Monitoring Intense Thunderstorms in the Hindu-Kush Himalayan Region

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Abstract. Some of the most intense thunderstorms on the planet routinely occur in the Hindu-Kush Himalaya region (HKH) region—where many government organizations lack the capacity needed to predict, observe and effectively respond to the threats and hazards associated with high impact convective weather. This project combines innovative numerical weather prediction, satellite-based precipitation and land imager techniques, into a high impact weather assessment toolkit (HIWAT) that will build the capabilities of national meteorological departments and other weather sensitive agencies in the HKH region to assess the potential threats and impacts of high impact convective weather.

Situational Awareness with NU-WRF

<table>
<thead>
<tr>
<th>Model</th>
<th>Output</th>
<th>Domain</th>
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</thead>
<tbody>
<tr>
<td>NU-WRF</td>
<td>Composite, significant tornado, derecho and large hail parameters</td>
<td>Hindu-Kush Himalaya</td>
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</table>

Intense Thunderstorm Activity in the HKH Region

Impact:
- Tornadoes have resulted in over 9,000 fatalities in Bangladesh during the 20th century (Bikos et al. 2016). A tornado in 1989 caused 1,500 deaths and another in 1996 caused over 780 deaths.
- A hailstorm over Khurum Sattar in 1988 resulted in 72 deaths.
- Lightning in 1995 struck a Pakistani village killing 35 (Holte 2010), and a 2015 windstorm in Peshawar killed 25.
- Commercial production of cherry peppers in Bhutan in 2016 was foiled by a large hailstorm.
- Flash flooding and resultant landslides killed over 100 people in Nepal during monsoonal rain storms of 2016.

Objectives:
- Develop a conversion allowing ensemble type modeling system over the HKH region for an end-user with very limited computational resources.
- Provide an observational means for assessing thunderstorm hazards over the HKH region.
- Identify regions of storm damage over the HKH region.

Threat Assessment Using GPM

EXAMPLE: 13 May 1996 Bangladesh Significant Tornado Event
- High-resolution WRF Forecast on 12 km model for Day 1
- TRMM-GPM 4 km model allowing ensemble model runs over domain 3
- 14.5 km WRF Valid 0830 UTC 13 May 1996

Impact Assessment Using Land Imager

EXAMPLE: 11 June 2015 Hail Event
- High-resolution WRF indicates potential for large hail over eastern Bangladesh on 11 June.
- DPR detected 55 dBZ reflectivity cores associated with 17–18 mph downburst gusts.

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