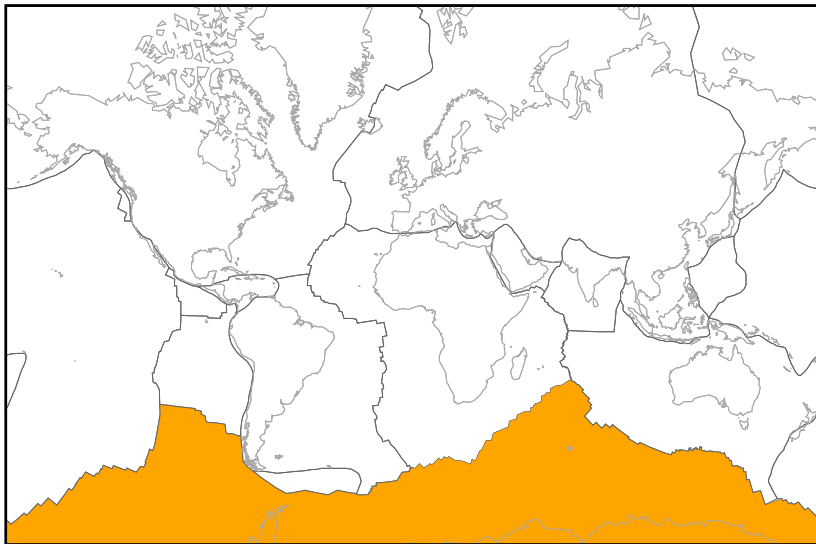


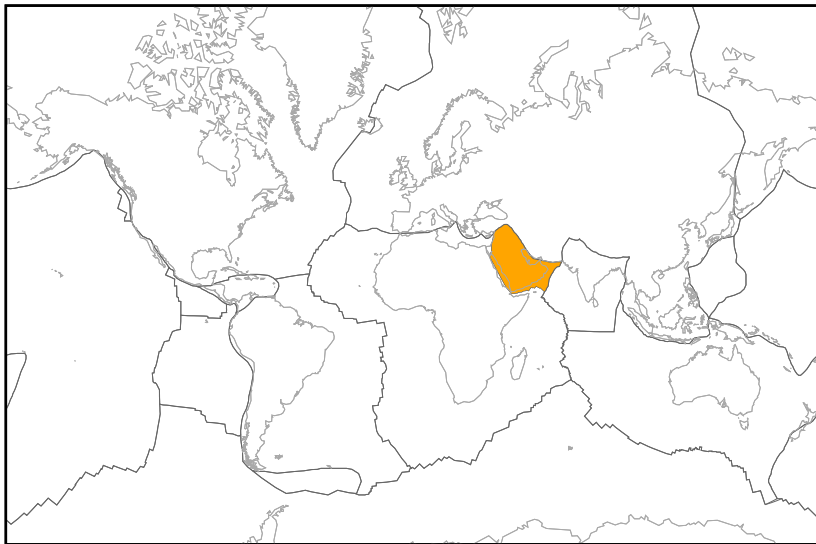
podział na płyty kontynentalne wg modelu NUVEL



