

Comprehending Complexity

- building an holistic view of the Universe

The Experts Network

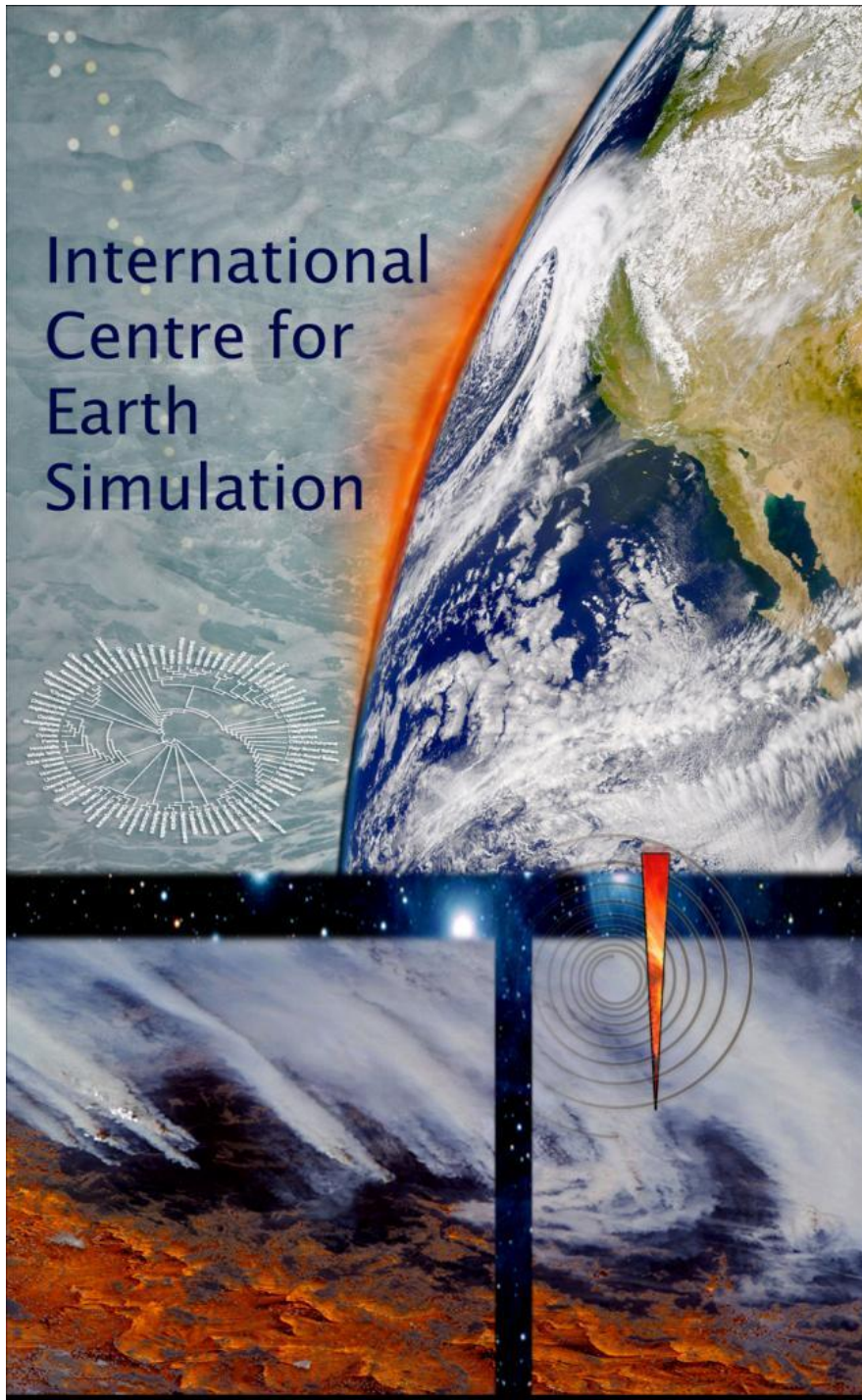
Bob Bishop

Geneva, 2 July 2014

Changing Paradigm

- Planet under pressure – 7 billion people
- Emissions, pollution, resource depletion
- Energy, water, food, land-use, urbanisation
- Stressed out governments, corporations, public
- **Need new picture of the planet = transition + big pivot**
- Internet-of-Things is here = deluge of big data
- Good time for innovation, creativity, start-ups
- New tools for comprehending complexity
- Real-time predictive visual data analytics

International Centre for Earth Simulation



ICES is a platform to integrate expertise:

science of space

+

bio-geo-physical of Earth

+

food-water-energy-waste

+

socio-economics



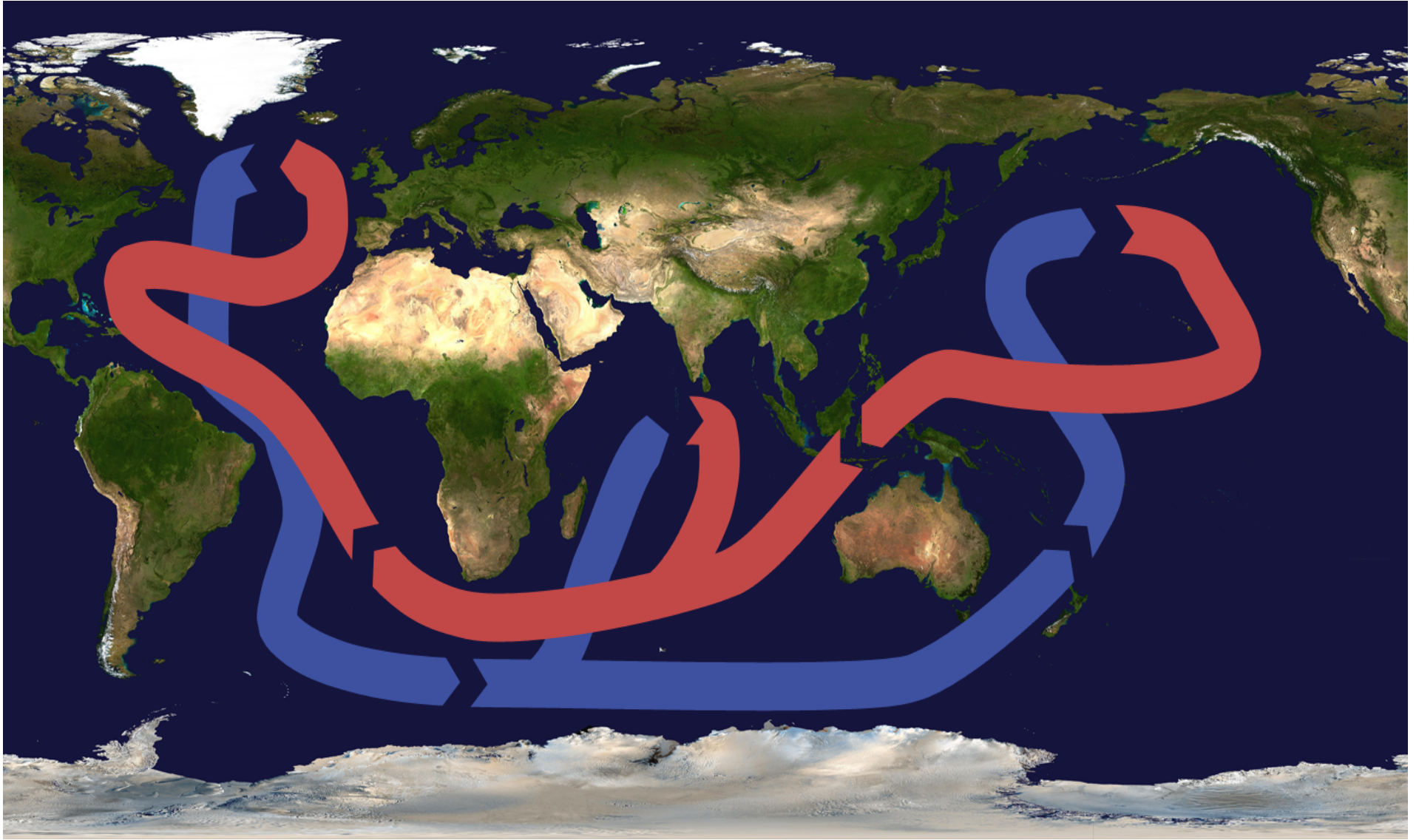
Southern Ocean from Encounter Bay - Australia



