Discovering a magnetized plasma ocean of mega tsunamis above the surface of the Sun

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Abstract

The earthquake that generated a tsunami in the Indian ocean on 26 Dec. 2004 was the second most powerful one ever recorded. However, this was merely a drop in the ocean compared with the tsunami we have discovered and modelled in the solar atmosphere. Wave driven phenomena are fundamental for the energetics and dynamism of the atmosphere of the Sun, as well as, being important in the context of the Sun-Earth connection. Wave-driven spicular jets are the most abundant features in the lower solar atmosphere, as can be seen in Fig. 1. These TRQs are localized to the Transition Region (TR), 2000 km above the visible solar surface. The TRQ is a sharp transition in temperature and density between the relatively and more dense lower solar chromosphere (2–10–6 K) and the very hot upper corona (1–15 x 108 K). The long-standing questing hunting enigma, one of the greatest puzzles of modern solar and astrophysics, may be addressed by firstly understanding the energetic and dynamism of the atmosphere of the Sun, as well as, being important in the context of the Sun-Earth connection. We report the initial observational snapshots of SAC (Sheffield Advanced Code) simulation, from left to right in Fig. 5, showing the advancing solution of plasma wave (Vx and Vy – top) and propagating supersonic plasma jets (Vz – middle) in a model solar atmosphere. The TRQ range is 15,000 km above 2004.

Solar Jets

Jet-like spicules are the most abundant features in the lower solar atmosphere. Wave-driven type III spicules are considered to be important in the energetic processes which heat the chromosphere. Type IV spicules result from photospheric magnetic reconnection. Jets of plasma (purple arrow) travel along magnetic field lines rooted in the inter-network of convective cells at the surface. Lower coronal micro-eruptions (blue arrow) result in plasma dynamics in the upper chromosphere and the transition region.

Mega Tsunami Observations

Solar jets are known to be capable of accelerating plasma in the coronal plasma ocean, and through magnetic reconnection in the chromosphere, it is possible that mega tsunamis are formed at Earth's surface during an earthquake. Our model to describe this process is illustrated in Fig. 6.

Impact on Solar Atmosphere

The TRQ model presented here is the first proposed viable mechanism in solar physics in understanding how the energy budget of the global TR could be maintained and partially replenished when wave transmission from the photosphere is considered. Each spicule can generate a mega tsunami wave at the TR and there is estimated to be 2,000,000 of these spicules happening at once. Here we have based the study on the rise velocity of 150s and 300s of the TRQ wave front. We computed the energy dumped in the TR atmosphere using the observed TRQ range. The TRQ range is 15,000 km above 2004.

Numerical Simulations

We report the initial observational snapshots of SAC (Sheffield Advanced Code) simulation, from left to right in Fig. 5, showing the advancing solution of plasma wave (Vx and Vy – top) and propagating supersonic plasma jets (Vz – middle) in a model solar atmosphere. The TRQ range is 15,000 km above 2004.

Conclusion

The TRQ model presented here is the first proposed viable mechanism in solar physics in understanding how the energy budget of the global TR could be maintained and partially replenished when wave transmission from the photosphere is considered. Each spicule can generate a mega tsunami wave at the TR and there is estimated to be 2,000,000 of these spicules happening at once. Here we have based the study on the rise velocity of 150s and 300s of the TRQ wave front. We computed the energy dumped in the TR atmosphere using the observed TRQ range. The TRQ range is 15,000 km above 2004.