afrykańska



antarktyczna



arabska



australijska

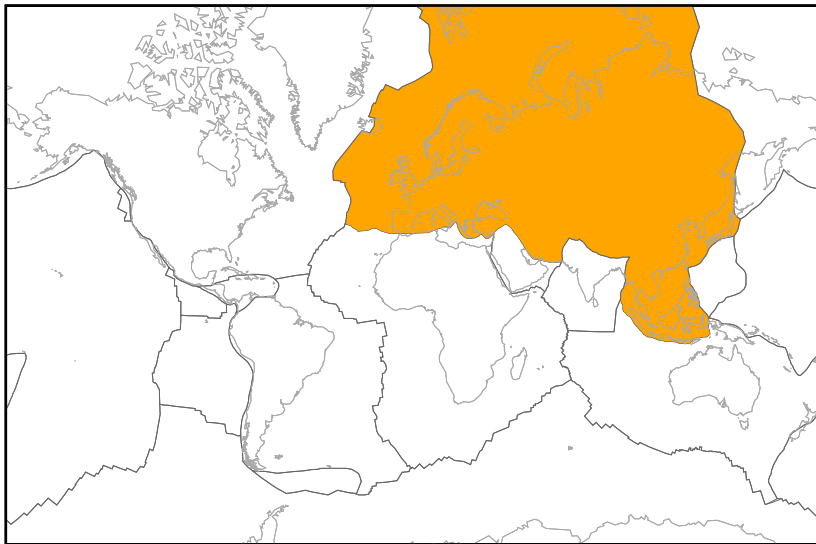


karaibska



kokosowa





euroazjatycka



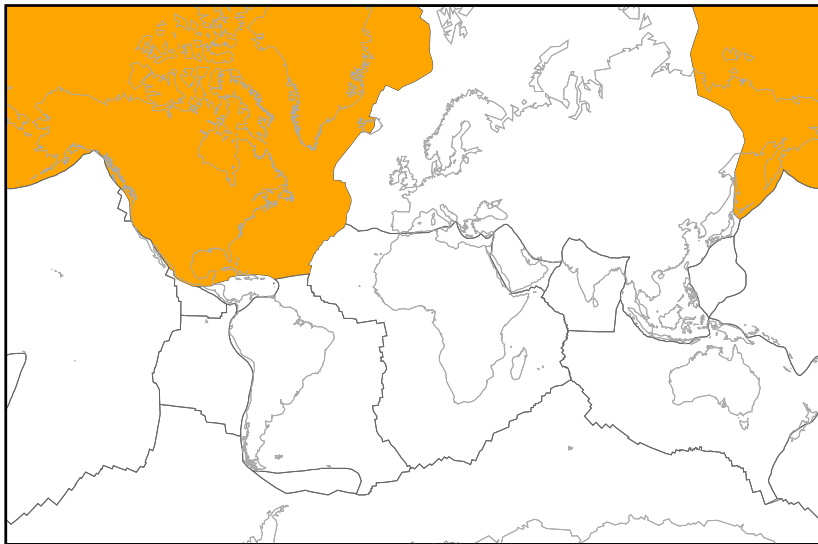
indyjska



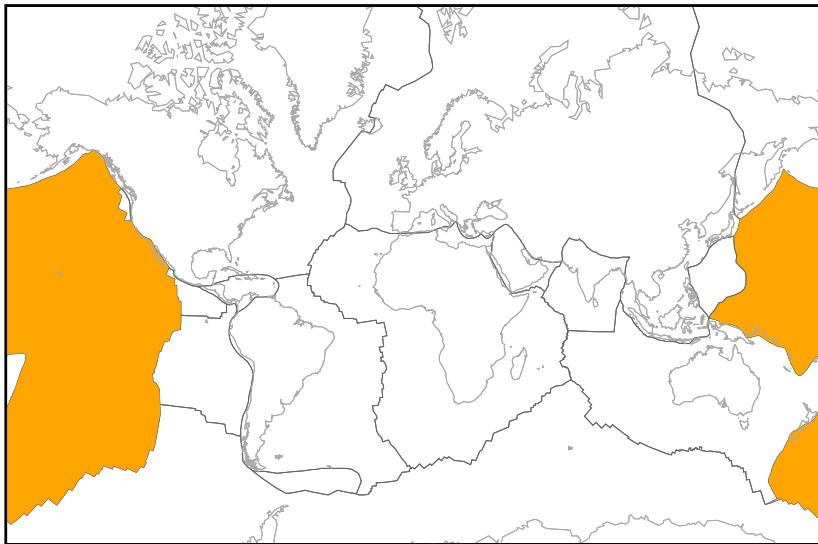
