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Wind power modelling for the South Pacific

Research Councils UK Energy For a Low Carbon Future

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Overview

1. Powering the future
2. The case for wind
3. Models of wind power technologies
4. Routes
5. Wind data
6. Averaged results
7. Fleet Suite: outlook
8. Conclusions

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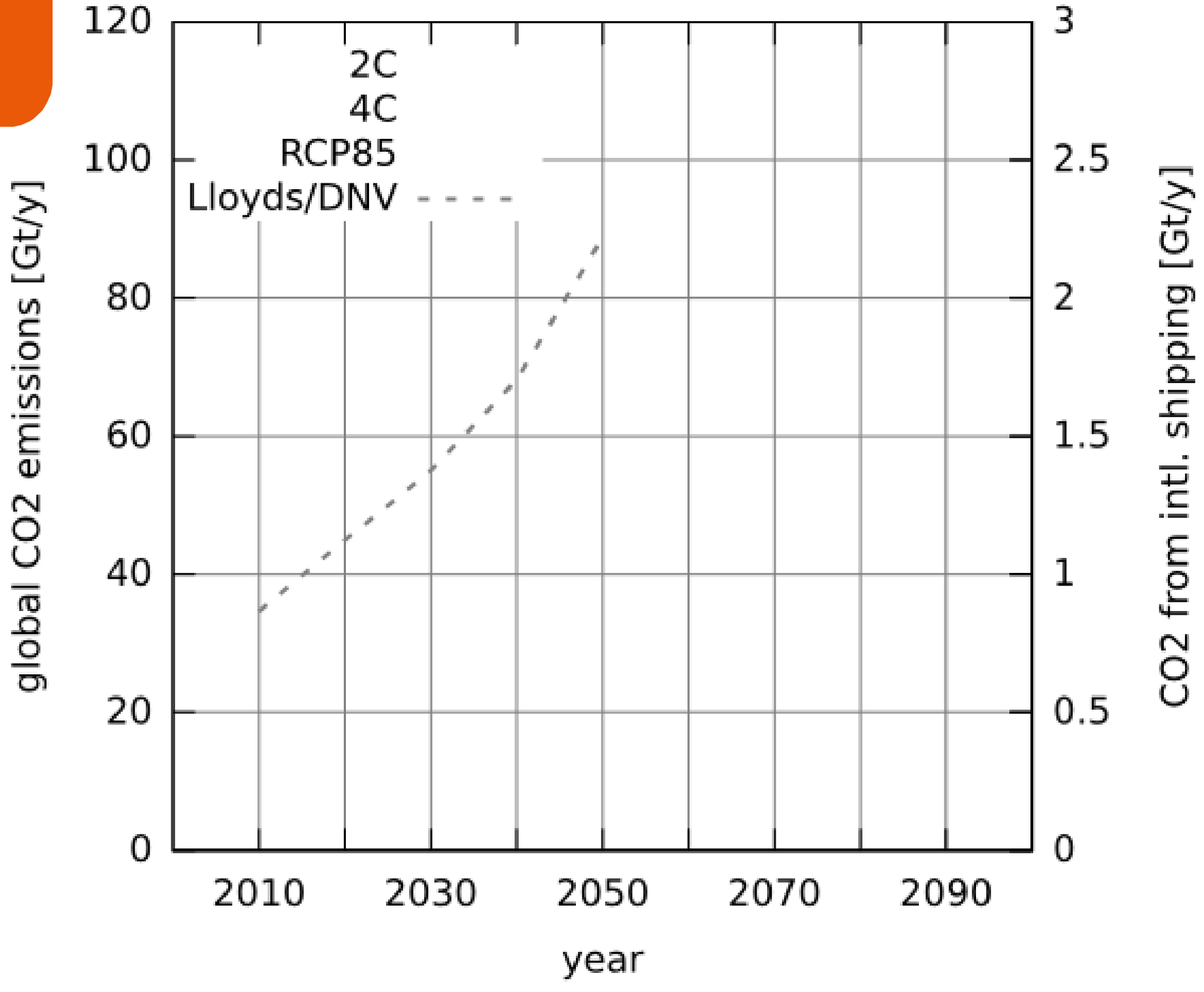
1. Powering the future



