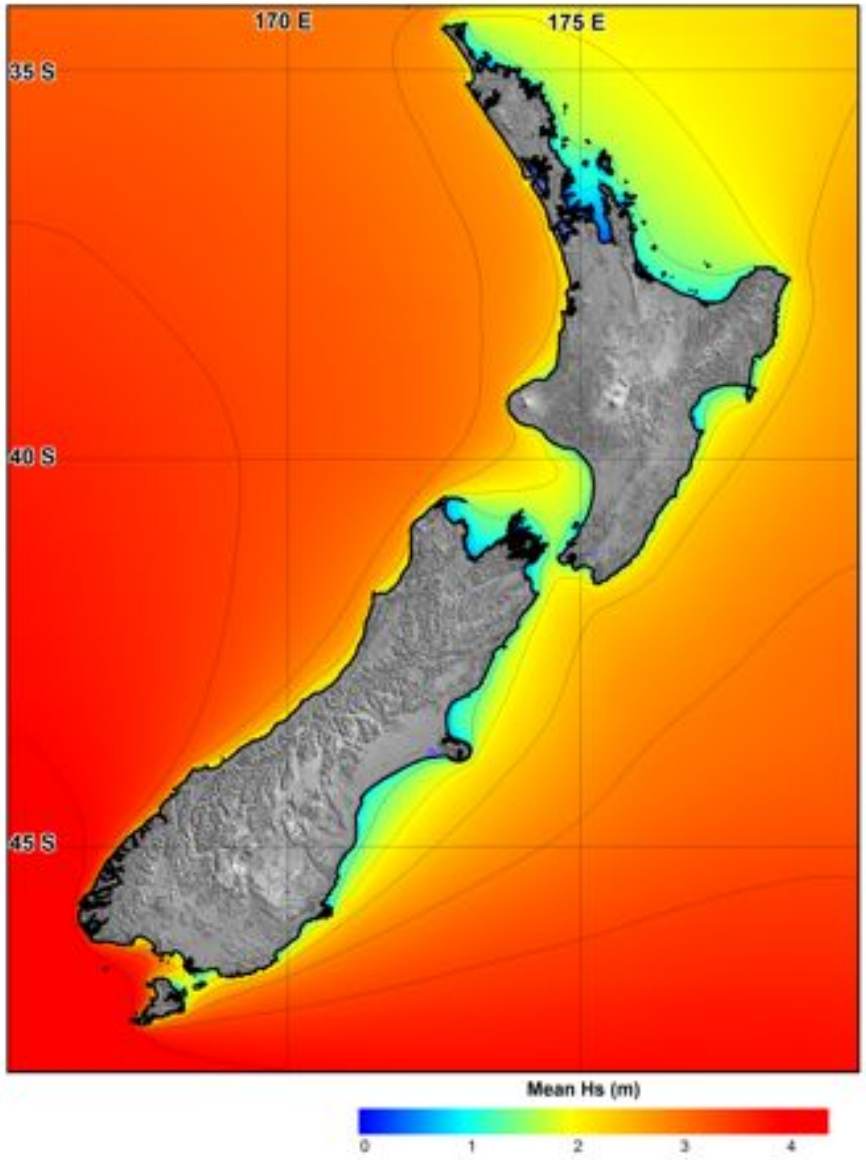


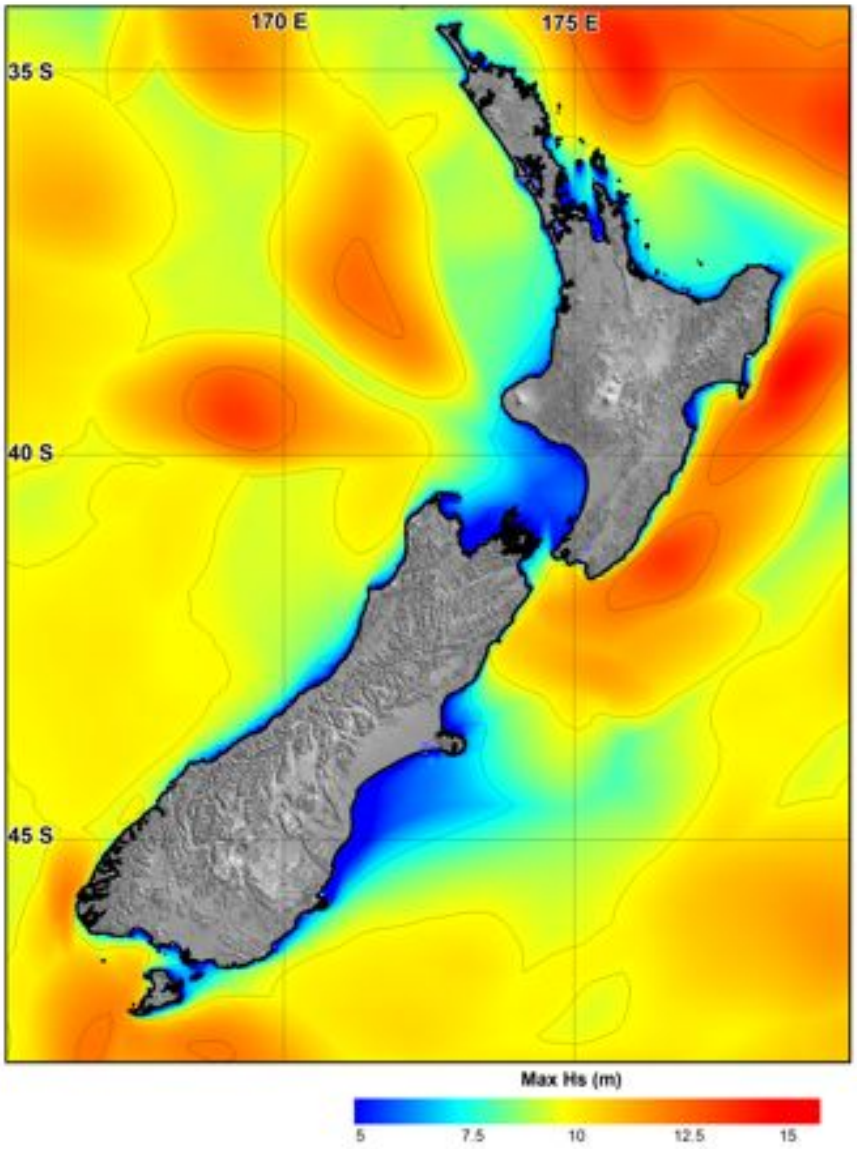


Great South Basin waves

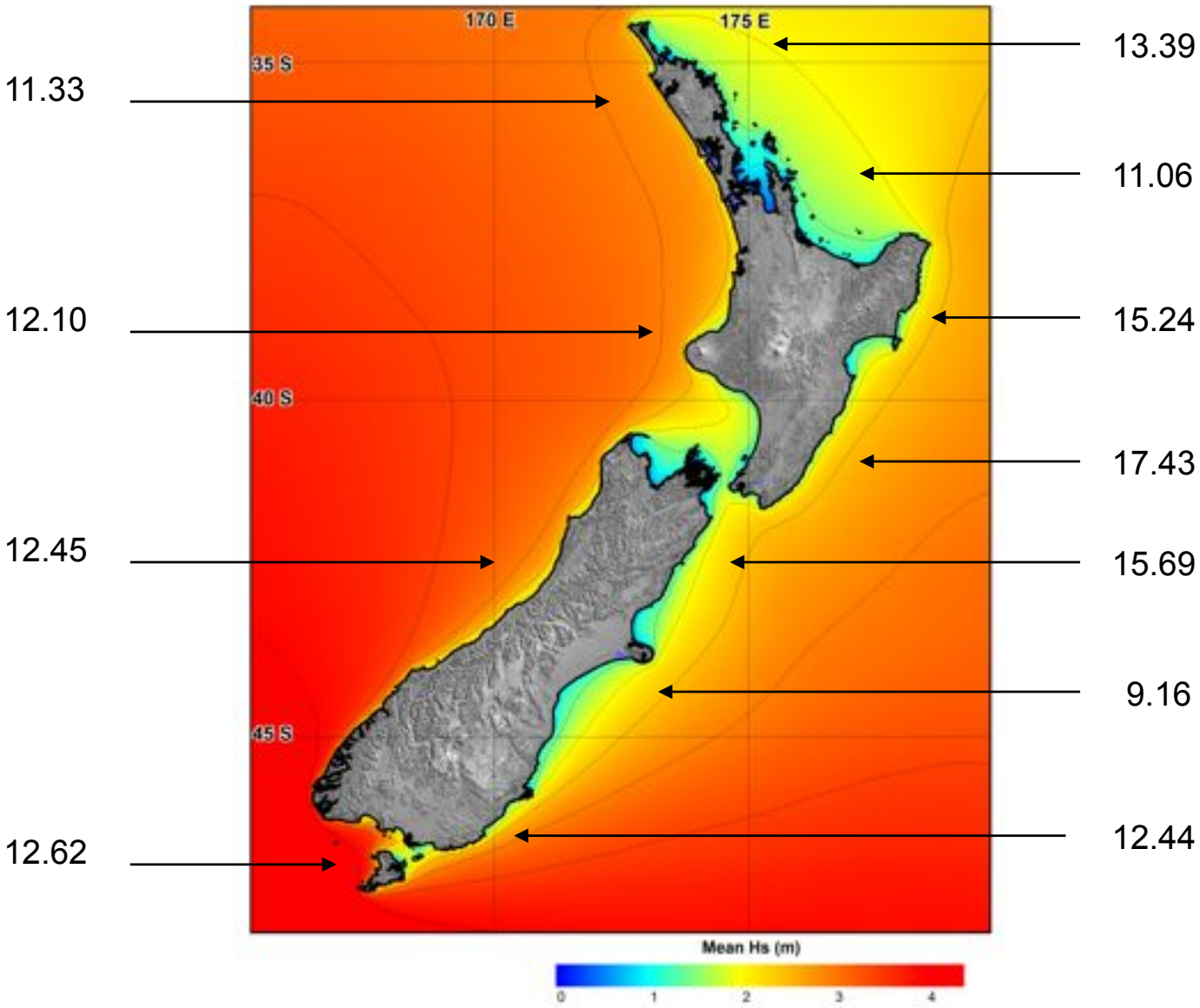