Juan de Fuca



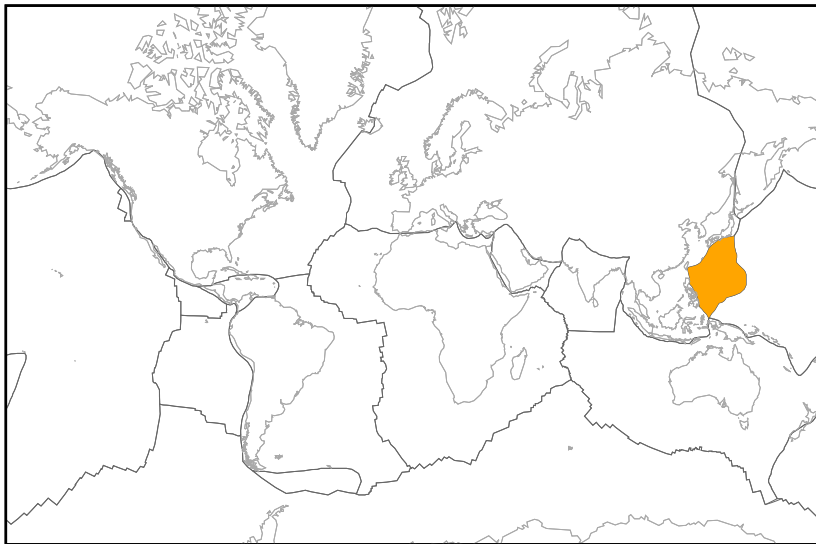
Nazca



północnoamerykańska



pacyficzna



filipińska

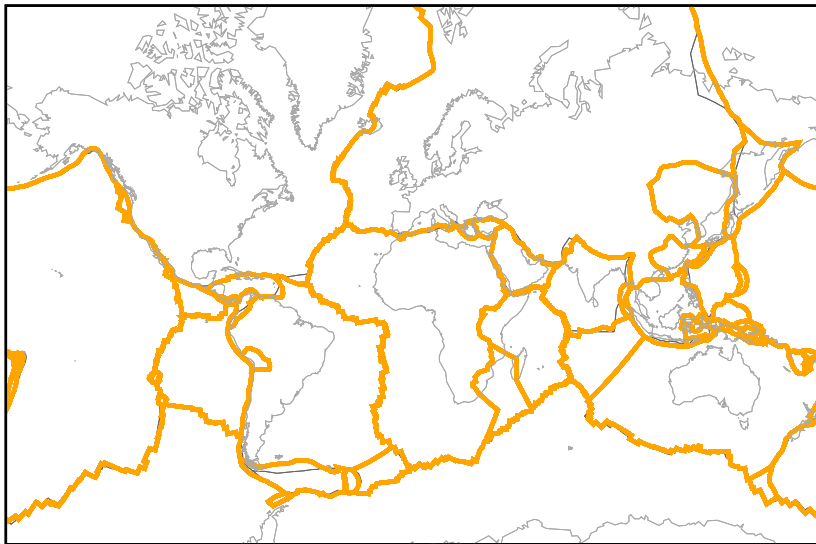


scotia





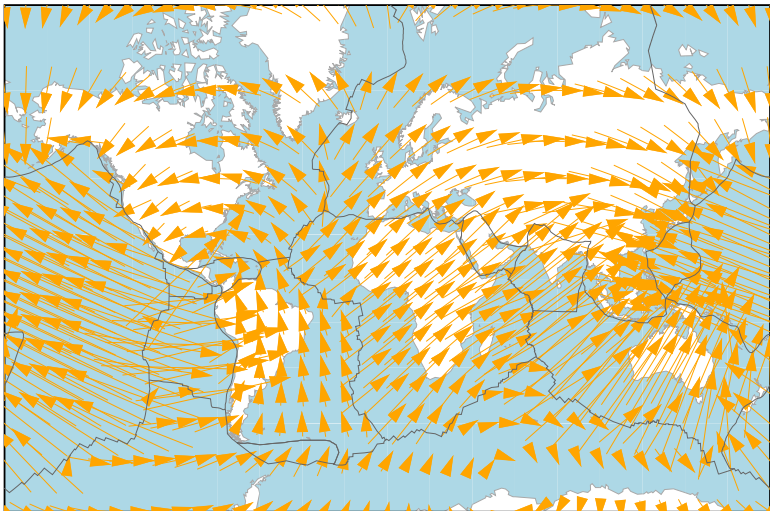
południowoamerykańska