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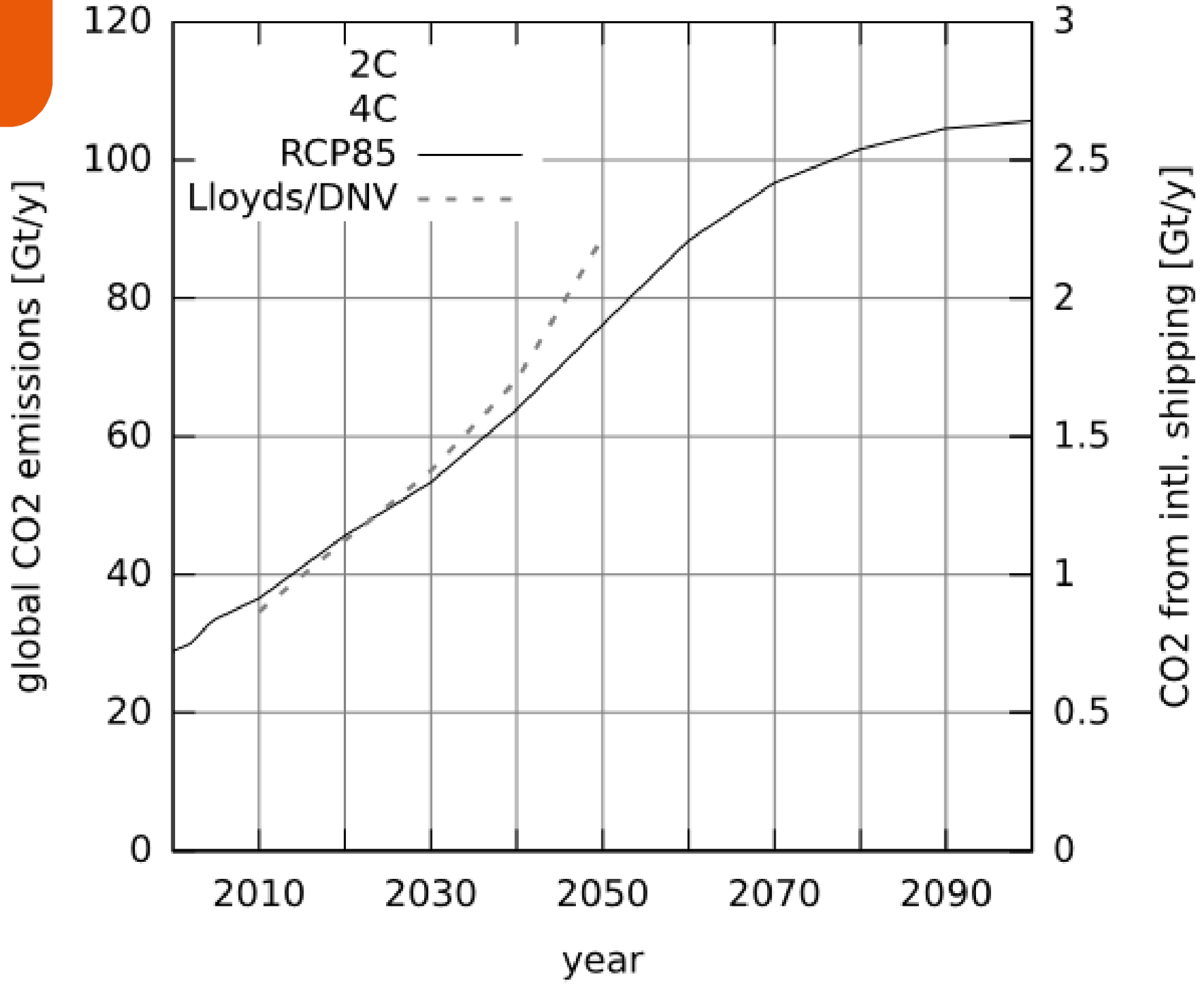

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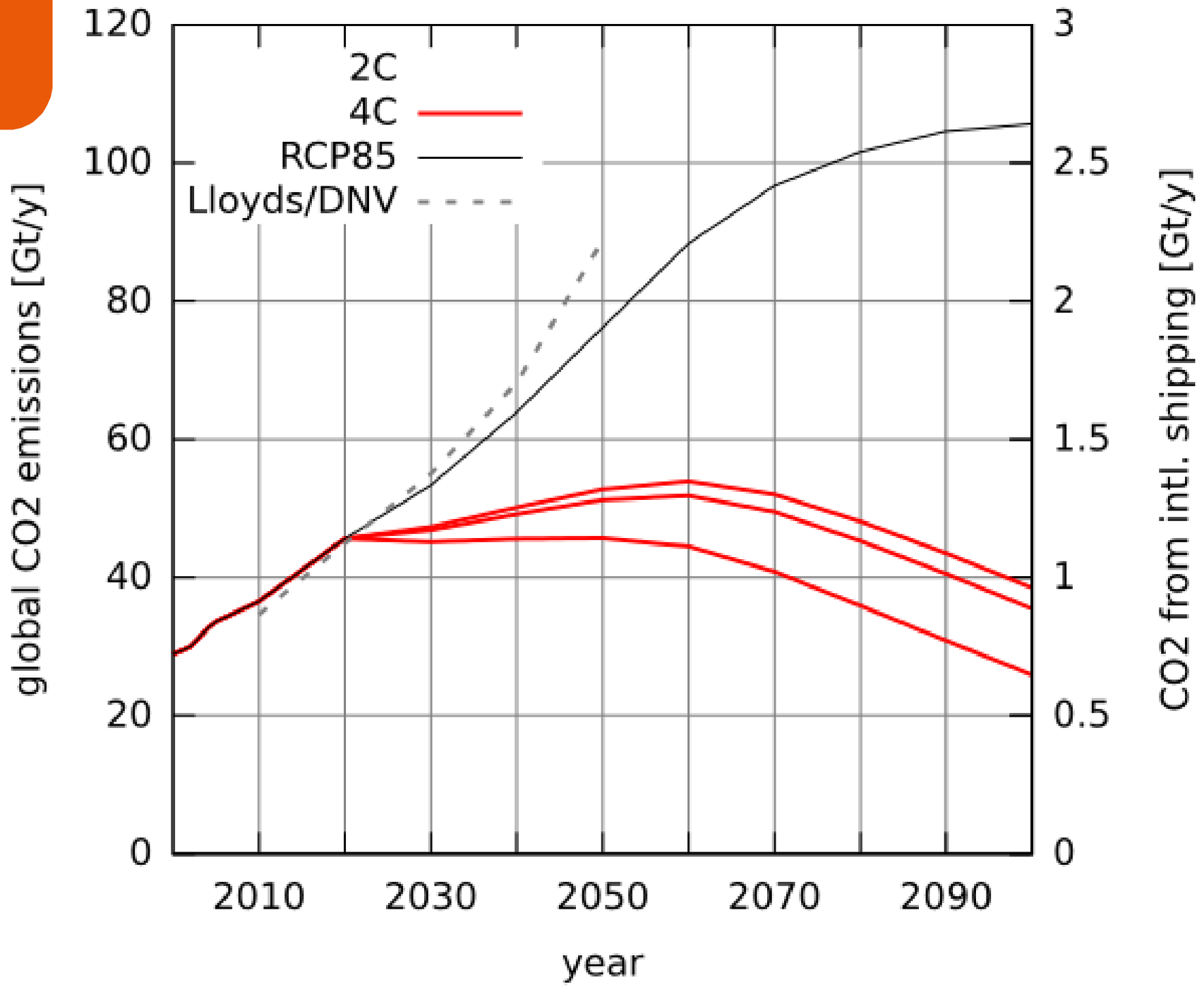