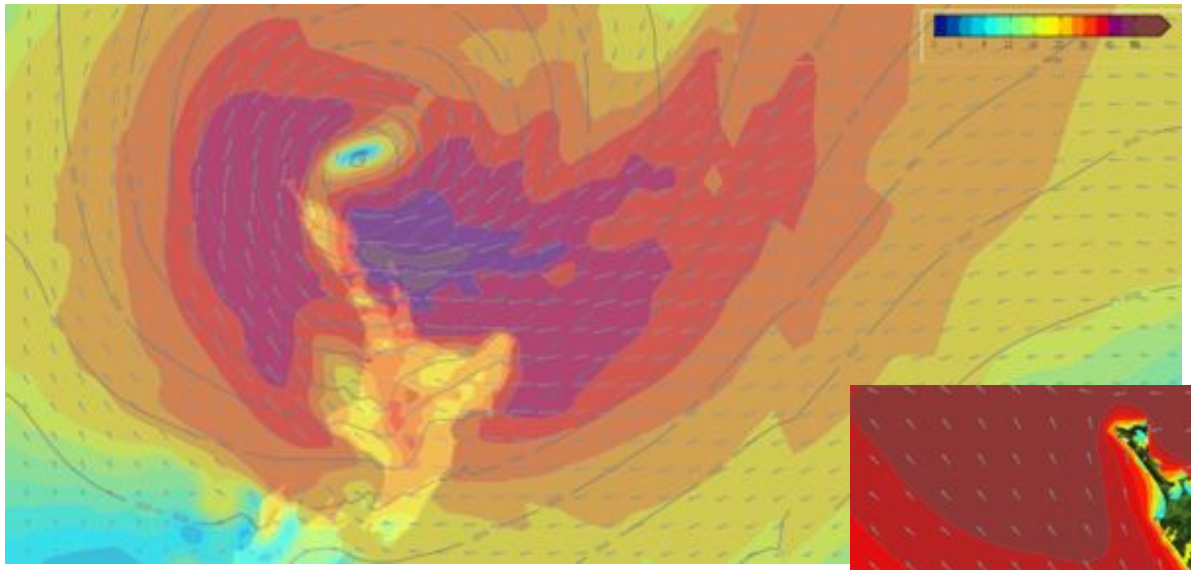
Wave climate

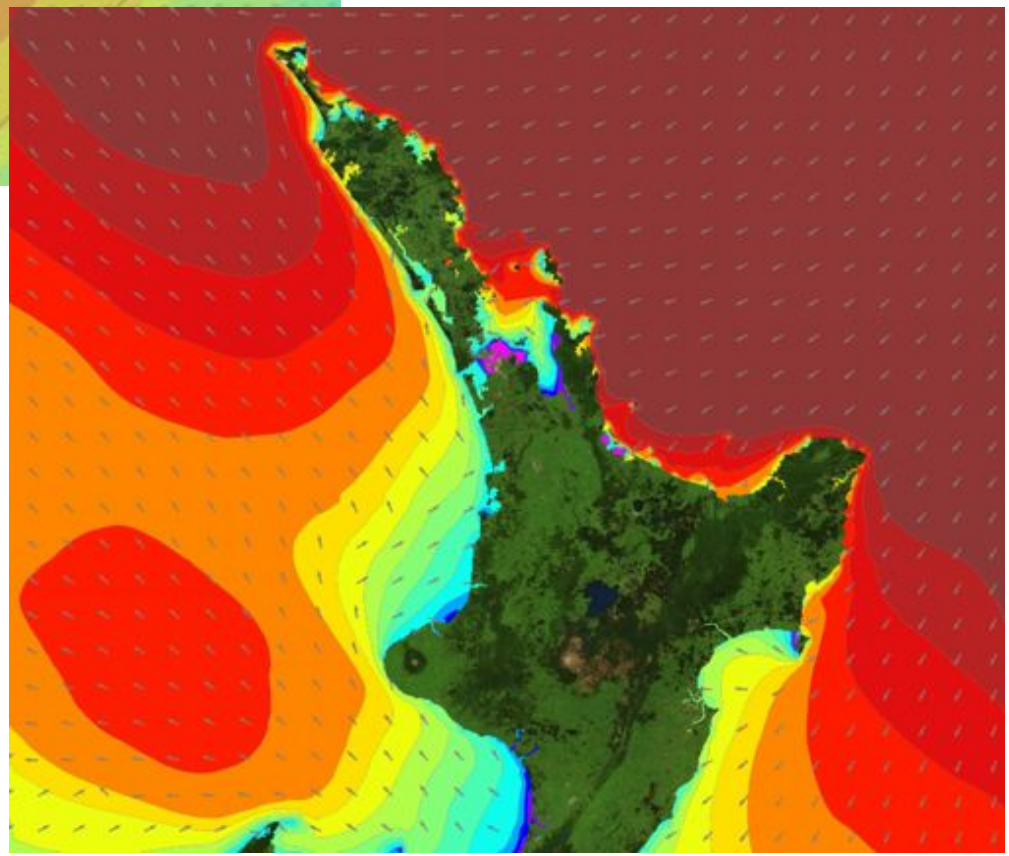




Wave climate 25-yr Hs RPV





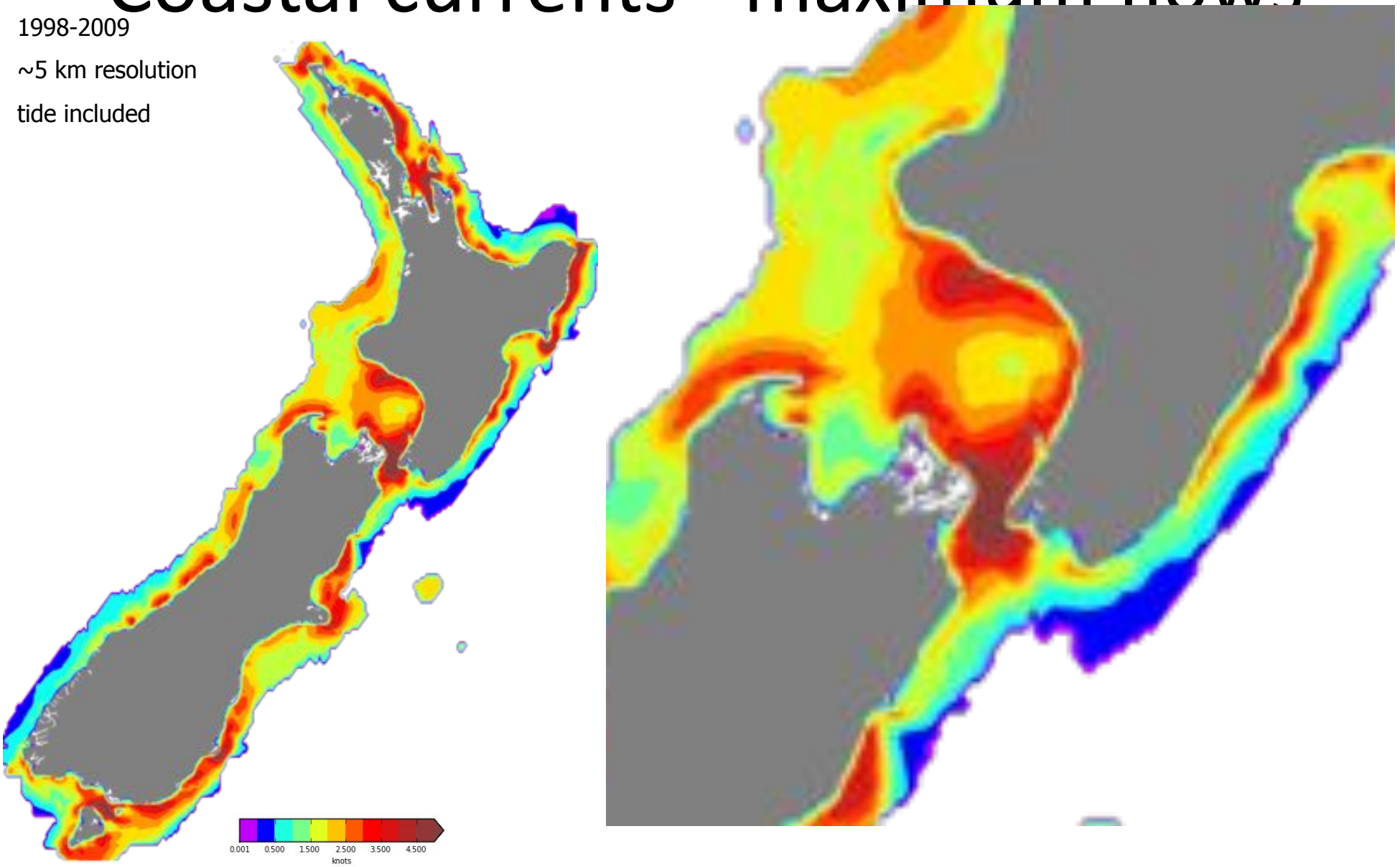