podział na płyty kontynentalne wg modelu MORVEL

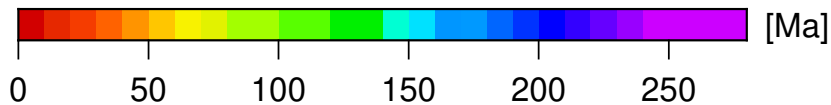
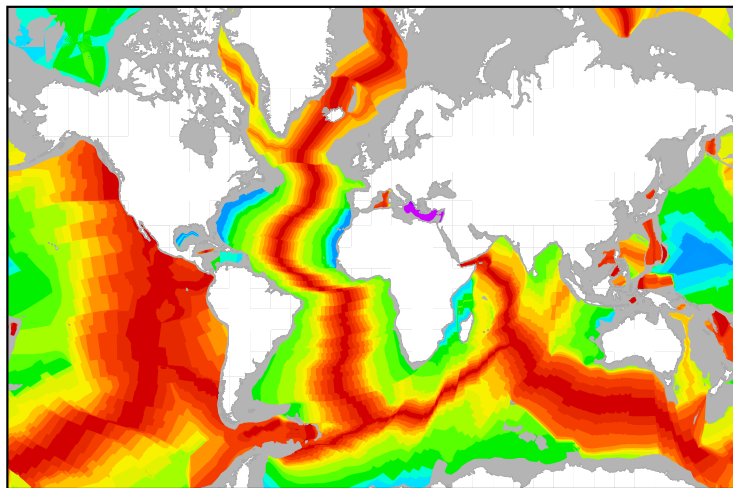


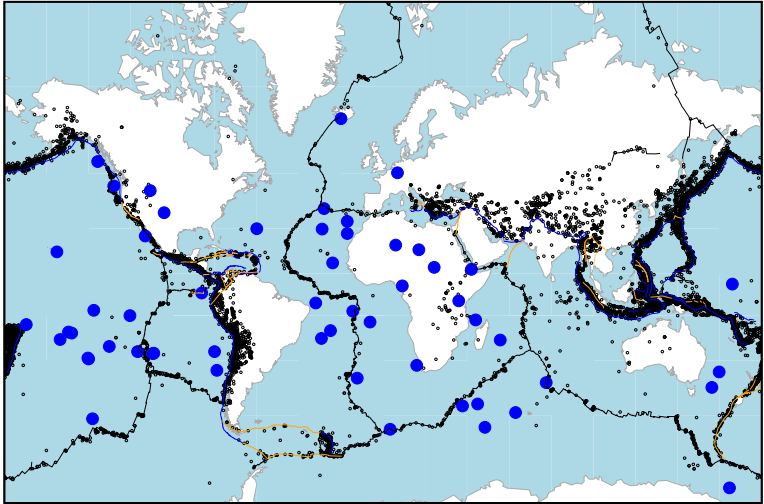
**Rysunek:** <http://www.ucmp.berkeley.edu/history/??????.html>

