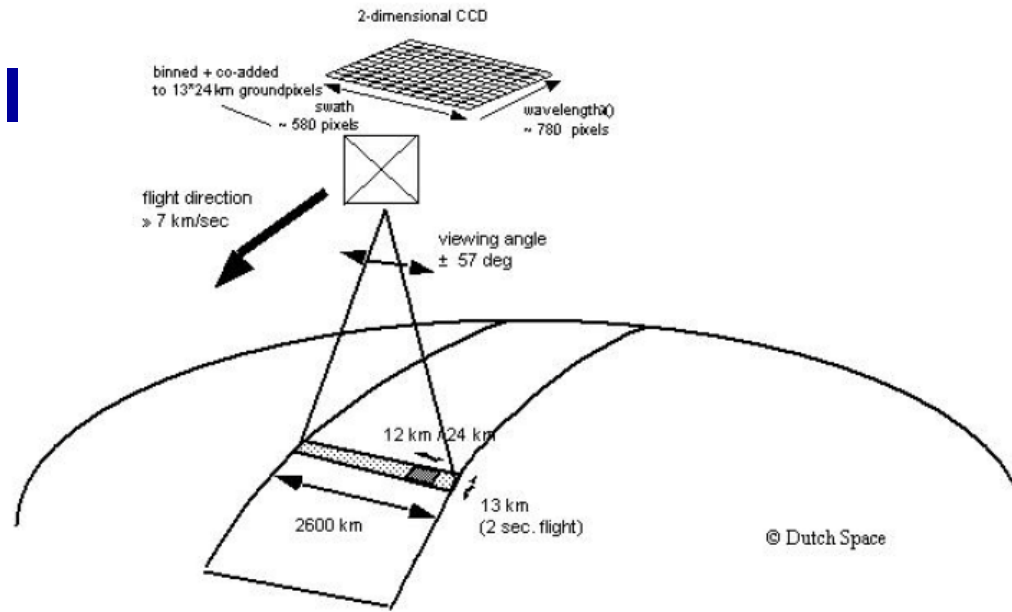


Ultraviolet (UV) Index Climatology of Nepal Himalaya Using Ozone Monitoring Instrument (OMI) Data

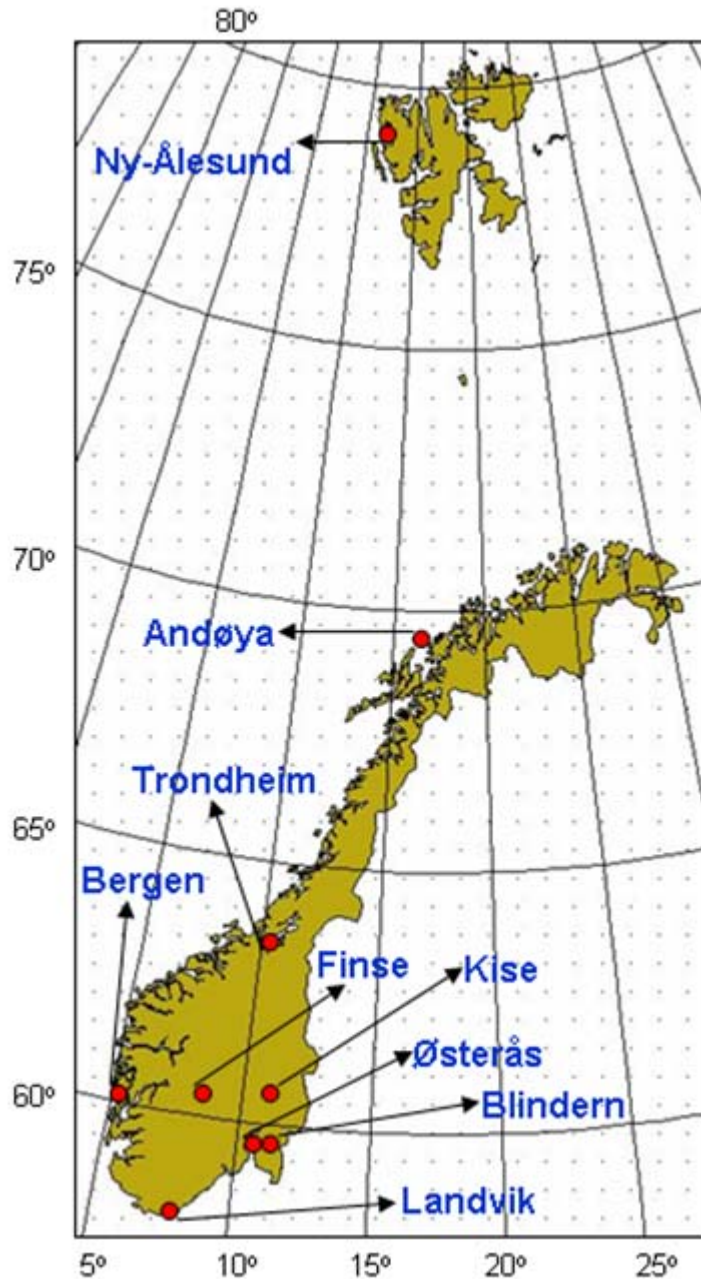
R.R. Sharma, B. Kjeldstad and P.J. Espy

Norwegian University of Science and Technology