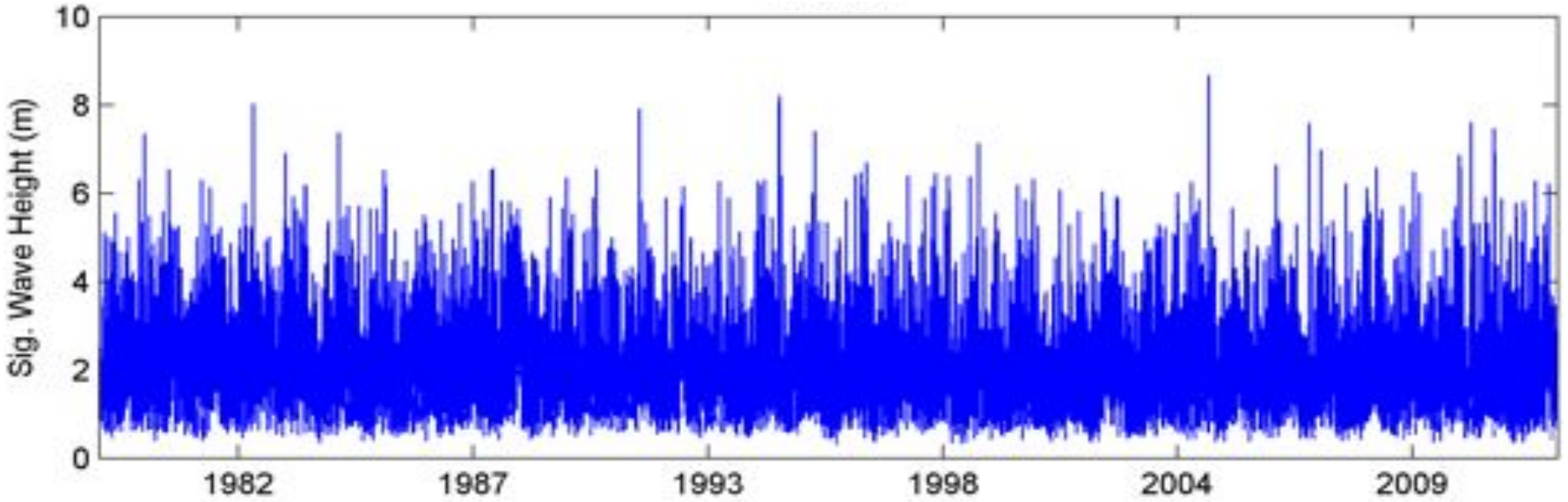
Coastal currents - maximum flows

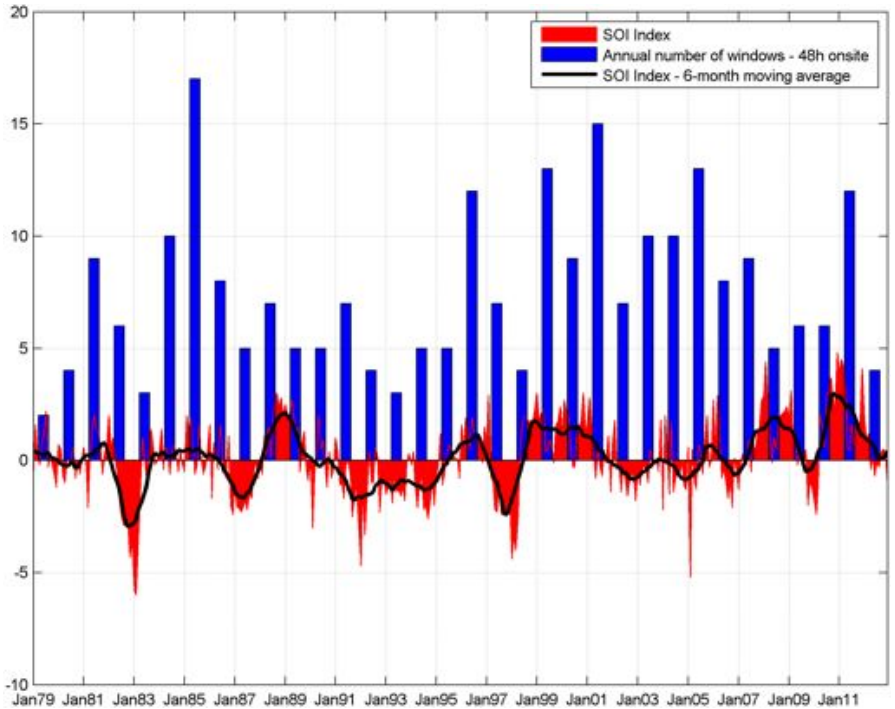
1998-2009

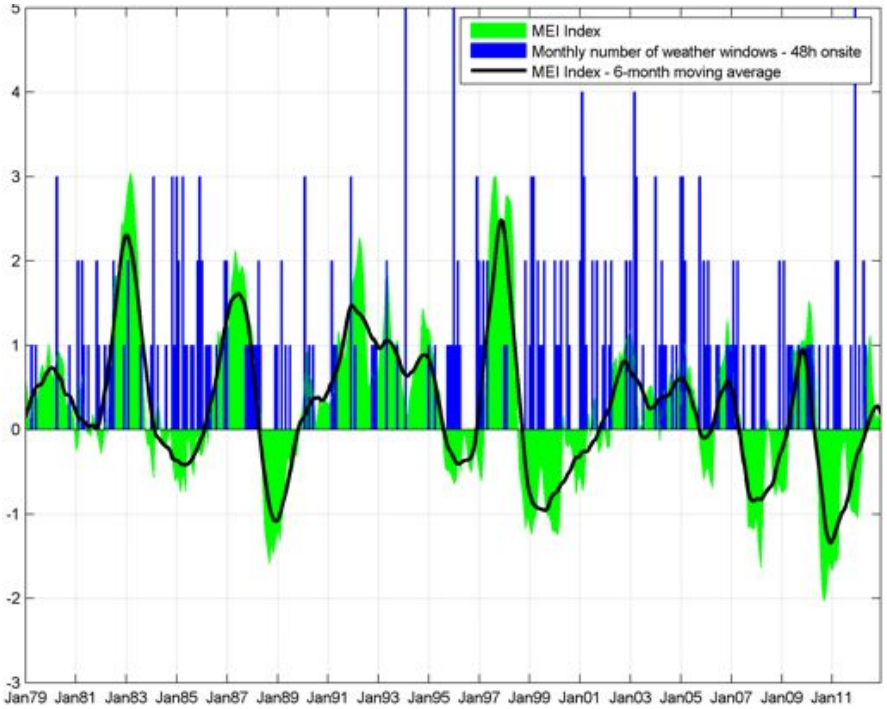