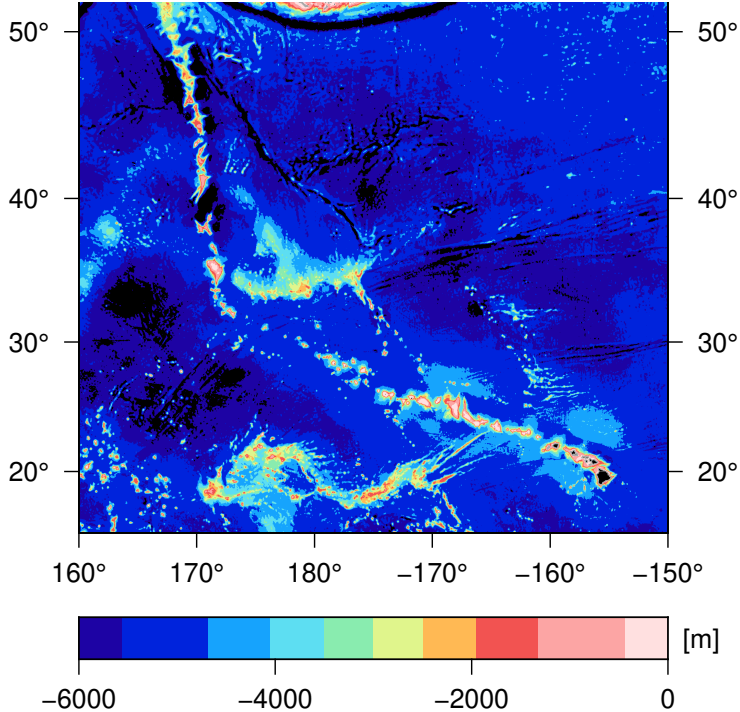


**Skąd znamy te prędkości?**

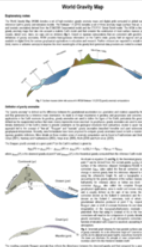
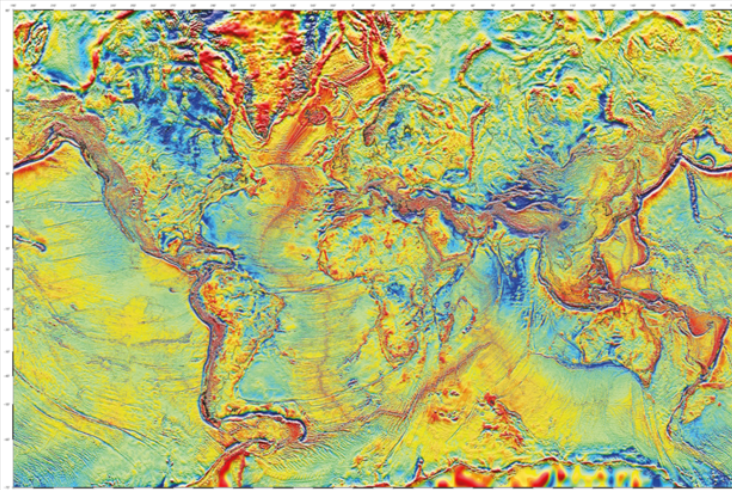
## Wiek dna











**Introduction**

The Earth's gravity field is a complex phenomenon that reflects the distribution of mass within the planet. This map provides a global view of the gravity anomalies, which are deviations from the expected gravity values based on a smooth Earth model. The anomalies are caused by variations in the density of the Earth's crust and upper mantle.

**Methodology**

The data for this map were collected from a variety of satellite and ground-based measurements. The satellite data include altimetry, laser altimetry, and satellite gravimetry. The ground-based data include gravimetry and geodesy. The data were processed using advanced techniques to produce a global gravity field model.

**Scale**

Scale: 1:100,000,000 (approximate)

**Projection**

Projection: WGS 84 UTM (Universal Transverse Mercator)

**Units**

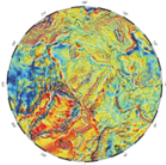
Units: Gravity anomalies are shown in mGal (milliGalileos). The color scale ranges from -100 mGal (blue) to 100 mGal (red).

