The disturbance in the core’s natural motion causes the earth

Science, Physics

The plot of the 2003 movie “ The Core” is centered on the apparent ceasing of the core’s rotation and the ensuing catastrophes that threaten to obliterate life on earth within a year’s time.

The disturbance in the core’s natural motion causes the Earth’s magnetic field to falter, and consequently leads to a myriad of disasters that escalate in intensity and gravity over time. To avert the threat of annihilation, a team of “ terranauts” was organized to travel into the Earth’s core to set off nuclear bombs that will restart its rotation.

For obvious reasons “ The Core” falls under thesciencefiction genre, but as with any typical sci-fi movie, a scrutiny of the movie should reveal just how much of its “ science” is factual and how much is made-up.

To resolve the predicament of the stalled core, the terranauts are to drill into the earth’s interior and are to set off nuclear bombs in the inner core to get it rotating again. For argument’s sake we shall assume that it may indeed be possible to build a vehicle capable of traveling and withstanding the tremendous heat and pressure in the Earth’s interior, and that a nuclear bomb strong enough for the purpose exists.

The question will then be whether the shock waves that will be generated by the nuclear bombs be able to jumpstart the core into rotating again.

For this to happen, a torque, or a twisting force, needs to be applied to the core to start it spinning. Specifically, the direction of the force should be tangential to the core (“ The Core (2003)”, par. 20), the same way that you

would try to make a globe spin by applying force along a tangent in its surface.

Contrary to what was shown in Zimky’s simulation in the movie, the shock waves from the explosion will doubtfully have any net effect when it hits the core (“ The Core (2003)”, par. 20) since the waves will radiate out of the point of explosion in all directions and will hit the core head-on.

Even as the waves radiate further out and be propagated tangentially to the core, they would be propagated equally on opposing sides and will therefore cancel each other out.

Another questionableobservationabout the simulation is that the waves seemed to be simply reflected by the outer core-mantle boundary so that it rebounds within the outer core. The bomb explosions are a form of induced seismic activity and from this vantage point, the shock waves can be discussed in terms of primary (P) and secondary (S) waves.

P waves are compressional waves that travel along the direction of propagation while S waves involve the displacement of material perpendicular to the direction that the wave is traveling. Both waves travel through the Earth’s interior and are refracted when they pass through materials of a different composition and density (“ Seismic Waves”, sec. 1. 1).

Considering this, the simulation appears oversimplified, if not inaccurate, since the primary waves will travel outward through the mantle and not simply bounce back inside the outer core. This would probably make the

simulation for the sequential detonation of the nuclear bombs likewise inaccurate.

Later on in the movie it is revealed that the reason for the core’s stalling was because of a top-secret government project named DESTINI (Deep Earth Seismic Trigger Initiative) which claims to have the ability to produce targeted seismic events anywhere on Earth by focusing high-energy electromagnetic waves down deeper fault lines.

It wasn’t explained in the movie why DESTINI intends to target these deeper fault lines but assuming that it is because they intend to produce “ deep focus” earthquakes that are, as of present, not yet fully understood and hence may not be as traceable in terms of their exact cause, then it doesn’t make much sense since these types of earthquakes usually are not as damaging as “ shallow focus” earthquakes (“ INDEPTH”, par. 5).

The latter’s focus occurs much nearer the surface and hence the seismic waves generated will be surface waves. Due to their nature, these waves are much more destructive than the P and S waves (“ Seismic Waves”, sec. 1. 2) that will be produced from deep focus earthquakes generated hundreds of kilometers deeper.

It is also hard to imagine an instrument capable of delivering energy that is powerful enough to createstressalong fault lines and in the process induce an earthquake. Even if such a device were possible, there’s still the question of how to target a specific location.

DESTINI claims to be able to create earthquakes ‘ anywhere’ but it is arguable that there’s a convenient fault for every conceivable target on the surface of the Earth. Even if the device were to target known active fault lines, it would be impossible to dictate the specific focus and epicenter of the resulting earthquake. It would also be shortsighted not to think that they would be running the risk of inadvertently producing earthquakes anywhere else along the fault line.

In the first place, are the catastrophes depicted in the movie really possible if the core were to stop spinning? G. Glatzmaier of the Inst. of Geophysics & Planetary Physics said that “ the super-rotation of the inner core is really neither a pure cause nor a pure effect of the magnetic field. The situation is much more intricate...”, so even if the core stalls it won’t automatically equate to a collapsing magnetic field. Likewise, the disasters attributed to the faltering geomagnetic field were dubious.

The incident with the birds in Trafalgar Square is highly unlikely. The answer was in the movie itself - when asked how birds navigate, Keyes’ graduate student answered jokingly that it was through “ eyesight” and only when Keyes asked how they navigate long-range did she reply that it was through sensing the Earth’s magnetic field. Birds do make use of the magnetic field but it is to find their way during long-distance and migratory flights, but even this is under debate (“ All About Birds”).

The Earth’s magnetic field does protect us from certain cosmic radiation, including solar winds but (“ Solar Wind”, sec 3. 3) microwave radiation is able to penetrate the Earth’s atmosphere because neither the magnetic field

nor the atmosphere effectively blocks this type of radiation (“ Solar Wind”, secs. 2 & 4).

The Sun’s energy reaches us mostly in the form of visible light (“ Solar System”, sec. 4) and though the Sun does emit microwave radiation, it won’t be in the form of an almost-visible and laser-like beam that can cut a bridge in two as depicted in the movie. Also, microwaves don’t cause severe sunburns because what causes the latter is exposure to ultraviolet light.

The movie did get some basic scientific facts right. Aside from the few already mentioned, the peach analogy is quite accurate if you compare it to a diagram of the Earth’s layers drawn to scale. The Marianas Trench is also indeed the deepest part of the Earth (“ Mariana Trench”, par. 1) and would make a logical choice as the point of entry if you were to travel into the interior of the Earth.

Compared to your average sci-fi film, “ The Core” seems to have left most of the “ science” out of its story. From a purely scientific point of view, the plot suffers from huge logical gaps in that the problem, its cause, and even the resolution to the said conflict are highly improbable, if not all together impossible. Hence, it would probably be a more accurate description to say that this fictional piece of work is likewise based mostly on science that is also bordering on fictional.

References:

All About Birds. 2006. Cornell Lab of Ornithology. 19 March 2007.

Glatzmaier, Gary A. “ I am wondering about the significance of the recent report that the earth's solid core rotates slightly faster than the earth's surface. Is this a cause or an effect of the earth's magnetic field?...” Online posting. 21 Oct. 1999. Scientific American. Com Ask the Experts: Geology. 19 March 2007.