~5 km resolution

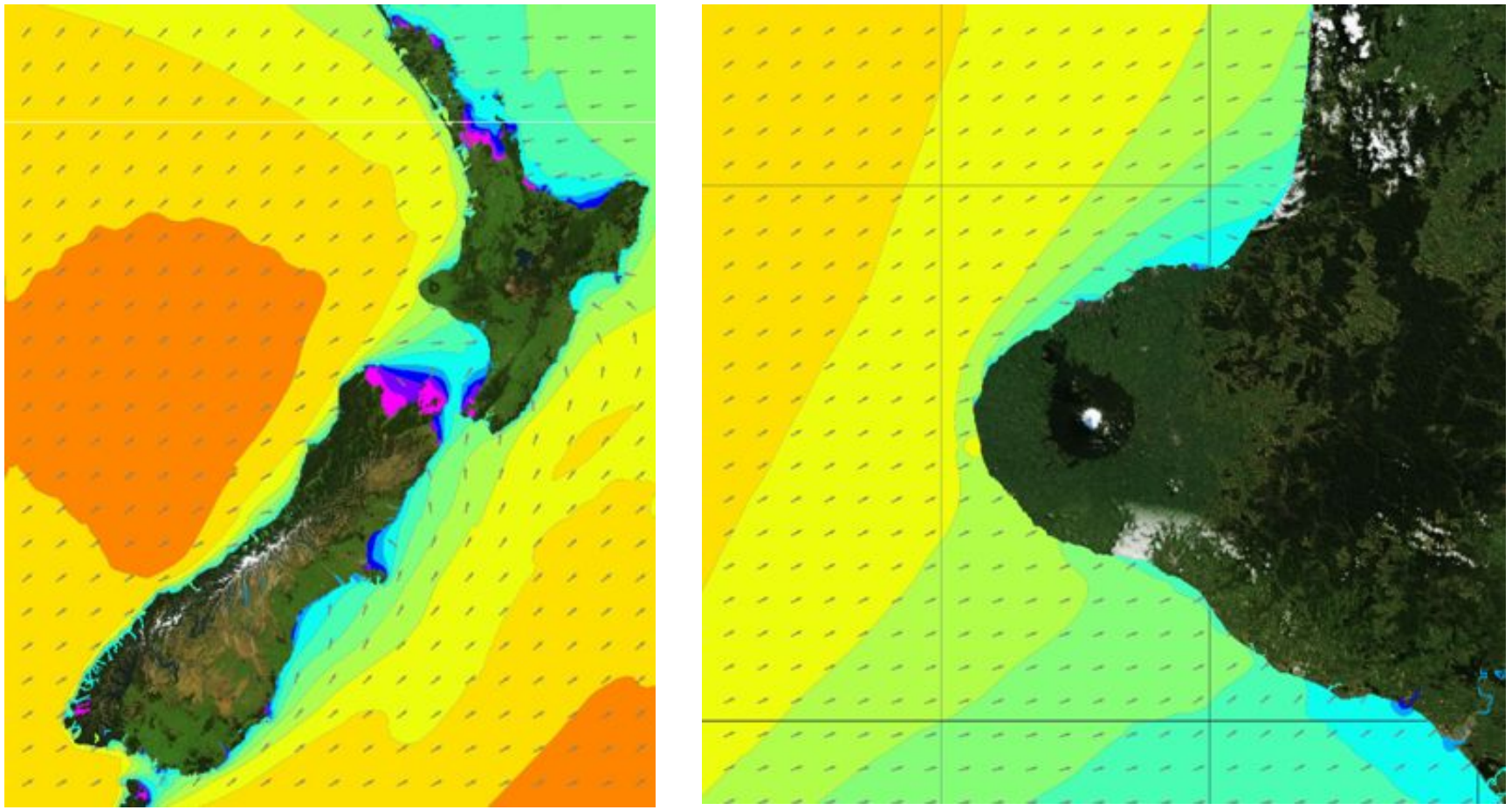
tide included

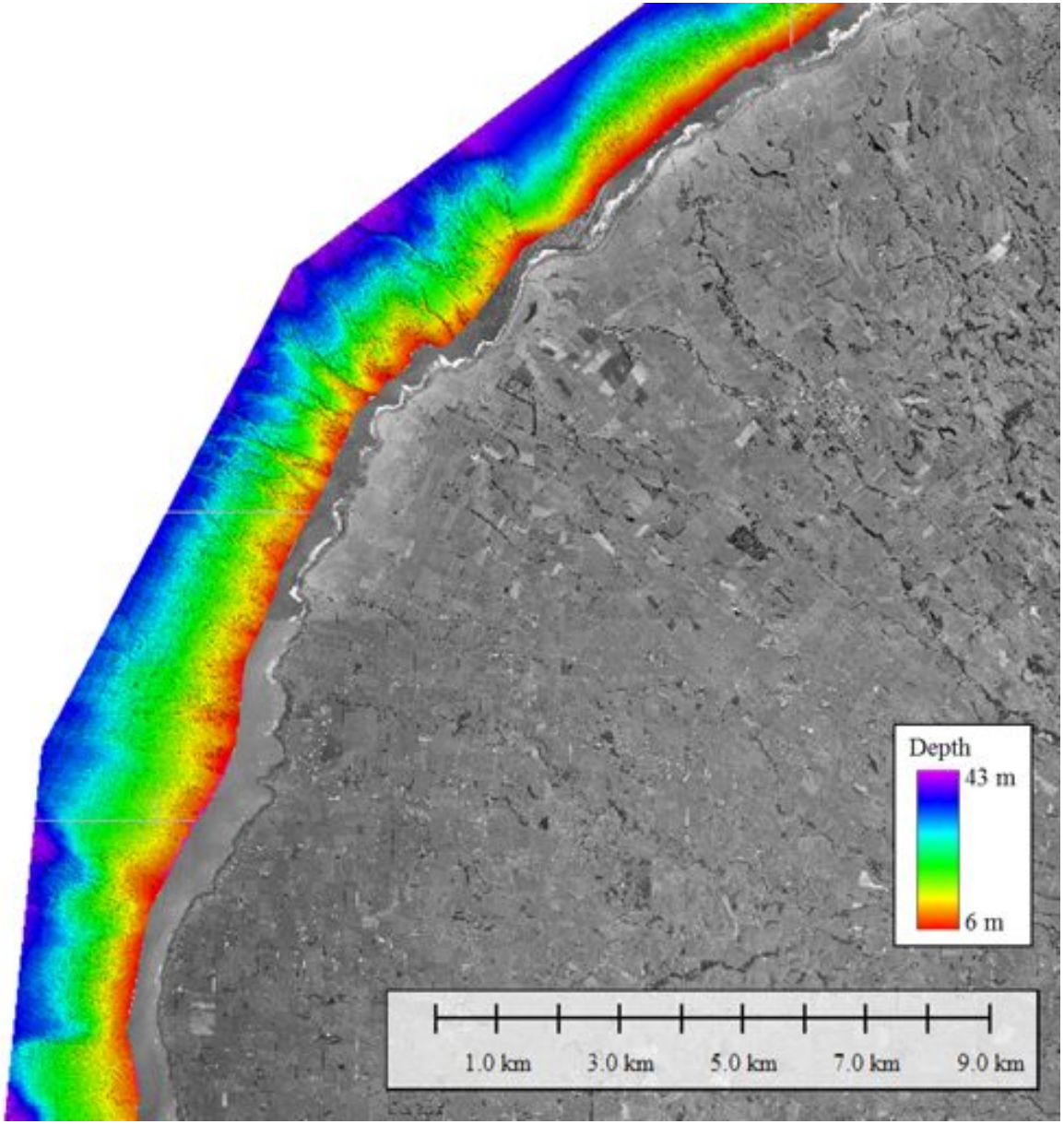


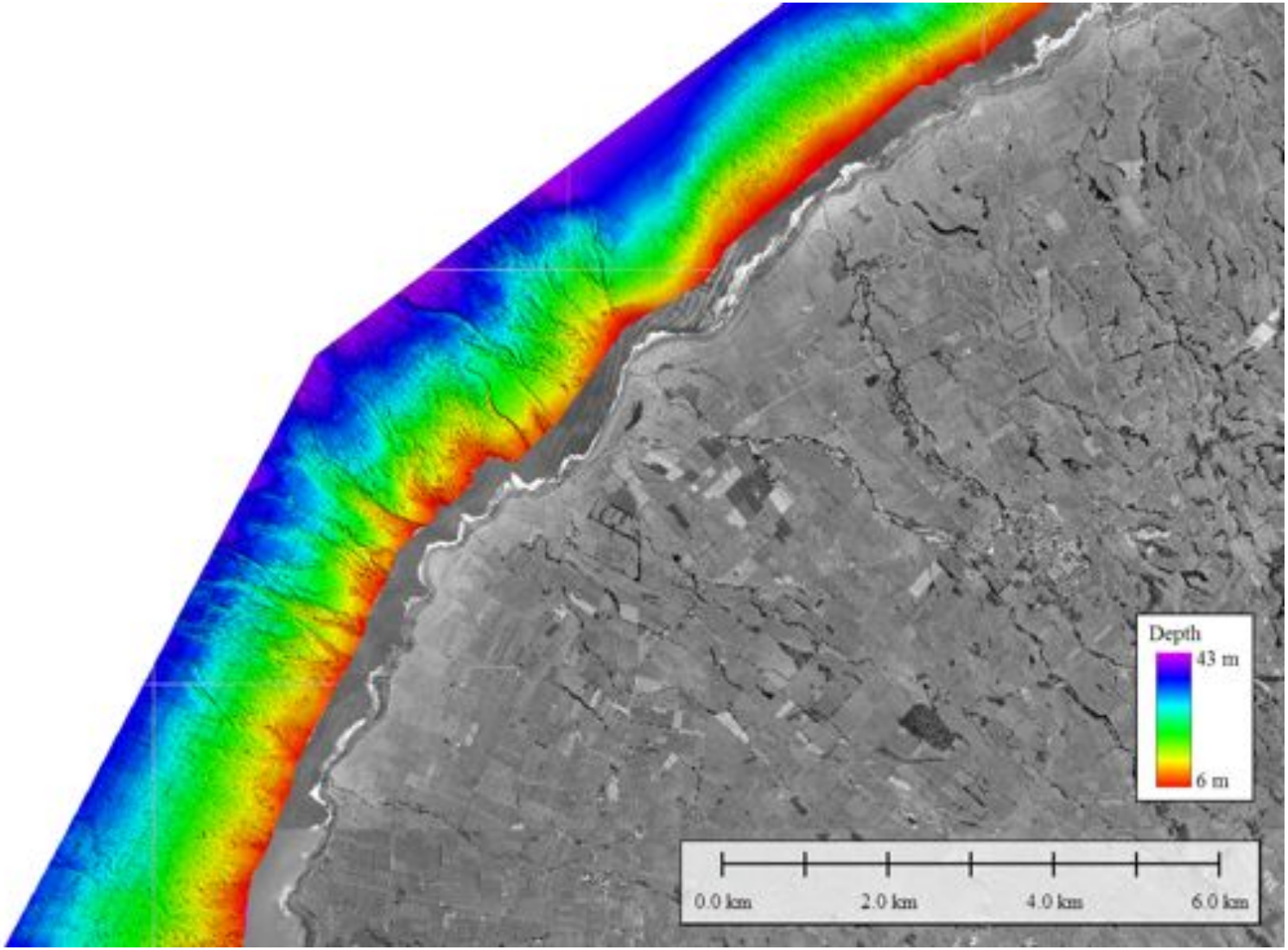

Sig. Wave Height (m)
