[EE] Evening Poster | A (Atmospheric and Hydrospheric Sciences) | A-AS Atmospheric Sciences, Meteorology & Atmospheric Environment

[A-AS03]Advances in Tropical Cyclone Research: Past, Present, and Future

convener:Masuo Nakano(JAMSTEC Japan Agency for Marine-Earth Science and Technology), Akiyoshi Wada(Typhoon Research Department Meteorological Research Institute), Sachie Kanada(名古屋大学宇宙地球環境研究所, 共同), Kosuke Ito(University of the Ryukyus)

Wed. May 23, 2018 5:15 PM - 6:30 PM Poster Hall (International Exhibition Hall7, Makuhari Messe)

Tropical cyclones (TCs) often bring torrential rainfall, gale, storm surge, and high surf that sometimes cause tremendous disasters. Therefore, understanding such phenomena associated with translation, intensity change, and precipitation of TCs and their accurate forecasts are important in the earth and planetary science. In addition, changes in the number and intensity of TCs due to global climate changes have been extensively studied by various approaches such as data rescue, data analyses, and climate modelling.
Especially in 2017, Typhoon Talim made landfall on all of four major islands of Japan first ever since 1951 and Typhoon Noru had a strange track. In the Northern Atlantic, Hurricanes Harvey, Irma and Maria caused tremendous damage in U.S.
Advances in innovative observations such as Himawari-8,9, unmanned drone, meteorological aircraft reconnaissance and supercomputers such as the earth simulator and K-computer have led to novel development of numerical weather forecasting and understanding of the phenomena due to the improvement of numerical modelling.
In this session, we welcome papers on various aspects of TC studies. We hope that the session will provide new direction for future TC research activity.

[AAS03-P03]Rapid intensification of extratropical and tropical cyclones in the context of solar wind-magnetosphere-ionosphere-atmosphere coupling

*Paul Prikryl[1,2], Takumi Tsukijihara[3], Robert Bruntz[4], Vojto Rušin[5] (1.Physics Department, University of New Brunswick, 2.Geomagnetic Laboratory, Natural Resources Canada, 3.Department of Earth and Planetary Sciences, Kyushu University, 4.Johns Hopkins University Applied Physics Laboratory, 5.Astronomical Institute, Slovak Academy of Sciences)

Keywords:Extratropical and tropical cyclones, Solar wind - magnetosphere - ionosphere - atmosphere coupling, Atmospheric gravity waves

The Wilcox effect, a relation between solar wind magnetic sector boundary structure and mid-latitude upper tropospheric vorticity [1], was confirmed [2] pointing to a possibility that coupling between the solar wind and the Earth’s magnetosphere, and ultimately the ionized and neutral atmosphere, can influence development of tropospheric weather. Recent results [3,4] that support such link are summarized and corroborated to show further evidence that explosive extratropical cyclones, and rapid intensification of tropical cyclones, tend to follow arrivals of high-speed solar wind streams from coronal holes or coronal mass ejections. Large amplitude magneto-hydrodynamic waves couple to the magnetosphere-ionosphere-atmosphere (MIA) system generating sources of medium-scale atmospheric gravity waves in the lower thermosphere at high latitudes. These gravity waves propagate upward and downward, and can be ducted in the lower atmosphere over long distances. Simulations of gravity wave propagation in a model atmosphere using the Transfer Function Model [5] show that propagating waves originating in the thermosphere can excite a spectrum of gravity waves in the lower atmosphere. In spite of significantly reduced amplitudes but

subject to amplification upon reflection in the upper troposphere, these gravity waves can trigger/release instabilities present in the troposphere to initiate convective bursts. Convective bursts have been linked to intensification of tropical cyclones. The latent heat release leads to intensification of storms. Explosive extratropical cyclones identified from storm tracks in the meteorological reanalysis datasets, and rapid intensification of tropical storms from the best-track databases, are investigated in the context of solar wind coupling to the MIA system using the superposed epoch analysis. Cases of tropical cyclones are shown to illustrate, sometimes very close, correlation between the intensification of tropical storms and the solar wind structure. These results suggest that vertical coupling in the atmosphere exerts downward control from solar wind to the lower atmospheric levels influencing development of extratropical and tropical cyclones.

[1] Wilcox J.M., et al., Science 180, 185–186, 1973.
[2] Prikryl P., et al., Ann. Geophys. 27, 1-30, 2009, doi:10.5194/angeo-27-1-2009.
[3] Prikryl P., et al., J. Atmos. Sol.-Terr. Phys. 149, 219-231, 2016, doi:10.1016/j.jastp.2016.04.002.
[4] Prikryl P., et al., J. Atmos. Sol.-Terr. Phys., in press, 2017, doi.org/10.1016/j.jastp.2017.07.023.
[5] Mayr H.G., et al., Space Sci. Rev. 54, 297–375, 1990.