

Equatorial Fountain in the Middle and Upper Atmosphere

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We are studying coupling processes in the Sun-Earth system, focusing on the behavior of the atmosphere in response to the solar energy inputs to the Earth. The solar energy is mainly divided into two parts: the solar radiation involving infra-red, visible, ultra-violet and X-ray, and the solar wind whose effects are evident in a polar region.

The solar radiation becomes maximum at the equator, then atmospheric disturbances are generated in the troposphere (altitude up to 10-15 km). In particular, over Indian Ocean to western Pacific, centered by Indonesia, cumulonimbus convection is most active in the world. It further excites various atmospheric waves that propagate upward transporting energy and momentum into the upper atmosphere. Various kinds of materials (atmospheric minor constituents) originating at low- and mid-latitude regions converge into the equatorial region, and they are blown upward passing through the equatorial tropopause at about 15 km altitude into the middle atmosphere (10-100 km), and spread to the whole globe. In the upper atmosphere above 100 km, plasma disturbances and equatorial ionization anomaly are generated around the equator. We are trying to capture the energy and material flow that occur in all height ranges of the equatorial atmosphere as Equatorial Fountain.

We constructed the Equatorial Atmosphere Radar (EAR) right over the equator in West Sumatra, Indonesia in 2001 under close collaboration with Indonesian research institutes and universities; LAPAN, BPPT, LIPI, BIG, BMKG and ITB. On the basis of successive achievements with EAR, we have been promoting a project to construct a state-of-the-art large atmospheric radar that is named the Equatorial Middle and Upper Atmosphere Radar (EMU). EMU is 10 times more powerful than EAR, and it will enable us to study the behavior of the troposphere, middle atmosphere and upper atmosphere. We will also enhance collaboration with international community, inviting researchers and students to the EMU observatory in order to study together the scientific mystery of the Equatorial Fountain.

Keywords: Equatorial atmosphere, Equatorial MU Radar, Atmospheric Waves, Tropopause, Middle Atmosphere, Plasma Bubble