(NTNU), Trondheim, Norway

AURA-OMI

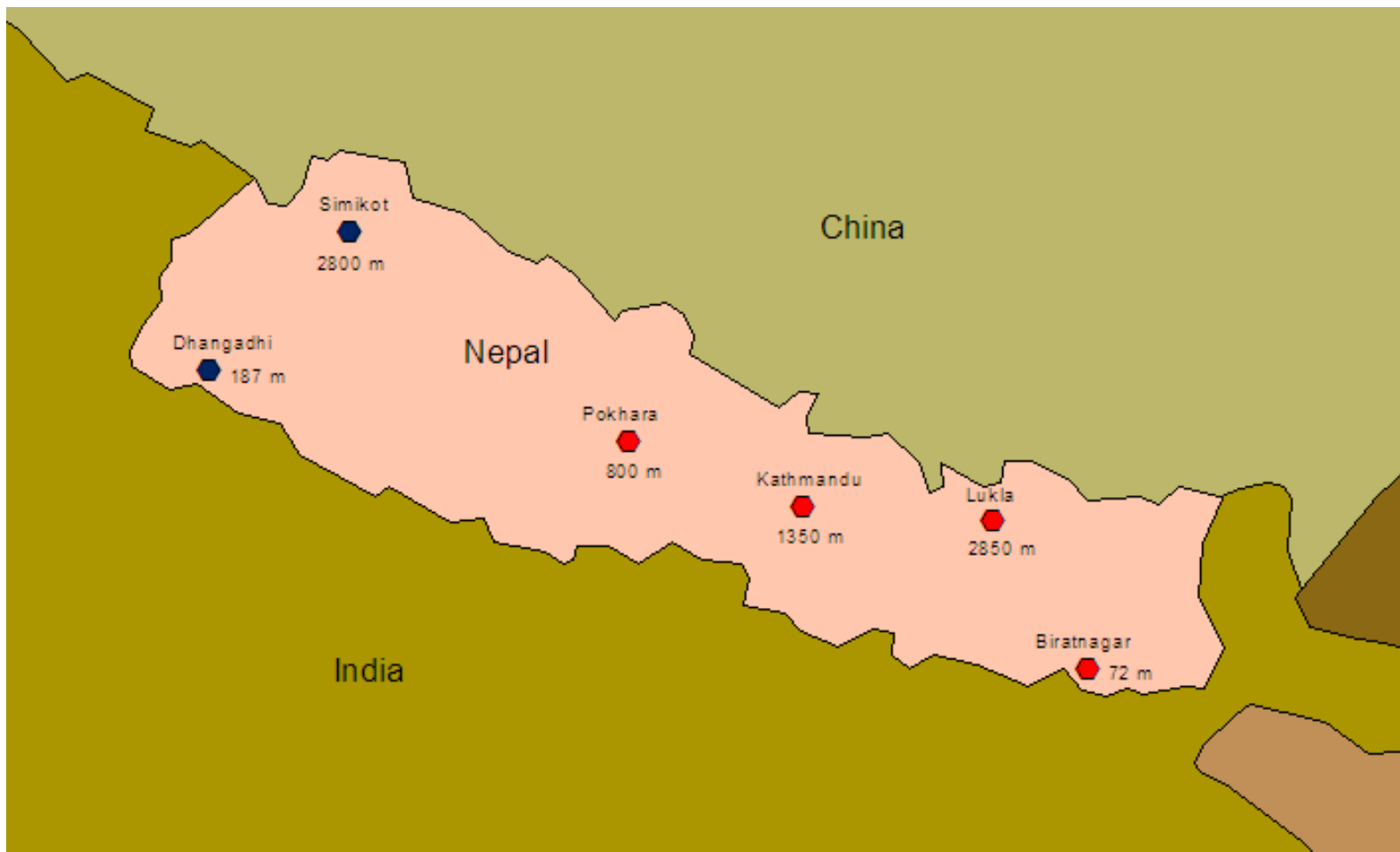


- Collaborative effort between the USA, the Netherlands, the UK and Finland
- Launched in July 2004
- Provides information on ozone, aerosols, clouds, surface