Dataset S1. GPS processing.

The GPS data have been processed using the Bernese software package (v5.2) (Dach *et al*., 2007) using 24 hour daily position solutions. The Centre for Orbit Determination (CODE) precise satellite orbit and clock parameters together with the I08.ATX absolute GPS receiver and satellite antenna phase centre model (Schmid *et al.,* 2007) are used to generate daily position time series. The carrier phase ionosphere-free linear combination is used to correct the first order ionosphere. Higher-order ionospheric effects are not considered here, as Hernandez-Pajares et al. (2007) and Petrie et al. (2010) showed that these effects are less than 1 mm. Tropospheric effects are modelled using the Global Mapping Function which maps the zenith troposphere delay to the elevation of each observation *(*Böhm *et al.,* 2007). A 10° elevation cut-off angle is used, a compromise to constrain tropospheric effects but minimize multipath errors. Non-tidal atmospheric loading displacements are modelled according to the Ray and Ponte (2003). The effects of ocean loading, are corrected using the FES2004 model (Lyard *et al*., 2006) from the Onsala Space Observatory (holt.oso.chalmers.se/loading). Ambiguity resolution involves a recursive strategy that includes code and phase-based widelane, QIF and direct L1/L2 fixed ambiguities, depending upon baseline length. The ITRF2008 reference frame is realised through the Helmert three parameter transformation of the daily coordinate positions. Global IGS sites include sites on the stable Pacific, Antarctic and Australian plates. Regional filtering of the resulting daily-coordinate time series was performed to attenuate common mode error (Wdowinski *et al.*, 1997) using a set of New Zealand stations that have close to linear behaviour over the 2000-2009 time period. During this filtering, data outliers were removed using the Median Absolute Deviation (MAD) robust estimator at the 4 level with  = 1.4826 × MAD.

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Table S1. Velocities derived for the full data set.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Lon | Lat | VE mm/yr | VN mm/yr | 1s VE mm/yr | 1s VE mm/yr | site ID |
| 170.1233 | -45.5657 | -30.63 | 31.36 | 0.38 | 0.47 | DME1 |
| 170.2279 | -45.2029 | -26.66 | 34.66 | 0.38 | 0.45 | DME2 |
| 169.9035 | -44.9384 | -30.05 | 31.81 | 0.37 | 0.41 | DME3 |
| 169.3023 | -44.7486 | -27.90 | 32.78 | 0.38 | 0.35 | DME5 |
| 169.2061 | -44.2861 | -22.89 | 35.17 | 0.47 | 0.44 | DPX3 |
| 170.5173 | -45.3709 | -31.68 | 32.41 | 0.56 | 0.49 | DQYF |
| 170.3217 | -45.4670 | -32.13 | 31.72 | 0.70 | 0.63 | DQYG |
| 170.2160 | -45.3830 | -30.88 | 31.94 | 0.96 | 0.95 | DQYH |
| 170.0669 | -45.2849 | -30.39 | 32.35 | 0.69 | 0.43 | DQYJ |