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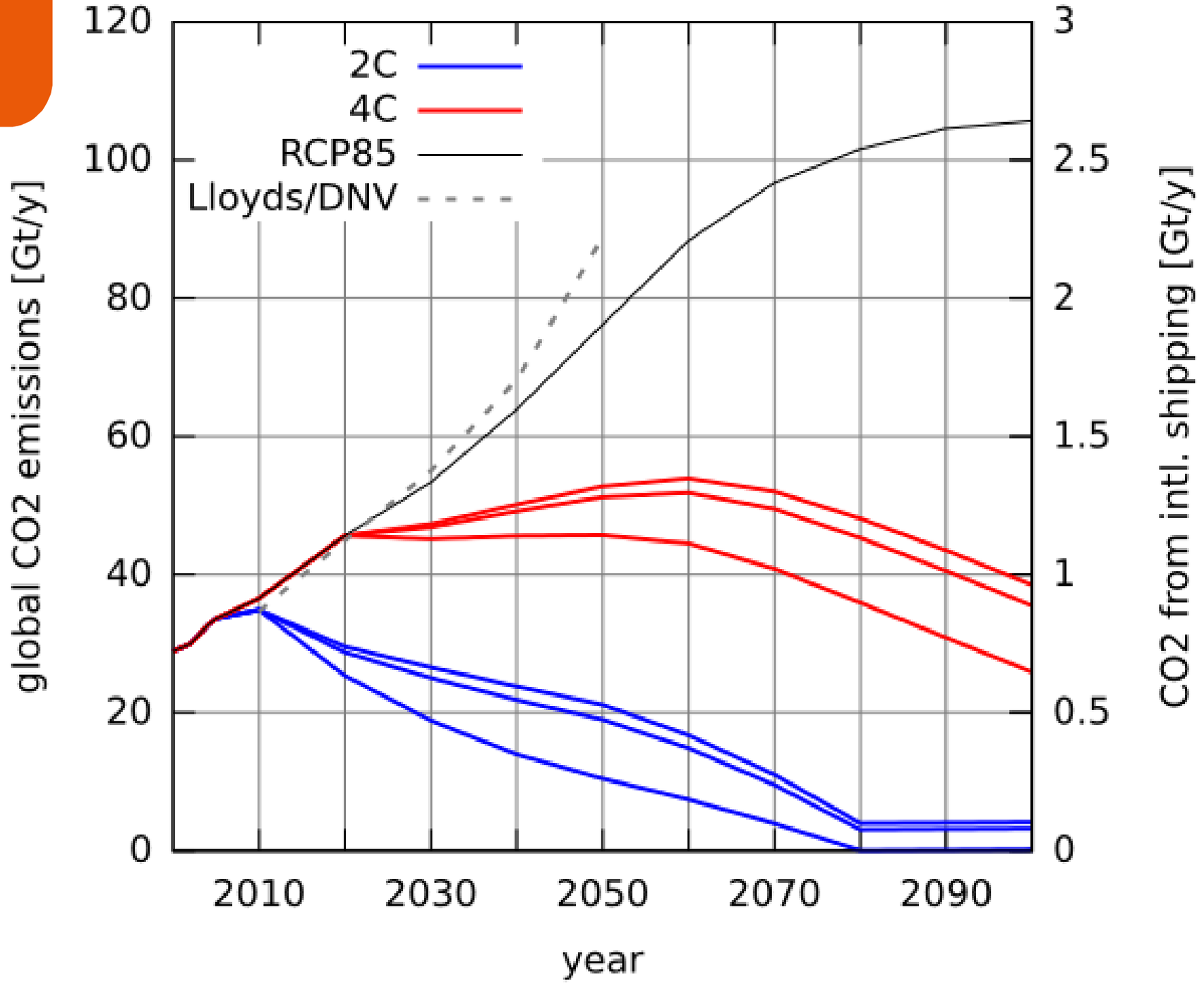

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2. The case for wind

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2. The case for wind

zero emissions

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2. The case for wind

zero emissions

free

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2. The case for wind

zero emissions

free

available on the oceans

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2. The case for wind

zero emissions

free

available on the oceans

there is a long history of wind-powered shipping

2. The case for wind

zero emissions

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available on the oceans

there is a long history of wind-powered shipping

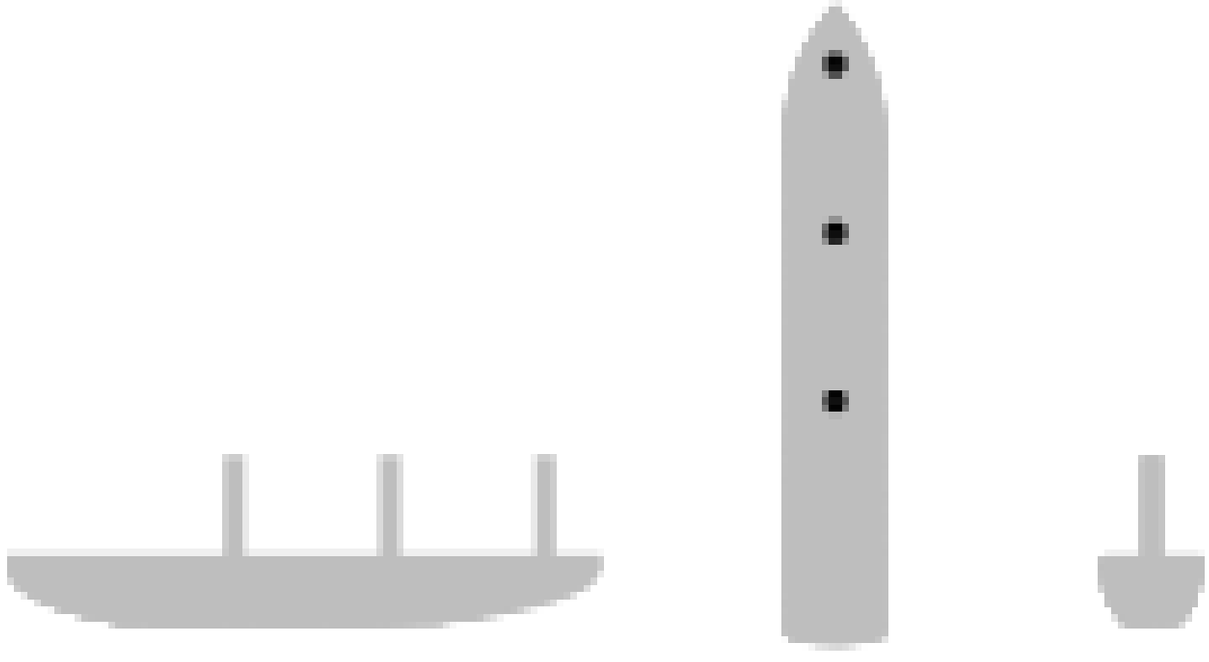
➔ what is the potential of various technologies?