UV irradiance (UV Index), trace gases.
- Wide swath (2600 km), sun synchronous (ECT 13:42), nadir viewing (13 x 24 km).
- Orbital period ~98 min., equatorial crossing time 13:42 hour.
- Global coverage

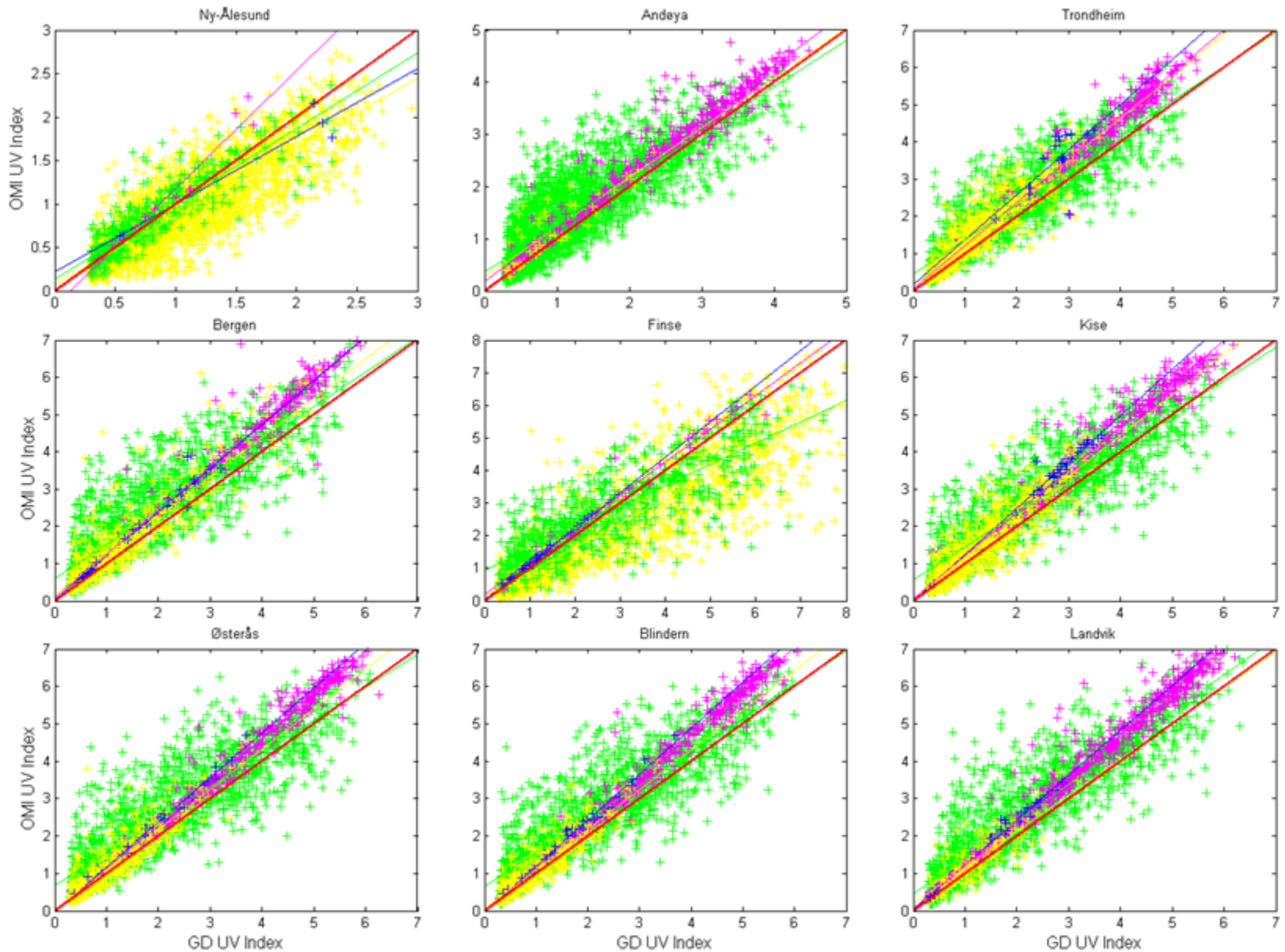