**References**

1. International Gravity Field Model (IGF06) - International Gravity Field Model (IGF06) - International Gravity Field Model (IGF06)

2. Earth Gravity Field Model (EGM08) - Earth Gravity Field Model (EGM08) - Earth Gravity Field Model (EGM08)

3. Gravity Field and Steady-State Ocean Circulation (GSO) - Gravity Field and Steady-State Ocean Circulation (GSO) - Gravity Field and Steady-State Ocean Circulation (GSO)



COMMISSION FOR THE GEOLOGICAL MAP OF THE WORLD (CGMW) / COMMISSION INTERNATIONALE DE LA CARTE GÉOLOGIQUE DU MONDE (CIGM)

## WORLD GRAVITY MAP / CARTE GRAVIMÉTRIQUE MONDIALE

(3) FREE-AIR ANOMALY ON THE EARTH'S SURFACE / ANOMALIE À L'AIR LIBRE SUR LA SURFACE TERRESTRE

Scale: 1:100,000,000 (approximate)

UNIT: mGal

© BENOÎT G. BOUQUIN, BRUNO M. KRAUS, FLORENTIN M. TALLU, R. SANDRILLO, G. SANGIULI, S. MARINO, F. MARINO, M. SANDRILLO

Bureau Gravimétrique International (BGI)

Geological Survey of Canada (GSC) - Institut canadien de géologie (ICG)

National Institute of Earth Science (NIES) - Institut national de la recherche scientifique (INRS)

International Association of Geodesy (IAGG) - International Association of Geodesy (IAGG)

International Gravity Field Model (IGF06) - International Gravity Field Model (IGF06)

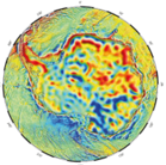
Earth Gravity Field Model (EGM08) - Earth Gravity Field Model (EGM08)

Gravity Field and Steady-State Ocean Circulation (GSO) - Gravity Field and Steady-State Ocean Circulation (GSO)

International Gravity Field Model (IGF06) - International Gravity Field Model (IGF06)

Earth Gravity Field Model (EGM08) - Earth Gravity Field Model (EGM08)

Gravity Field and Steady-State Ocean Circulation (GSO) - Gravity Field and Steady-State Ocean Circulation (GSO)



**Jak opisać ruch płyty?**

# Jak opisać ruch płyty?

## Twierdzenie Eulera

położenie bieguna Eulera ( $\Phi, \Lambda$ )

prędkość kątowna ( $\Omega$ )

(kąt przeciwnie do ruchu wskazówek zegara)

Table S4. NNR-MORVEL56 angular velocities and full covariance matrix

-----  
 NNR-MORVEL56 Angular Velocities  
 (no-net-rotation frame fixed)

Ab	Lat deg N	Lon deg E	Omega deg/Ma
pa	-63.5756	114.6975	0.6509
am	63.1704	-122.8242	0.2973
an	65.4235	-118.1053	0.2500
ar	48.8807	-8.4909	0.5588
au	33.8612	37.9414	0.6316
ca	35.1956	-92.6236	0.2862
co	26.9346	-124.3074	1.1978
cp	44.4352	23.0880	0.6080
eu	48.8509	-106.5007	0.2227
in	50.3722	-3.2898	0.5438
jf	-38.3086	60.0379	0.9513
lw	51.8860	-69.5195	0.2856
na	-4.8548	-80.6447	0.2087
nb	47.6763	-68.4377	0.2921
mq	49.1891	11.0524	1.1440
nz	46.2348	-101.0564	0.6957
ps	-46.0242	-31.3615	0.9098
ri	20.2450	-107.2861	4.5359
sa	-22.6179	-112.8327	0.1090
sc	22.5244	-106.1485	0.1464
sm	49.9506	-84.5154	0.3393
sr	-32.4957	-111.3224	0.1072
su	50.0558	-95.0218	0.3368
sw	-29.9420	-36.8671	1.3616
yz	63.0285	-116.6180	0.3335
SL	50.7058	-143.4675	0.2677
BH	-39.9983	100.4994	0.7988