3. Models of wind power technologies

1. **Flettner rotor**

height = 35m; width = 5m

C_L=12.5; C_D=0.2; C_M=0.2;



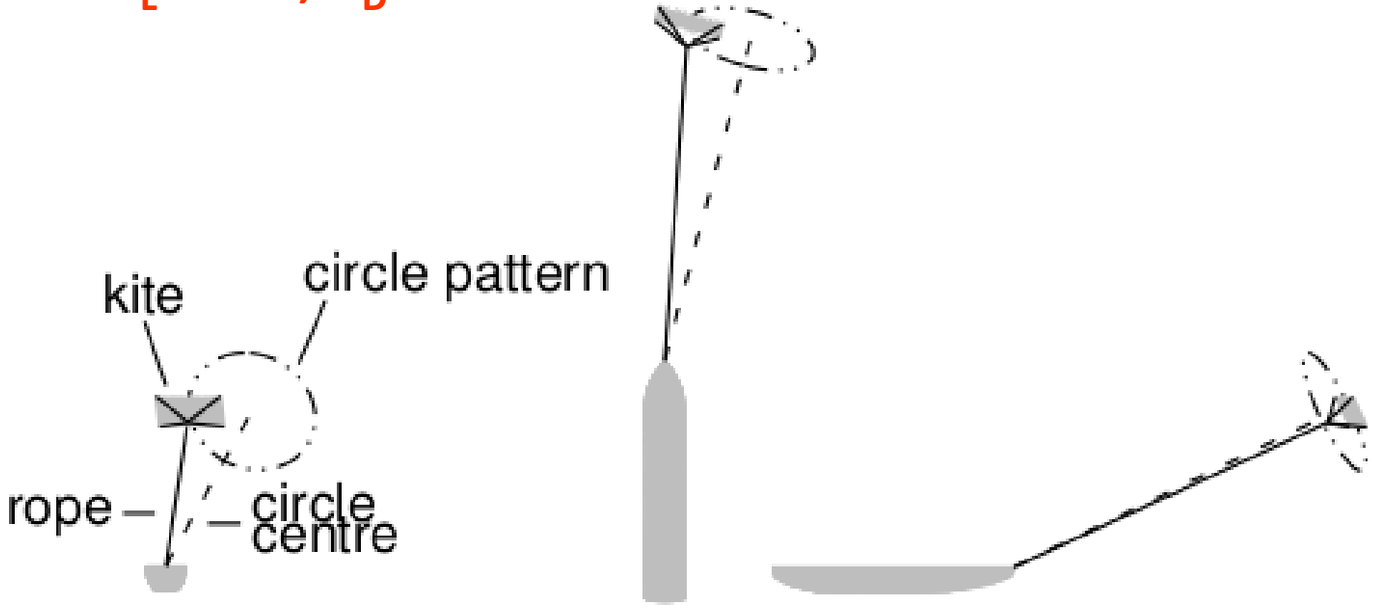
3. Models of wind power technologies

1. **Flettner rotor** — **height = 35m; width = 5m**

   C_L=12.5; C_D=0.2; C_M=0.2;

2. **Towking kite** — **width = 50m; chord = 10m**

   C_L=12.5; C_D=0.2



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3. Models of wind power technologies

1. **Flettner rotor** — height = 35m; width = 5m; C_L=12.5; C_D=0.2; C_M=0.2;
2. **Towking kite** — width = 50m; chord = 10m; C_L=1.0; C_D=0.29
3. **Solid body sail** — height = 40m; chord = 10m; C_L=1.2; C_D=0.12