| 169.8031 | -45.4785 | -30.02 | 31.84 | 0.45 | 0.48 | DQYK |
| 169.9785 | -45.0476 | -30.15 | 32.30 | 0.63 | 0.46 | DQYL |
| 169.6290 | -45.2628 | -29.93 | 32.52 | 0.38 | 0.39 | DQYM |
| 169.6155 | -45.1069 | -29.90 | 33.13 | 0.47 | 0.43 | DQYN |
| 169.3546 | -44.9333 | -29.15 | 32.88 | 0.38 | 0.37 | DQYP |
| 169.4253 | -45.6764 | -30.42 | 32.21 | 0.42 | 0.61 | DQYQ |
| 170.5972 | -45.8837 | -32.32 | 31.41 | 0.32 | 0.32 | DUND |
| 169.7664 | -45.9703 | -30.65 | 31.79 | 0.45 | 0.58 | DQYR |
| 170.0481 | -45.7819 | -31.07 | 31.75 | 0.41 | 1.01 | E2K3 |
| 169.1698 | -45.0804 | -29.26 | 32.91 | 0.55 | 0.42 | E2K4 |
| 169.3207 | -45.4739 | -29.03 | 32.20 | 0.41 | 0.68 | E2K6 |
| 170.0812 | -46.2019 | -30.00 | 33.36 | 0.68 | 0.73 | ECFG |
| 170.1212 | -46.1465 | -30.59 | 33.28 | 0.88 | 0.47 | ECFH |
| 170.1505 | -46.1631 | -30.30 | 33.18 | 0.73 | 0.54 | ECFJ |
| 170.2184 | -46.0559 | -29.95 | 34.66 | 1.36 | 1.14 | ECFK |
| 169.3731 | -46.1297 | -30.28 | 32.87 | 0.83 | 0.52 | EEBF |
| 168.8212 | -45.9130 | -30.92 | 33.37 | 0.72 | 0.51 | EEBG |
| 168.7086 | -45.4565 | -29.75 | 34.46 | 1.17 | 0.52 | EEBH |
| 168.7557 | -45.1280 | -29.52 | 33.52 | 0.76 | 0.77 | EEBJ |
| 169.4964 | -44.6977 | -29.28 | 32.57 | 0.87 | 0.75 | EEBK |
| 169.8669 | -44.5438 | -29.97 | 32.26 | 1.07 | 0.62 | EEBL |
| 170.2489 | -44.6176 | -32.47 | 30.83 | 0.97 | 0.89 | EEBM |
| 170.5342 | -44.8071 | -32.20 | 31.45 | 0.71 | 0.56 | EEBN |
| 170.7002 | -44.9825 | -31.86 | 31.49 | 0.74 | 0.59 | EEBP |
| 169.3083 | -45.2310 | -30.92 | 31.42 | 0.30 | 0.30 | LEXA |
| 170.5109 | -45.8695 | -31.74 | 31.13 | 0.22 | 0.22 | OUSD |

Table S2. Velocities derived for data set recorded before July 2009.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Lon | Lat | VE mm/yr | VN mm/yr | 1s VE mm/yr | 1s VE mm/yr | site ID |
| 170.1233 | -45.5657 | -30.63 | 31.36 | 0.51 | 0.58 | DME1 |
| 170.2279 | -45.2029 | -26.66 | 34.66 | 0.47 | 0.53 | DME2 |
| 169.9035 | -44.9384 | -30.05 | 31.81 | 0.47 | 0.49 | DME3 |
| 169.3023 | -44.7486 | -27.90 | 32.78 | 0.47 | 0.45 | DME5 |
| 169.2061 | -44.2861 | -22.89 | 35.17 | 0.53 | 0.50 | DPX3 |
| 170.5173 | -45.3709 | -31.68 | 32.41 | 0.67 | 0.62 | DQYF |
| 170.3217 | -45.4670 | -32.13 | 31.72 | 0.80 | 0.73 | DQYG |
| 170.2160 | -45.3830 | -30.88 | 31.94 | 1.03 | 1.02 | DQYH |
| 170.0669 | -45.2849 | -30.39 | 32.35 | 0.78 | 0.57 | DQYJ |
| 169.8031 | -45.4785 | -30.02 | 31.84 | 0.59 | 0.61 | DQYK |
| 169.9785 | -45.0476 | -30.15 | 32.30 | 0.73 | 0.59 | DQYL |
| 169.6290 | -45.2628 | -29.93 | 32.52 | 0.53 | 0.54 | DQYM |
| 169.6155 | -45.1069 | -29.90 | 33.13 | 0.60 | 0.57 | DQYN |
| 169.3546 | -44.9333 | -29.15 | 32.88 | 0.54 | 0.54 | DQYP |
| 169.4253 | -45.6764 | -30.42 | 32.21 | 0.56 | 0.71 | DQYQ |