Norwegian UV monitoring stations

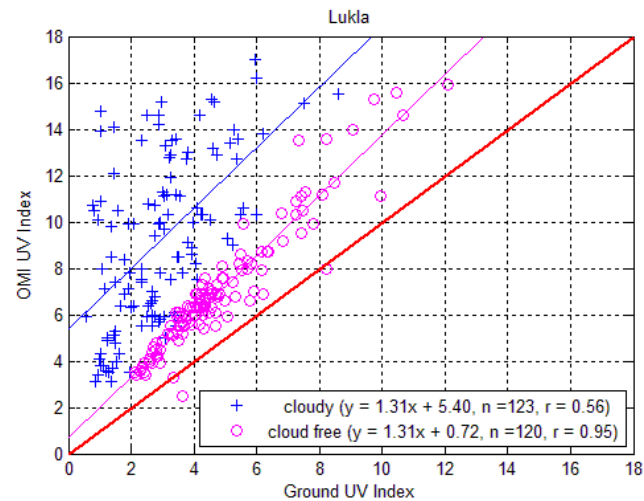
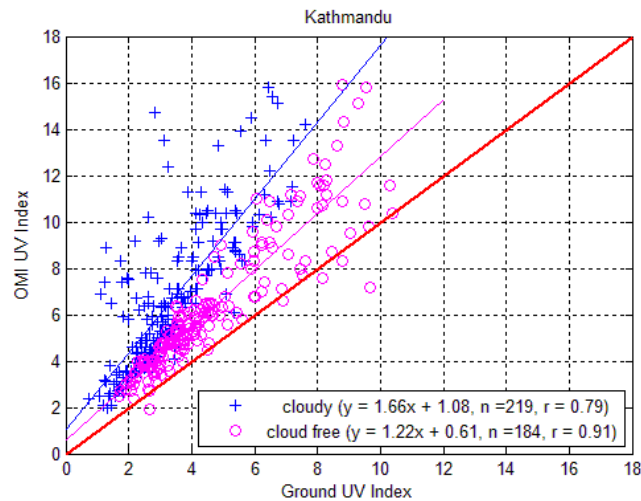
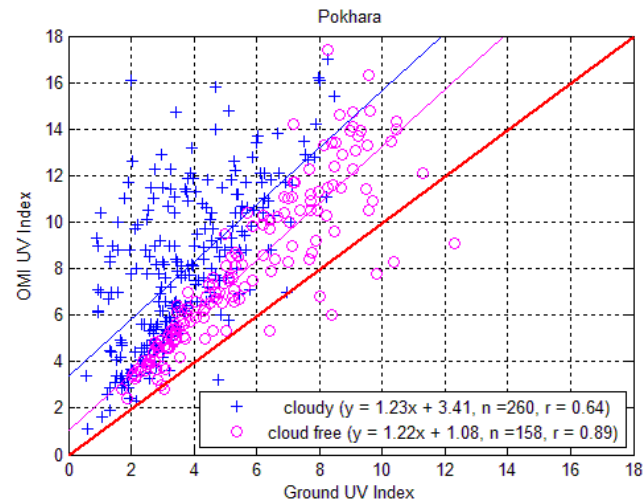
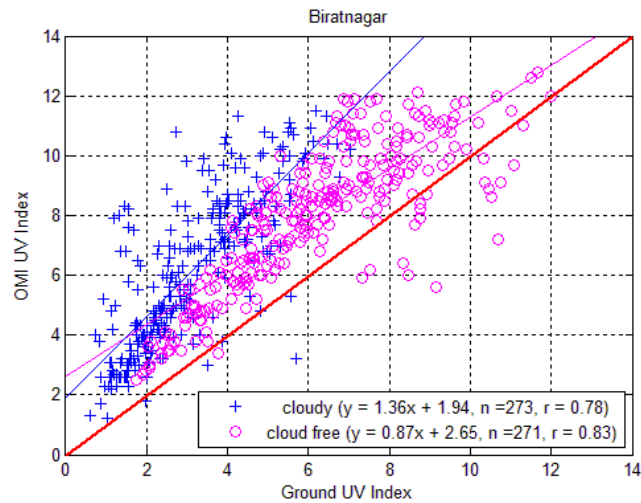
- **Nine stations from 1995/96 and 58°-79°N**