1802: Nicolas Baudin & Matthew Flinders



The Great Ocean Conveyor Belt



Thermohaline circulation by Brisbane CC BY-SA 3.0 using
NASA Goddard Space Flight Center images from Visible Earth

When things go wrong!



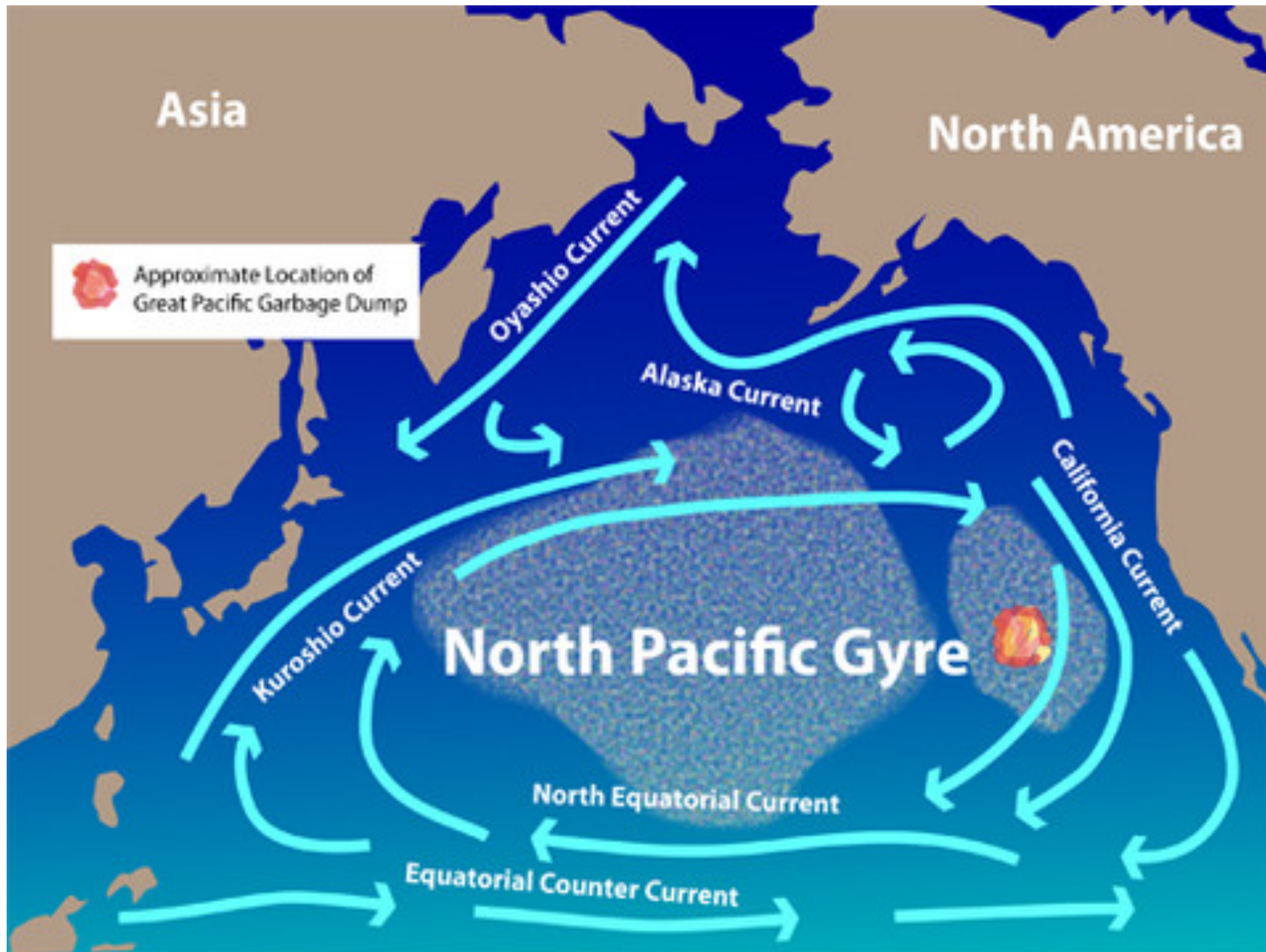
Japan Earthquake & Tsunami 11 March 2011