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4. Routes

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Auckland, New Zealand

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Auckland, New Zealand

Avatiu, Cook Islands

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Auckland, New Zealand

Avatiu, Cook Islands

Majuro, Marshall Islands

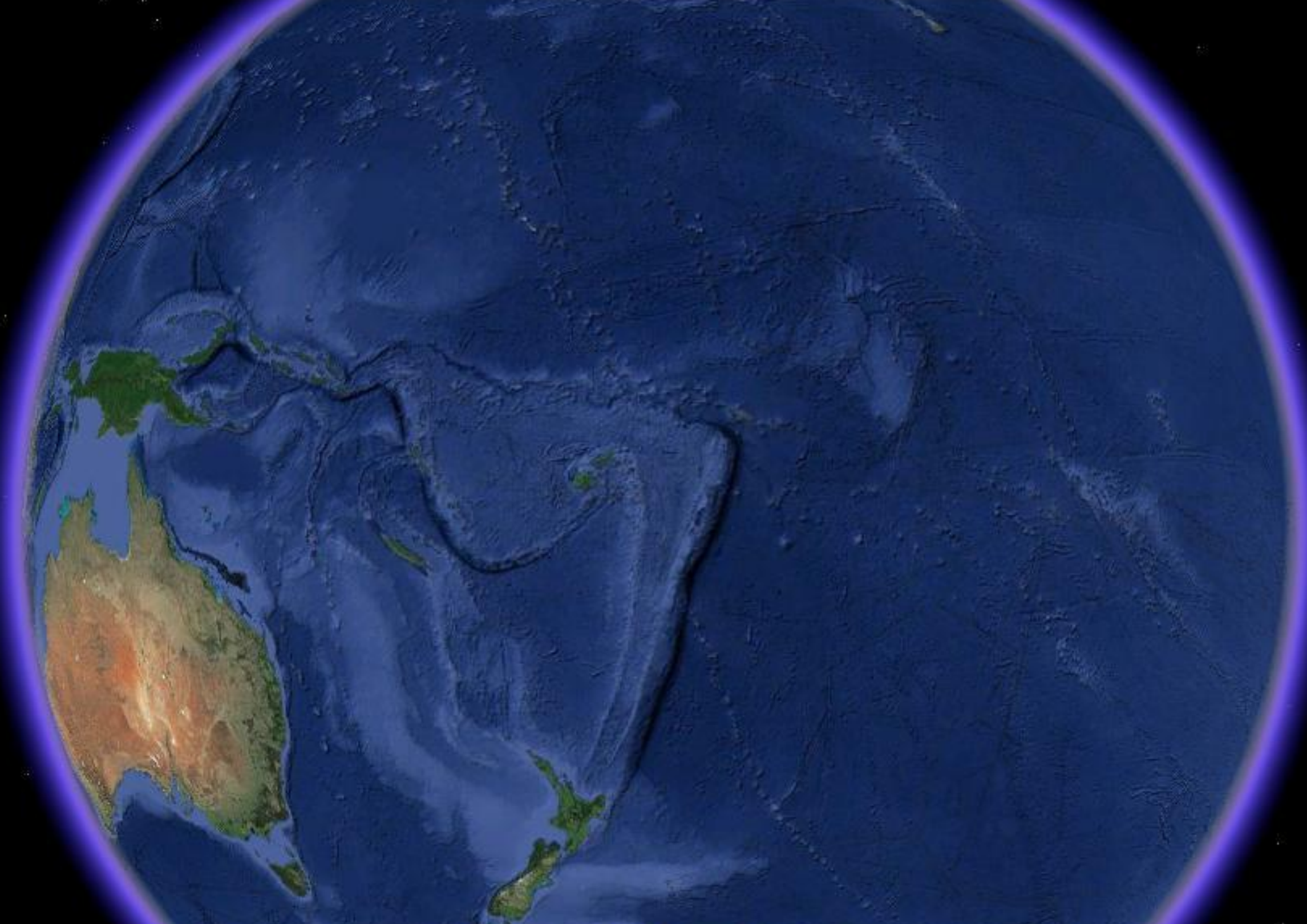
4. Routes

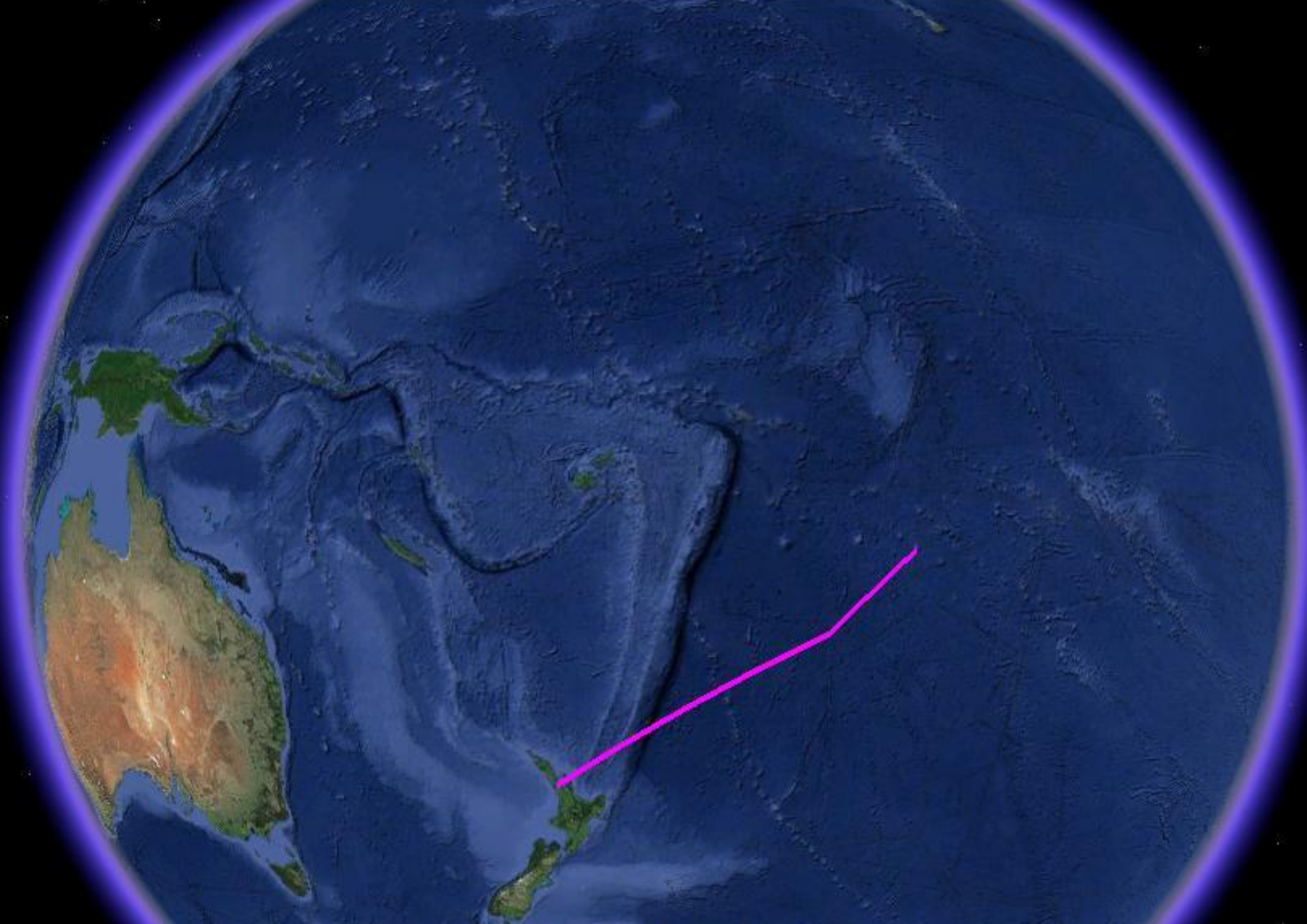