- **Operation by Norwegian Radiation Protection Authority (NRPA), in co-operation with NILU.**
- **Altitude range (10 - 1210 m)**
- **Used multiband Filter Radiometer of type GUV (5 channel).**
- **The calibration based on the travelling transfer standard GUV**
- **Intercomparison, and Harmonization ($\pm 4.6\%$ (2-sigma) for all sky conditions and $SZA < 80^\circ$)**



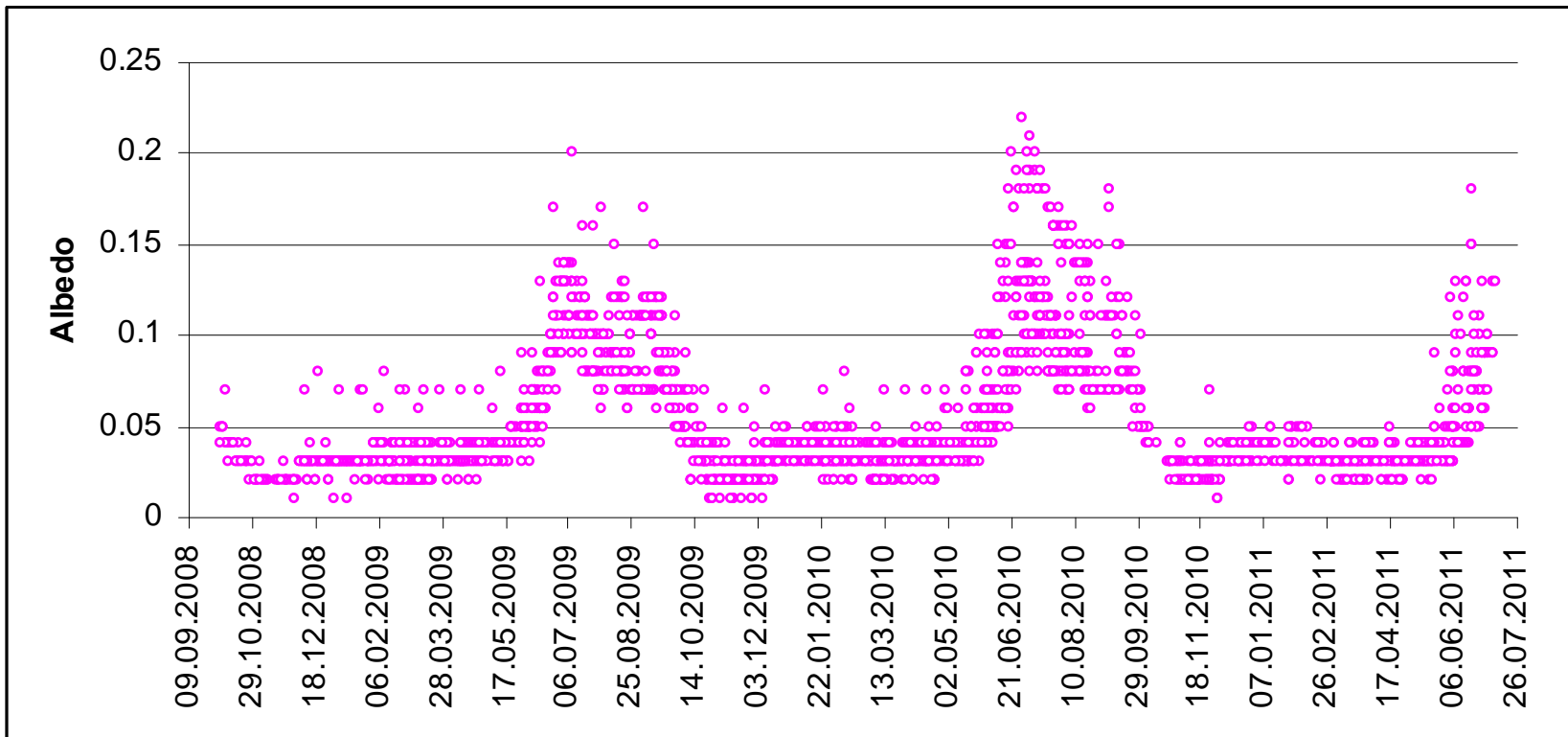
- **Solar Radiation and Aerosol in Himalayan Region (SAHR) project under the Institute of Engineering of Pulchowk Campus of Tribhuvan University**