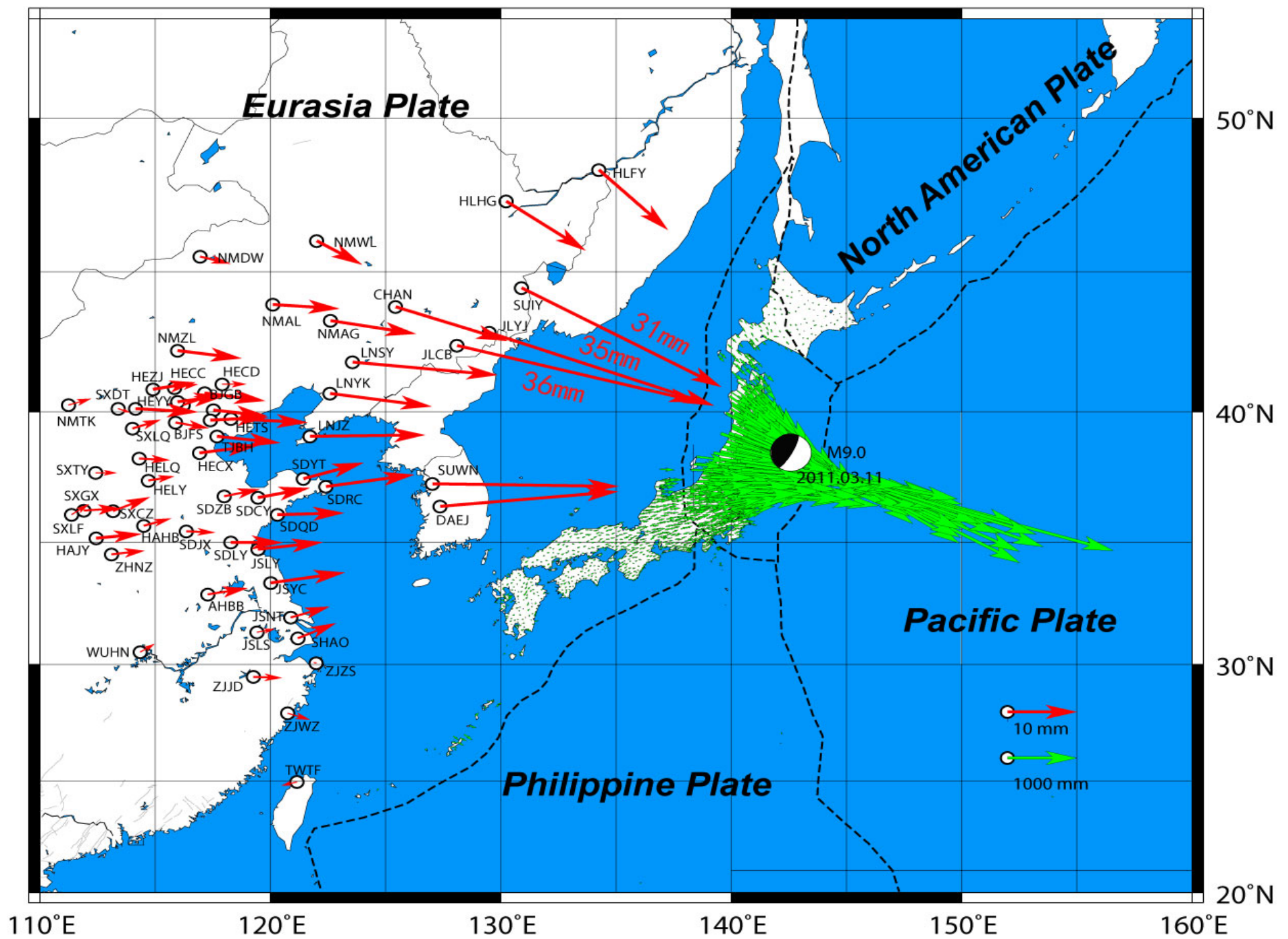


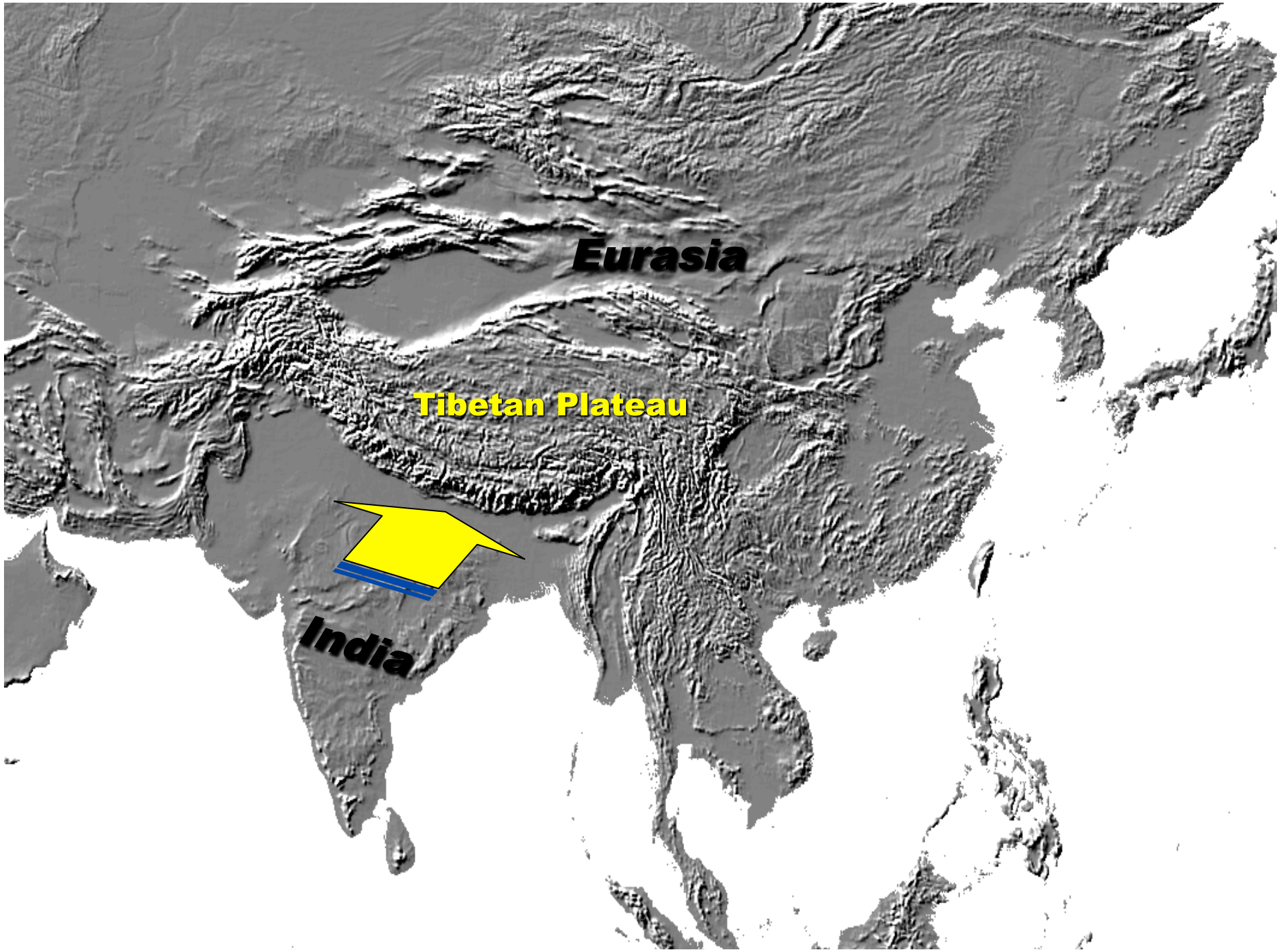
U.S. Navy photo by Mass Communication Specialist 3rd Class Kevin B. Gray/Released)