MO	14.2480	92.6656	0.7742
SS	-2.8685	130.6236	1.7029
WL	0.1050	128.5186	1.7444
CR	-20.3985	170.5303	3.9232
FT	-16.3322	178.0679	5.1006
KE	39.9929	6.4584	2.3474
NI	-3.2883	-174.4882	3.3136
TO	25.8737	4.4767	8.9417
PM	31.3510	-113.9038	0.3171
AS	19.4251	122.8665	0.1239
AT	40.1121	26.6585	1.2105
GP	2.5287	81.1806	5.4868
EA	24.9729	67.5269	11.3343
JZ	34.2507	70.7429	22.3676
OK	30.3022	-92.2813	0.2290
NB	-45.0406	127.6370	0.8563
SB	6.8767	-31.8883	8.1107
MN	-3.6699	150.2676	51.5690
NH	0.5684	-6.6018	2.4688
BR	-63.7420	142.0636	0.4898
CL	-72.7849	72.0525	0.6066
MA	11.0533	137.8404	1.3061
ND	17.7331	-122.6815	0.1162
AP	-6.5763	-83.9776	0.4881
BU	-6.1254	-78.1008	2.2287
MS	2.1477	-56.0916	3.5655
BS	-1.4855	121.6413	2.4753
TI	-4.4363	113.4976	1.8639
ON	36.1163	137.9182	2.5391
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$$\frac{d\varphi}{dt} = \Omega \cdot \cos \Phi \cdot \sin(\lambda - \Lambda)$$

$$\frac{d\lambda}{dt} = \Omega \cdot [\sin \Phi - \cos(\lambda - \Lambda) \cdot \operatorname{tg} \varphi \cos \Phi]$$

## EU NNR-NUVEL1

$$\Omega = 0.2337^\circ / 10^6 \text{ lat},$$

$$\Lambda = 247.725^\circ,$$

$$\Phi = 50.631^\circ$$

$$\frac{d\varphi}{dt} = \Omega \cdot \cos \Phi \cdot \sin(\lambda - \Lambda)$$

$$\frac{d\lambda}{dt} = \Omega \cdot [\sin \Phi - \cos(\lambda - \Lambda) \cdot \operatorname{tg} \varphi \cos \Phi]$$

$V_n, V_e, V_u$  ?  
 $V, \alpha$  ?

**EU NNR-NUVEL1**

$$\Omega = 0.2337^\circ / 10^6 \text{ lat},$$

$$\Lambda = 247.725^\circ,$$

$$\Phi = 50.631^\circ$$

## EU NNR-NUVEL1

$$\omega_X = -0.000981,$$

$$\omega_Y = -0.002395,$$

$$\omega_Z = 0.003153 \text{ [rad}/10^6 \text{ lat]}$$



$$V_X = \omega_Y Z - \omega_Z Y$$

$$V_Y = \omega_Z X - \omega_X Z$$

$$V_Z = \omega_X Y - \omega_Y X$$

## EU NNR-NUVEL1

$$\omega_X = -0.000981,$$

$$\omega_Y = -0.002395,$$

$$\omega_Z = 0.003153 \text{ [rad}/10^6 \text{ lat]}$$

## Do układu lokalnego

## Do układu lokalnego

$$\begin{bmatrix} V_e \\ V_n \\ V_u \end{bmatrix} = \begin{bmatrix} -\sin \lambda & \cos \lambda & 0 \\ -\sin \varphi \cos \lambda & -\sin \varphi \sin \lambda & \cos \varphi \\ \cos \varphi \cos \lambda & \cos \varphi \sin \lambda & \sin \varphi \end{bmatrix} \cdot \begin{bmatrix} V_x \\ V_y \\ V_z \end{bmatrix}$$



*O modelach ruchu płyt (b.d.)*. URL: <http://www.ucmp.berkeley.edu/geology/tectonics.html>.



UNAVCO *plate motion calculator (b.d.)*. URL: [http://www.unavco.org/community\\_science/science-support/crustal\\_motion/dxdt/model.html](http://www.unavco.org/community_science/science-support/crustal_motion/dxdt/model.html).