0
2
4
6
8
10
1982
1987
1993
1998
2004
2009

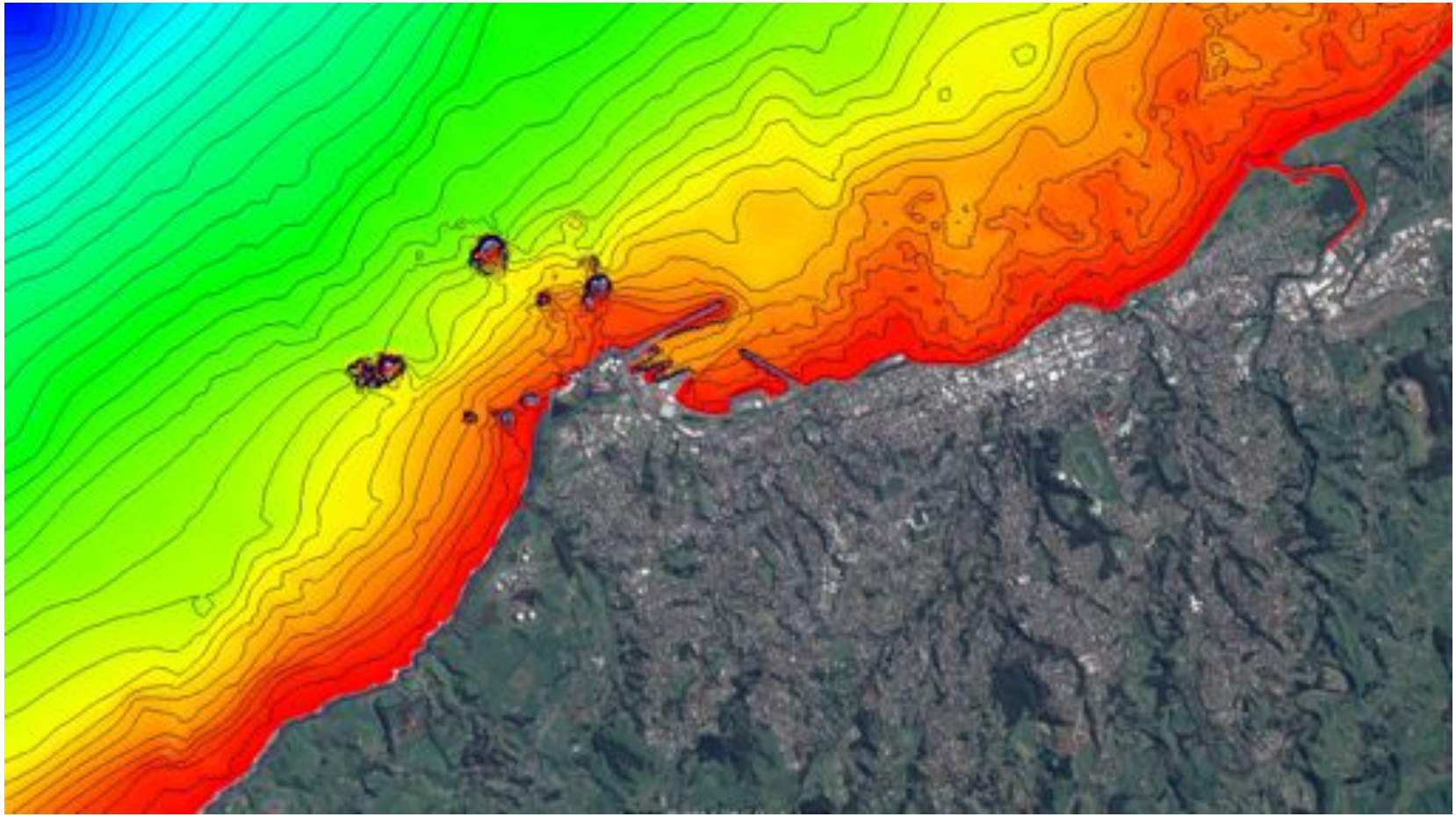

SOI Index
Annual number of windows - 48h onsite
SOI Index - 6-month moving average
20
15
10
5
0
-5
-10
Jan79 Jan81 Jan83 Jan85 Jan87 Jan89 Jan91 Jan93 Jan95 Jan97 Jan99 Jan01 Jan03 Jan05 Jan07 Jan09 Jan11


MEI Index
Monthly number of weather windows - 48h onsite
MEI Index - 6-month moving average
5
4
3
2
1
0
-1
-2
-3
Jan79 Jan81 Jan83 Jan85 Jan87 Jan89 Jan91 Jan93 Jan95 Jan97 Jan99 Jan01 Jan03 Jan05 Jan07 Jan09 Jan11


0.0
0.5
1.0
2.0
3.0
4.0
6.0
8.0
m


Depth
43 m
6 m
1.0 km
3.0 km
5.0 km
7.0 km
9.0 km


Depth
43 m
6 m
0.0 km
2.0 km
4.0 km
6.0 km




Thanks for your time