Japan: cascading impact across all of society

- M9.0 earthquake offshore 11.03.2011
- 10m tsunami strikes NE coastline of Japan
- Water surge to 45m height in coastal valleys
- 400,000 structures destroyed + 18,500 lives
- Global manufacturing supply chain disrupted
- 3 nuclear reactors meltdown - towns evacuated
- TEPCO bankrupt, Prime Minister Kan resigns
- Switzerland & Germany decommit nuclear power
- Global nuclear industry standards changed forever
- Radio-active contamination of Pacific fish stock detected





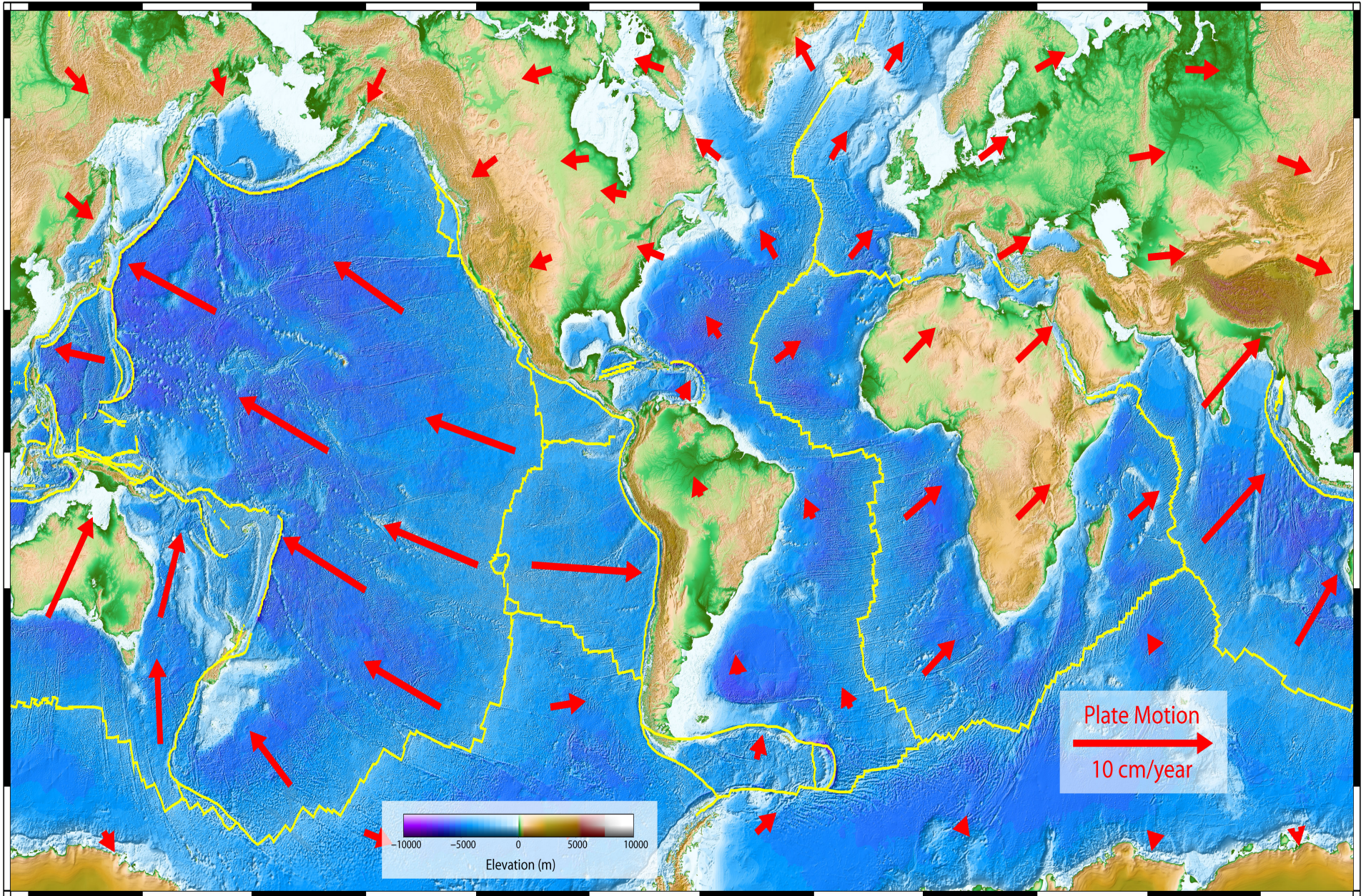


Eurasia

Tibetan Plateau

India

Continental drift, plate tectonics & subduction



The Ring of Fire includes 452 major volcanoes!



