Monitoring Extreme Weather in the Hindu Kush Himalaya Region

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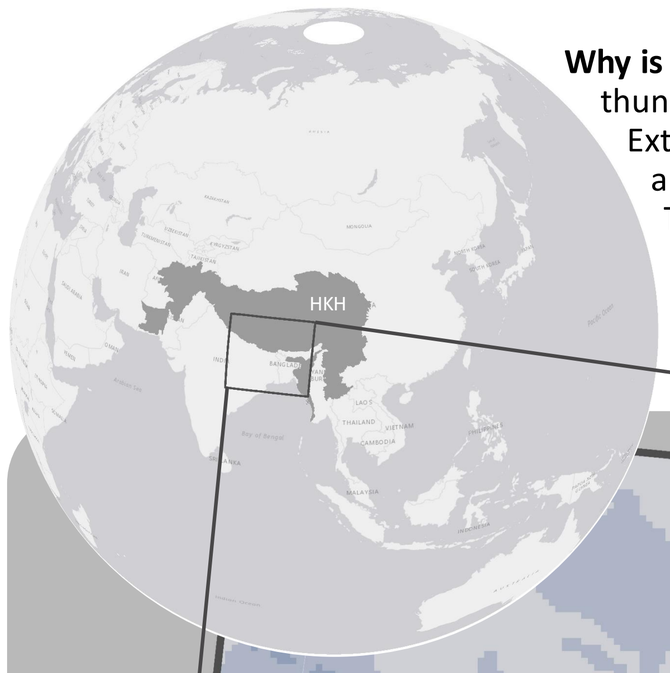
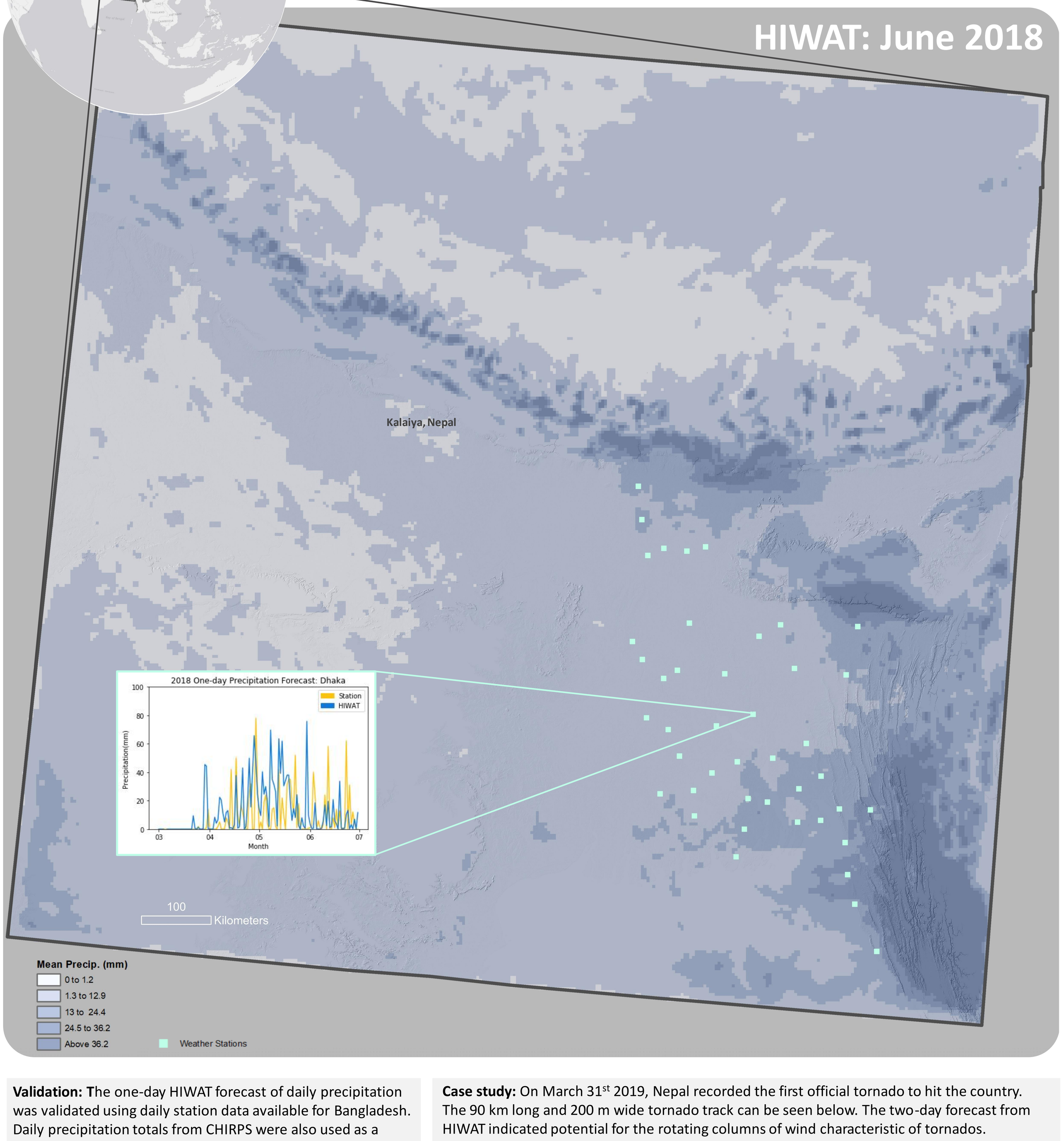