| 170.5972 | -45.8837 | -33.62 | 30.93 | 0.42 | 0.42 | DUND |
| 169.7664 | -45.9703 | -31.39 | 32.32 | 0.56 | 0.65 | DQYR |
| 170.0481 | -45.7819 | -31.82 | 32.22 | 0.55 | 1.01 | E2K3 |
| 169.1698 | -45.0804 | -31.14 | 33.63 | 0.65 | 0.57 | E2K4 |
| 169.3207 | -45.4739 | -31.37 | 33.03 | 0.72 | 0.79 | E2K6 |
| 170.0812 | -46.2019 | -26.96 | 25.03 | 3.82 | 4.53 | ECFG |
| 170.1212 | -46.1465 | -32.30 | 33.88 | 0.93 | 1.02 | ECFH |
| 169.3083 | -45.2310 | -29.30 | 32.50 | 0.40 | 0.40 | LEXA |
| 170.5109 | -45.8695 | -32.27 | 31.16 | 0.26 | 0.26 | OUSD |

Table S3. Velocities derived from data recorded after July 2009.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Lon | Lat | VE mm/yr | VN mm/yr | 1s VE mm/yr | 1s VE mm/yr | site ID |
| 170.1233 | -45.5657 | -33.78 | 33.21 | 1.25 | 1.25 | DME1 |
| 170.2279 | -45.2029 | -28.25 | 35.96 | 0.67 | 0.67 | DME2 |
| 169.9035 | -44.9384 | -32.83 | 33.06 | 0.92 | 0.92 | DME3 |
| 169.3023 | -44.7486 | -30.75 | 33.03 | 1.01 | 1.01 | DME5 |
| 169.2061 | -44.2861 | -27.57 | 34.48 | 1.75 | 1.75 | DPX3 |
| 170.5173 | -45.3709 | -34.44 | 32.72 | 0.78 | 0.78 | DQYF |
| 170.3217 | -45.4670 | -32.33 | 32.34 | 0.64 | 0.64 | DQYG |
| 170.2160 | -45.3830 | -33.35 | 31.96 | 1.08 | 1.08 | DQYH |
| 170.0669 | -45.2849 | -34.52 | 32.93 | 1.00 | 1.00 | DQYJ |
| 169.8031 | -45.4785 | -33.51 | 32.56 | 0.86 | 0.86 | DQYK |
| 169.6290 | -45.2628 | -32.25 | 33.15 | 0.81 | 0.81 | DQYM |
| 169.6155 | -45.1069 | -32.61 | 33.14 | 0.78 | 0.78 | DQYN |
| 169.3546 | -44.9333 | -30.91 | 32.82 | 0.76 | 0.76 | DQYP |
| 169.4253 | -45.6764 | -31.94 | 32.61 | 0.92 | 0.92 | DQYQ |
| 170.5972 | -45.8837 | -33.62 | 30.93 | 0.51 | 0.51 | DUND |
| 170.0481 | -45.7819 | -33.04 | 33.57 | 1.17 | 1.17 | E2K3 |
| 169.1698 | -45.0804 | -31.15 | 32.71 | 0.82 | 0.82 | E2K4 |
| 169.3207 | -45.4739 | -31.76 | 31.55 | 1.60 | 1.60 | E2K6 |
| 170.0812 | -46.2019 | -31.40 | 31.98 | 0.63 | 0.63 | ECFG |
| 170.1212 | -46.1465 | -32.75 | 32.74 | 0.67 | 0.67 | ECFH |
| 170.1505 | -46.1631 | -31.81 | 32.22 | 0.64 | 0.64 | ECFJ |
| 170.2184 | -46.0559 | -33.62 | 32.52 | 1.30 | 1.30 | ECFK |
| 169.3731 | -46.1297 | -31.41 | 32.70 | 0.53 | 0.53 | EEBF |
| 168.8212 | -45.9130 | -30.92 | 33.33 | 0.73 | 0.73 | EEBG |
| 168.7086 | -45.4565 | -31.08 | 34.31 | 0.82 | 0.82 | EEBH |
| 168.7557 | -45.1280 | -31.23 | 33.14 | 0.80 | 0.80 | EEBJ |
| 169.4964 | -44.6977 | -29.99 | 32.07 | 0.82 | 0.82 | EEBK |
| 169.8669 | -44.5438 | -30.69 | 32.47 | 1.12 | 1.12 | EEBL |
| 170.2489 | -44.6176 | -33.13 | 30.37 | 1.01 | 1.01 | EEBM |
| 170.5342 | -44.8071 | -32.76 | 31.00 | 0.66 | 0.66 | EEBN |
| 170.7002 | -44.9825 | -32.47 | 31.50 | 0.67 | 0.67 | EEBP |
| 169.3083 | -45.2310 | -30.90 | 31.40 | 0.46 | 0.46 | LEXA |
| 170.5109 | -45.8695 | -31.73 | 31.58 | 0.42 | 0.42 | OUSD |