Mount St. Helens eruption 1980



Cascadia Subduction Zones & Volcanoes





Cascadia Resilience Center

Animations of Earth and Sun

Understanding global aerosol transportation

<http://www.youtube.com/watch?v=t9GgII0tbHA>

Understanding ocean eddy currents

<http://www.youtube.com/watch?v=CCmTY0PKGDS>

Understanding the global ocean conveyor belt

http://www.youtube.com/watch?v=3niR_-Kv4SM

Simulation of Antarctic ice flows

<http://www.youtube.com/watch?v=ptqQmPdHDz4>

The Sun is a continuous nuclear reaction

<http://www.youtube.com/watch?v=jt0Hlc9hTVI>

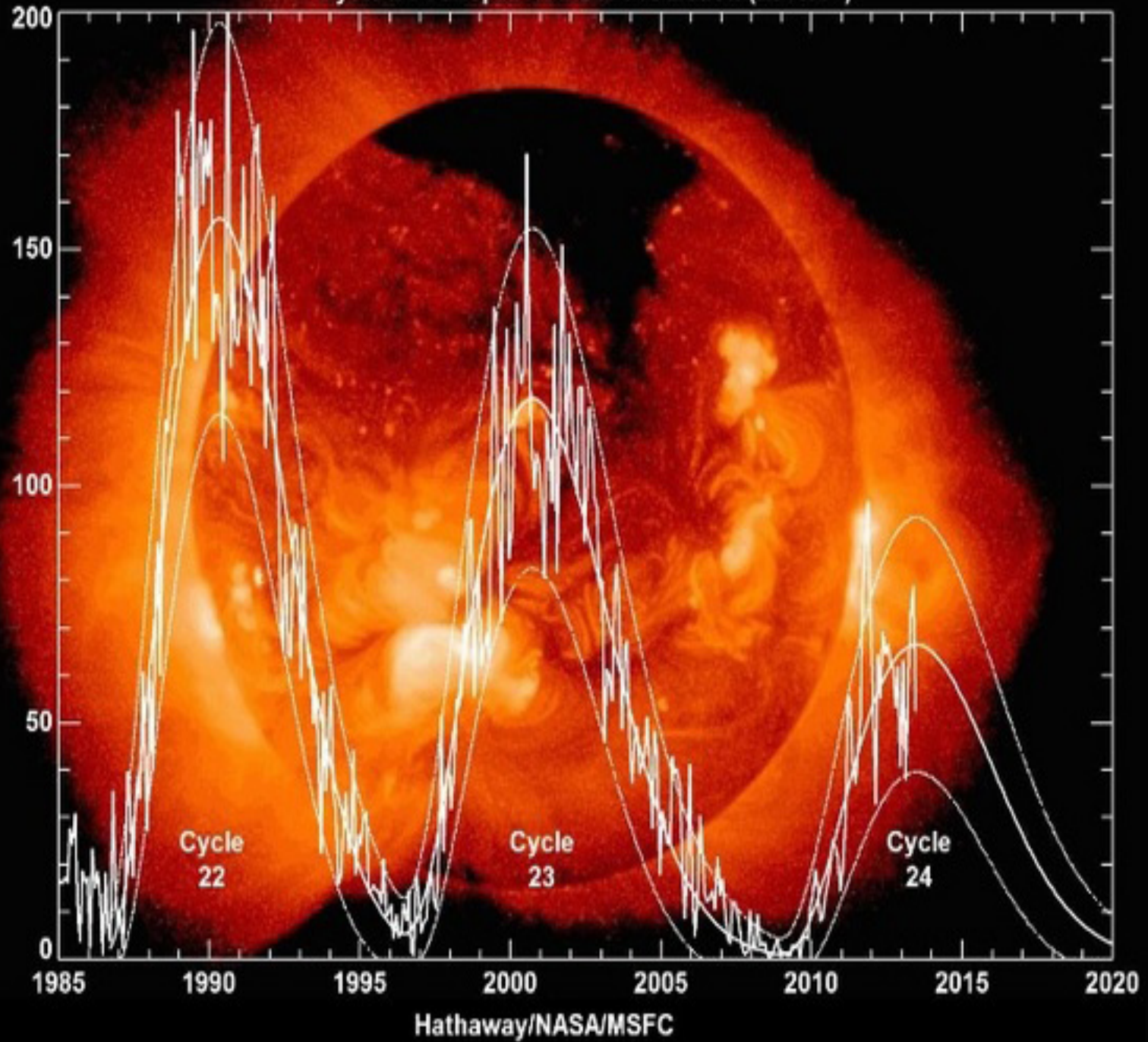
The Sun throws out radiation, high energy particles and CMEs

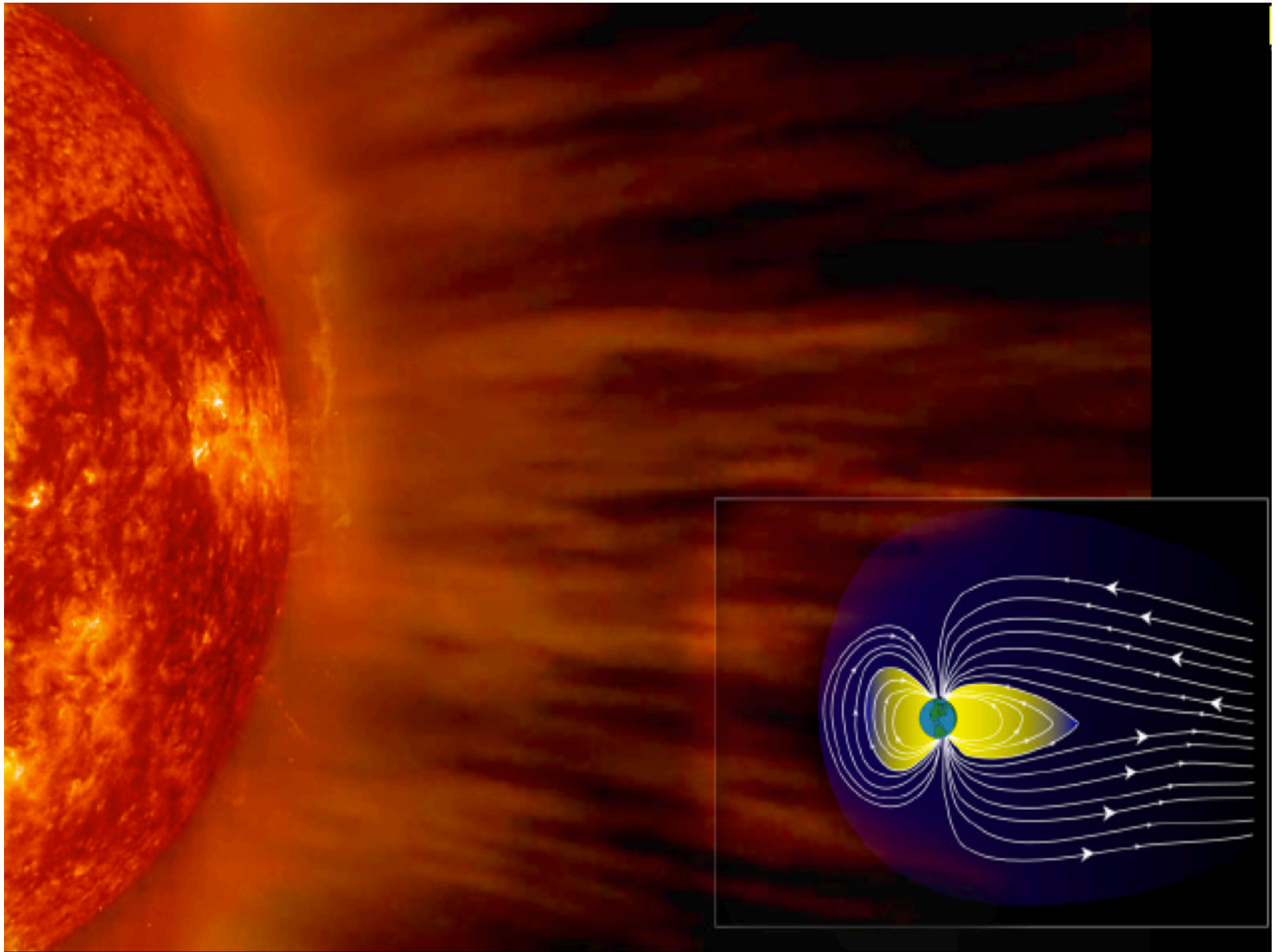
<http://www.youtube.com/watch?v=sg3NAdOYp8Q>