Why is monitoring extreme weather events important? The HKH region experiences many extreme weather events, such as thunderstorms, especially during monsoon season. These events can cause economic hardship and loss of life. Monitoring Extreme Weather in the HKH Region is a service in development through SERVIR-Hindu Kush Himalaya that aims to develop a customized numerical weather prediction toolkit to assess these high impact events in this relatively data sparse region. The High Impact Weather Assessment Toolkit (HIWAT) consists of an ensemble Weather Research and Forecasting (WRF) model, threat assessments based on the Global Precipitation Measurement (GPM) missions, and impact assessments Based on Landsat and the Moderate Resolution Imaging Spectroradiometer (MODIS) imagery. In spring 2019, we began validation of forecasted precipitation using station data in Bangladesh and Climate Hazards Group InfraRed Precipitation with Station data (CHIRPS).



Validation: The one-day HIWAT forecast of daily precipitation was validated using daily station data available for Bangladesh. Daily precipitation totals from CHIRPS were also used as a proxy for precipitation in the HKH region. For March through August 2018, the Pearson's Correlation Coefficient for daily HIWAT and CHIRPS precipitation was 0.27. For March through June 2018, the Pearson's Correlation Coefficient for HIWAT and station precipitation was 0.33. With p-values of 0, these low, positive correlations are statistically significant. The actual daily precipitation is shown for a weather station in Dhaka, Bangladesh, alongside the precipitation forecasted by HIWAT.

Case study: On March 31st 2019, Nepal recorded the first official tornado to hit the country. The 90 km long and 200 m wide tornado track can be seen below. The two-day forecast from HIWAT indicated potential for the rotating columns of wind characteristic of tornados.

Who can benefit from this service in the Hindu Kush Himalaya Region? Key stakeholders, including the Department of Hydrology and Meteorology in Nepal and the Bangladesh Meteorological Department, can view the probability of extreme weather events such as high rainfall rates, high impact wind, and more through an online application.

Acknowledgments: NASA SERVIR Science Coordination Office & Applied Science Team, including Patrick Gatlin & Jonathan Case | Service Layer Credits: Esri, HERE, GARMIN, OpenStreetMap contributors, and the GIS user community | Selected references for validation: Dezfuli, A., Ichoku, C., Huffman, G., Mohr, K., Selker, J., van de Giesen, N., … Annor, F. (2017). Validation of IMERG precipitation in Africa. Journal of Hydrometeorology, 18(10), urn:issn:1525–755x. https://doi.org/10.1175/JHM-D-17-0139.1; Rivera, J., Marianetti, G., & Hinrichs, S. (2018). Validation of CHIRPS precipitation dataset along the Central Andes of Argentina. Atmospheric Research, 213, 437–449. https://doi.org/10.1016/j.atmosres.2018.06.023; Shrestha, N., Qamer, F., Pedreros, D., Murthy, M., Wahid, S., & Shrestha, M. (2017). Evaluating the accuracy of Climate Hazard Group (CHG) satellite rainfall estimates for precipitation based drought monitoring in Koshi basin, Nepal. Journal of Hydrology: Regional Studies, 13(C), 138–151. https://doi.org/10.1016/j.ejrh.2017.08.00 | Tornado Track Imagery: Planet Team (2017). Planet Application Program Interface: In Space for Life on Earth. San Francisco, CA. https://api.planet.com. | Nepal Tornado Info: Smriti Mallapaty (12 April 2019). "Nepali scientists record country's first tornado". Nature. doi:10.1038/d41586-019-01159-w. | Shuttle Radar Topography Mission data used for hill shade: Jarvis, A., H.I. Reuter, A. Nelson, E. Guevara, 2008, Hole-filled SRTM for the globe Version 4, available from the CGIAR-CSI SRTM 90m Database (http://srtm.csi.cgiar.org).
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