Auckland, New Zealand

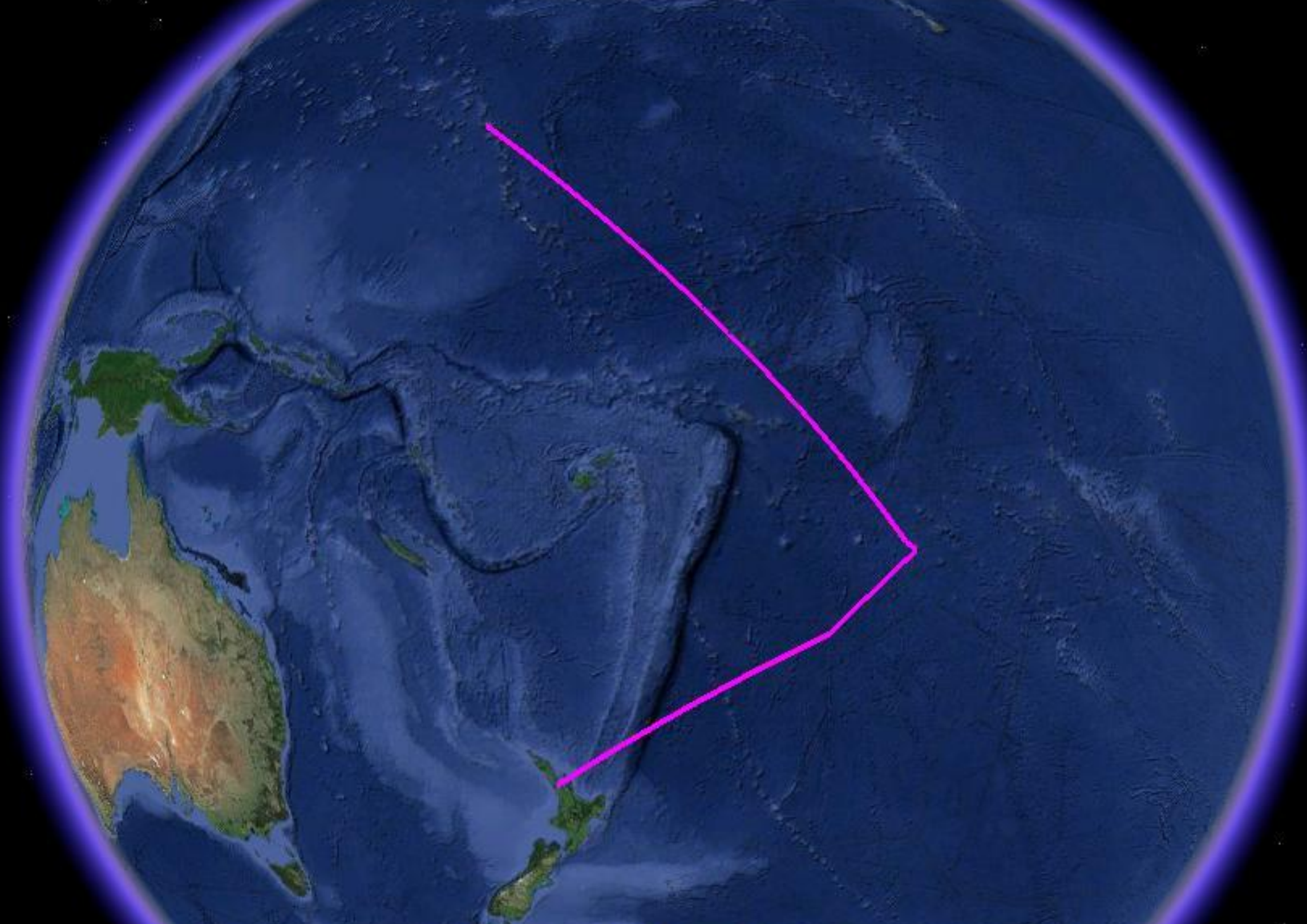
Avatiu, Cook Islands

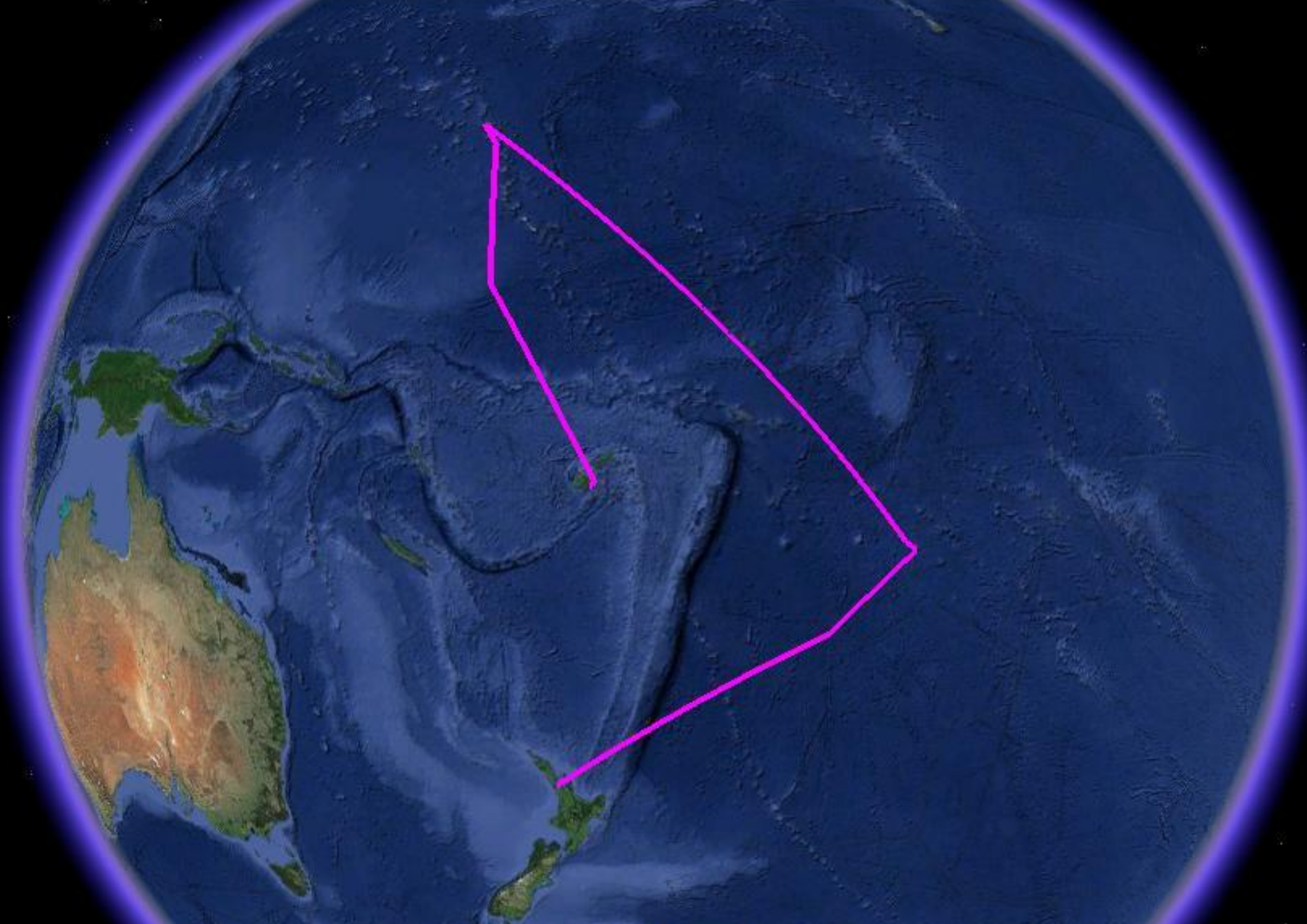
Majuro, Marshall Islands

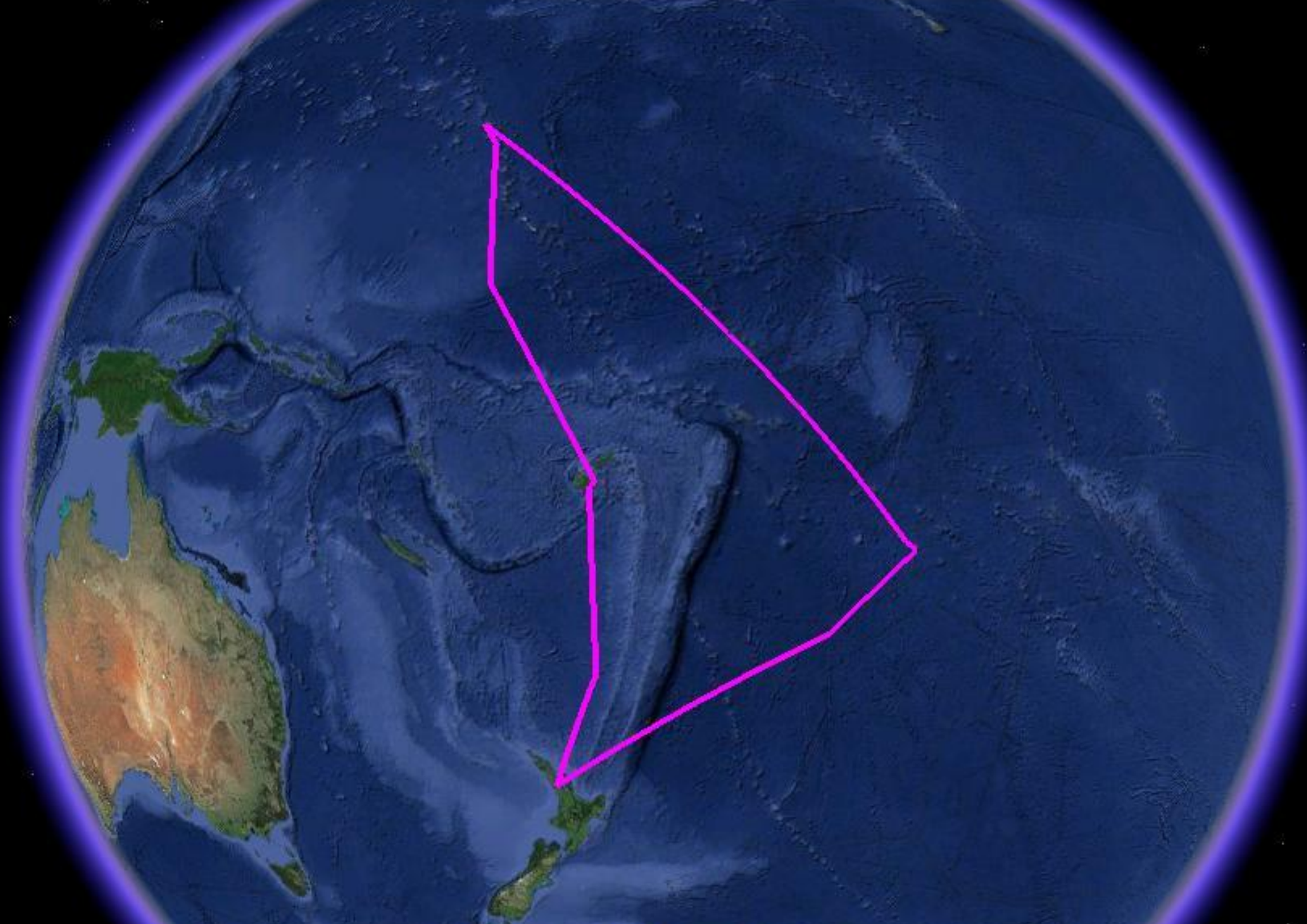
Suva, Fiji Islands

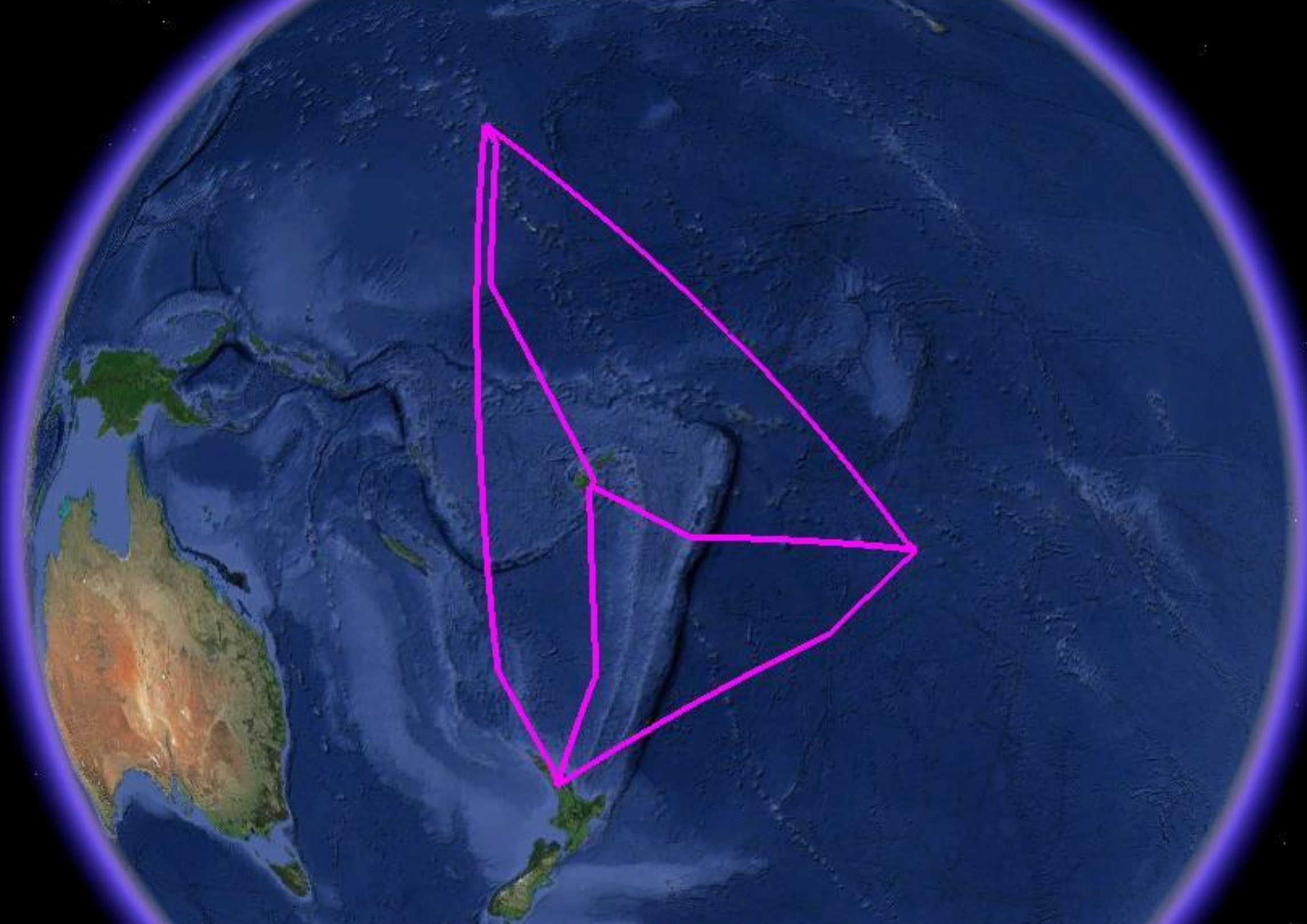












5. Wind data

MERRA:

Modern-Era Retrospective Analysis for Research and Applications (NASA)

540 x 360 reanalysis data

Height level 50m

1st quarter of 2011 → 13 different dates sampled

6. Averaged results

(assuming a constant ship speed of 11.7 knots or 6.0 m/s)

Wind power contribution in kW:

Route (and back) \ Technology	rotor	kite	sail
Auckland → Suva	303 (339)	304 (135)	93 (171)
Suva → Majuro	291 (320)	181 (130)	74(103)
Majuro → Avatiu	246 (174)	19 (186)	81 (42)
Avatiu → Auckland	297 (339)	307 (190)	110 (92)
Auckland → Majuro	333 (368)	262 (156)	80 (136)
Suva → Avatiu	239 (186)	55 (218)	65 (56)

7. Fleet Suite: outlook

Pathfinding/routing

Environmental data: wind, waves, currents

Development of technology models

Optimisation

Validation

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8. Conclusions

Potential for wind powered shipping is there

The Fleet Suite tools are work in progress…

… on the way to smart power for shipping

Some way to go –
the future of wind powered transport shipping is still open.