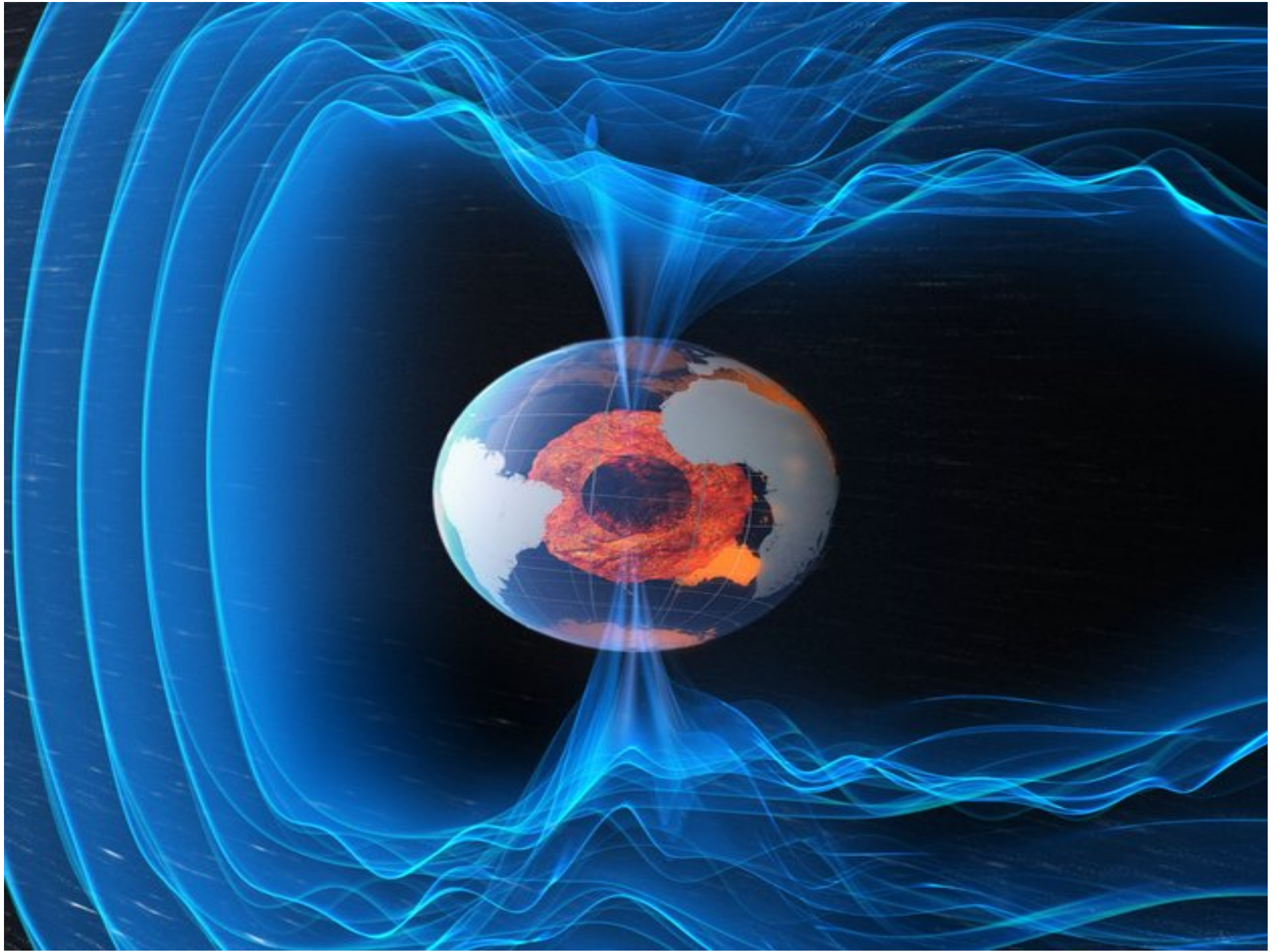
Understanding potential asteroid impacts

<http://www.youtube.com/watch?v=66mHHaWtlt0&list=PL3wsGij5ig-F130HGWXL6acsM1xhd8PEm>

Cycle 24 Sunspot Number Prediction (2013/07)



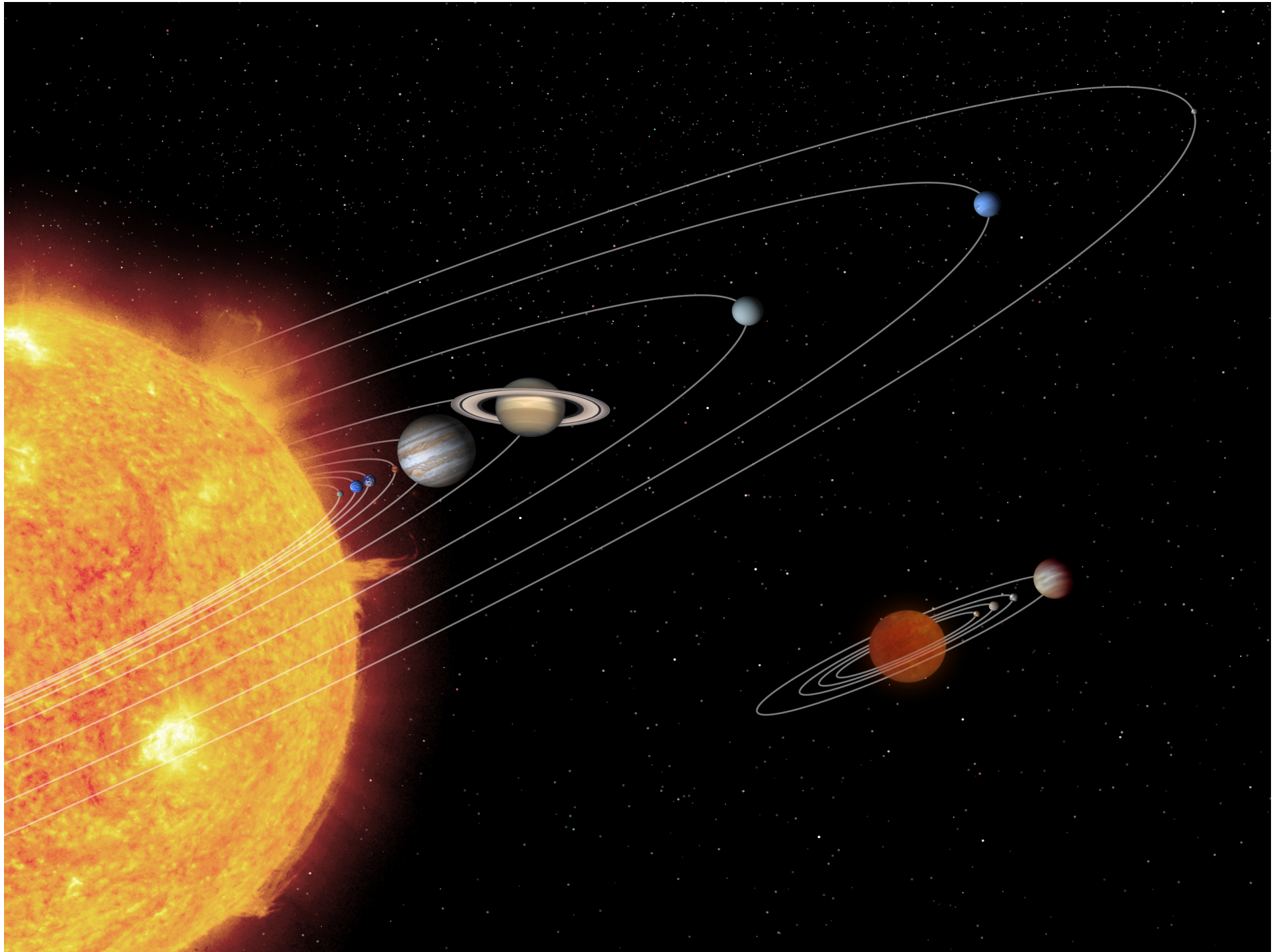


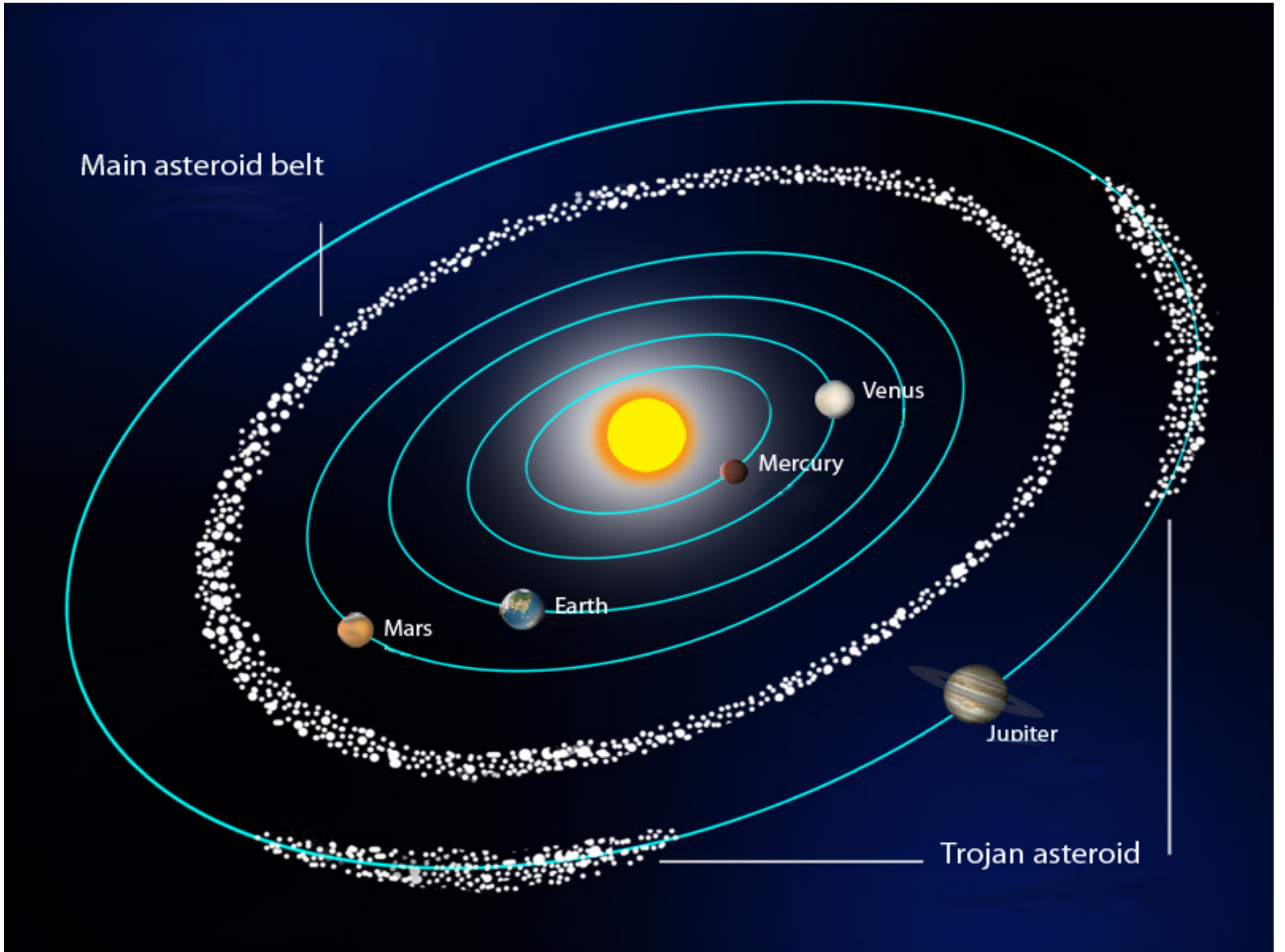
















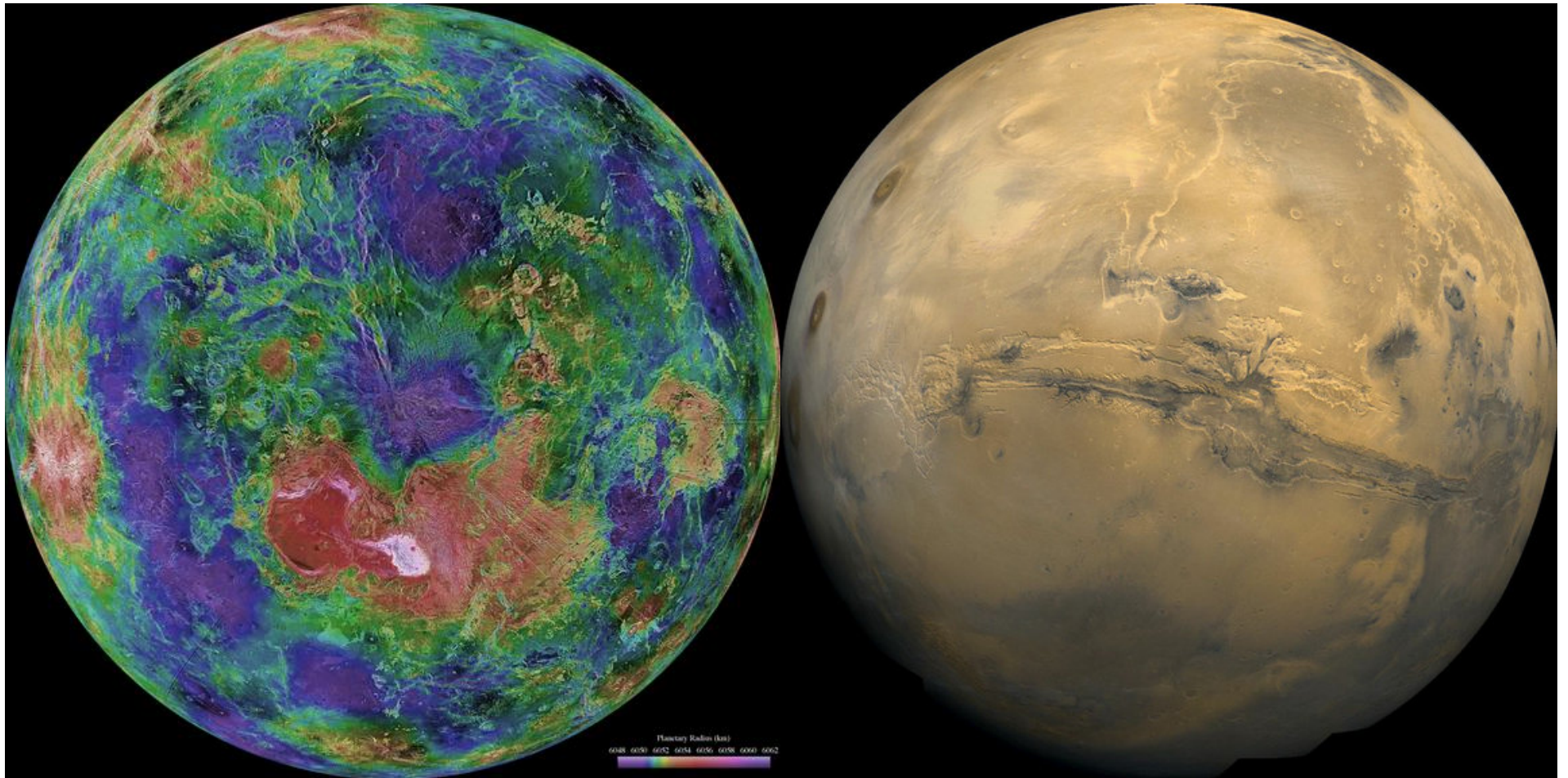
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RESOURCES™

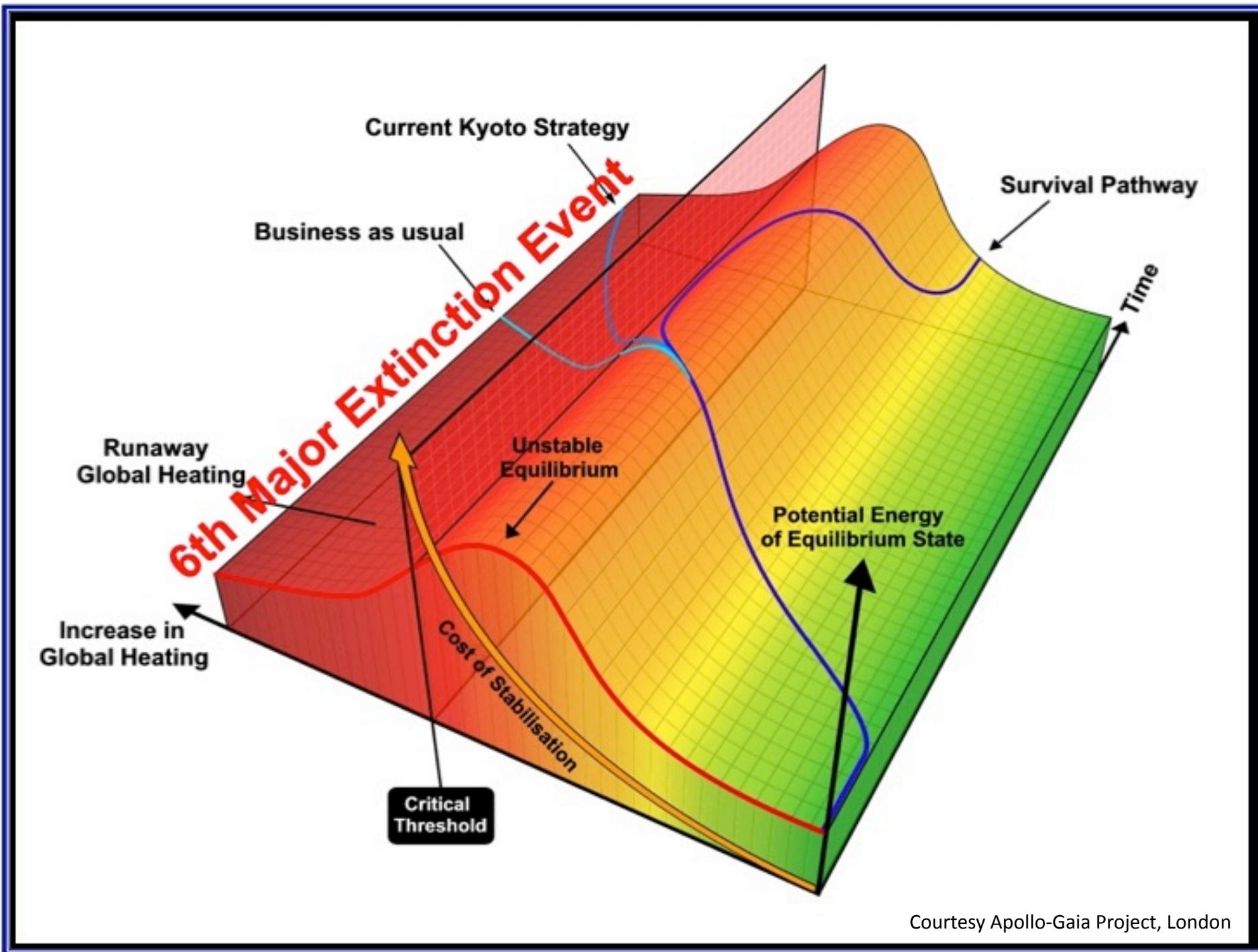
THE ASTEROID MINING COMPANY



The Road Ahead

Could Future Earth = Venus? Mars?





Courtesy Apollo-Gaia Project, London

Modeling
Simulation
Supervisualization

...

Retreat from Tipping Points

Towards a Green & Circular Economy

Accounting for Natural Capital + Ecological Services

Civic Engagement

...

Visualisation helps to enlighten!
Evidence-based decision making
Downscaling from global to local



**Helping guide the successful transformation of human society
in an era of rapid climate change and frequent natural disasters.**

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