- **Four stations 2008-2009 and 70- 2850 m**
- **MBFR type manufactured by Norwegian Air Research Institute (NILU)**



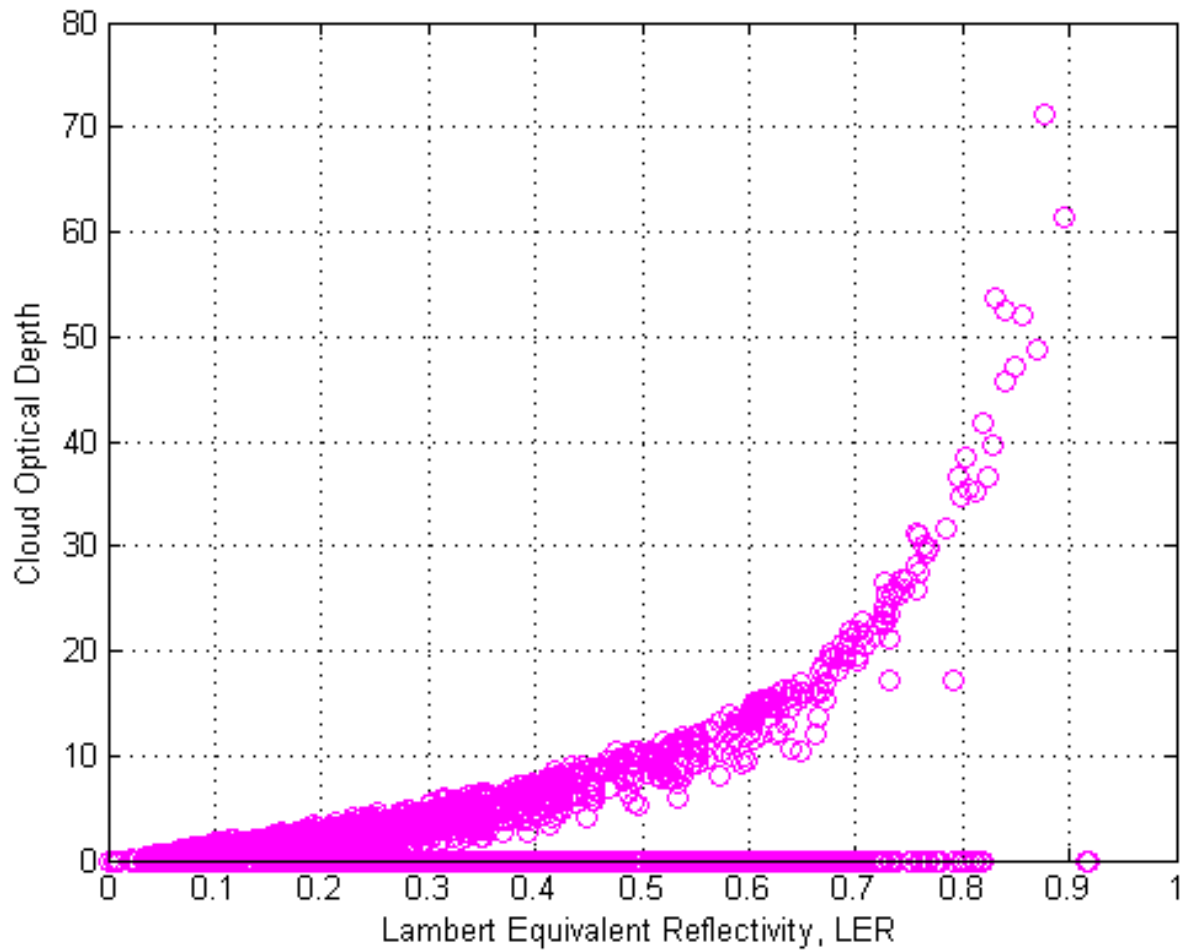
Scatter plots showing OMI and Ground UV indices of Nine stations (Bias 9-20% for cloud free/snow free cond.)



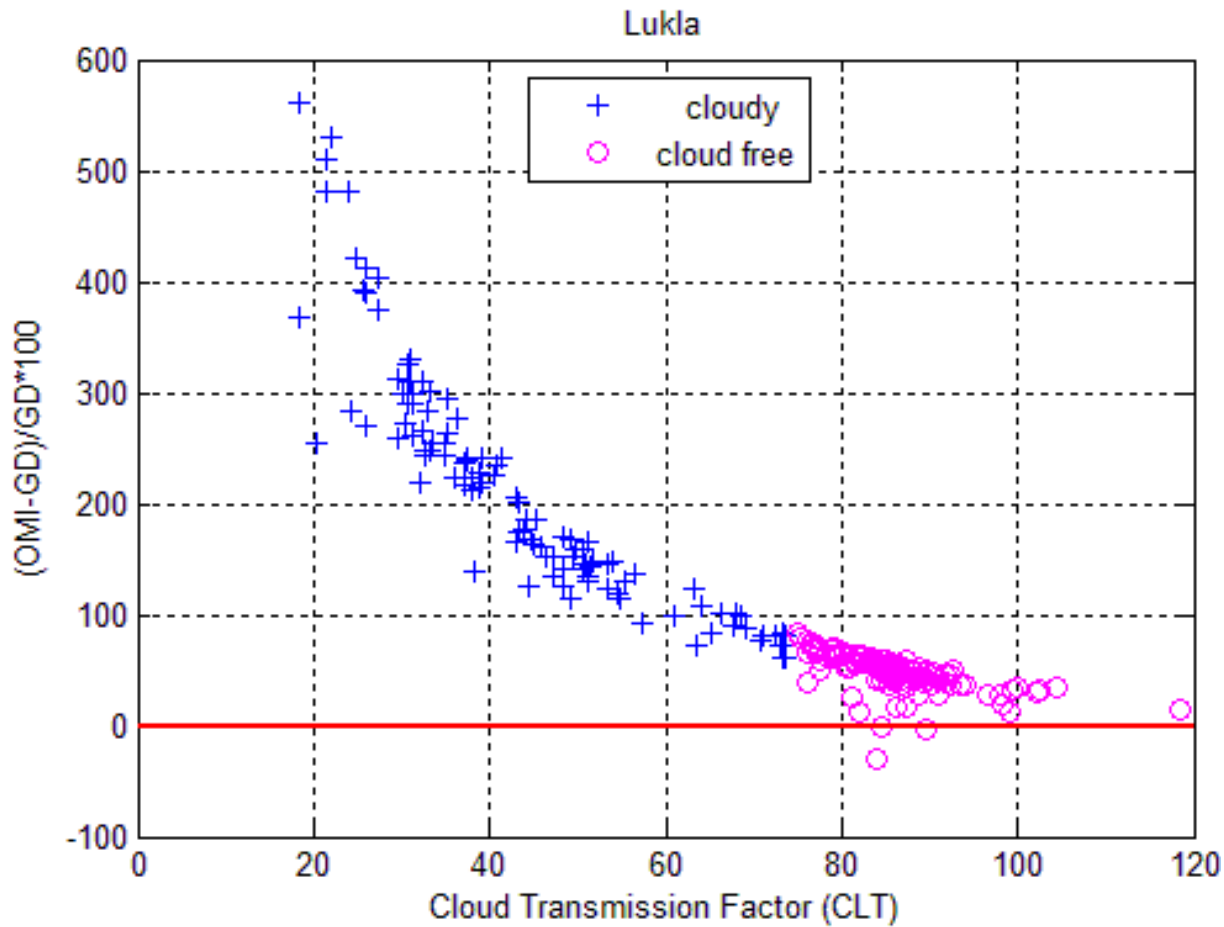
Scatter plots showing OMI and Ground UV indices of four stations (Bias 35-48% for cloud free and snow free condition).



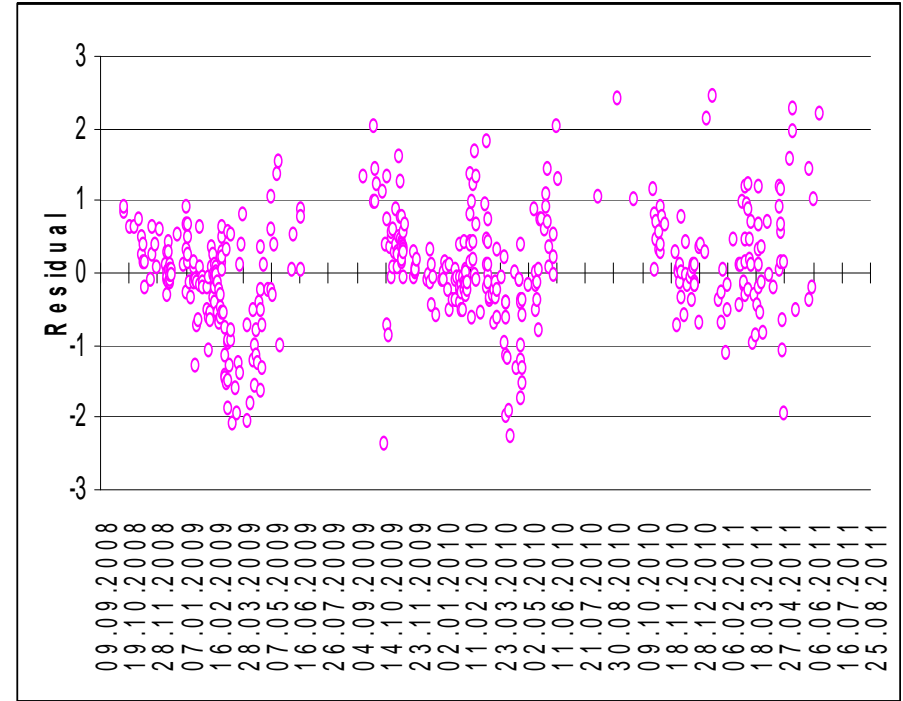
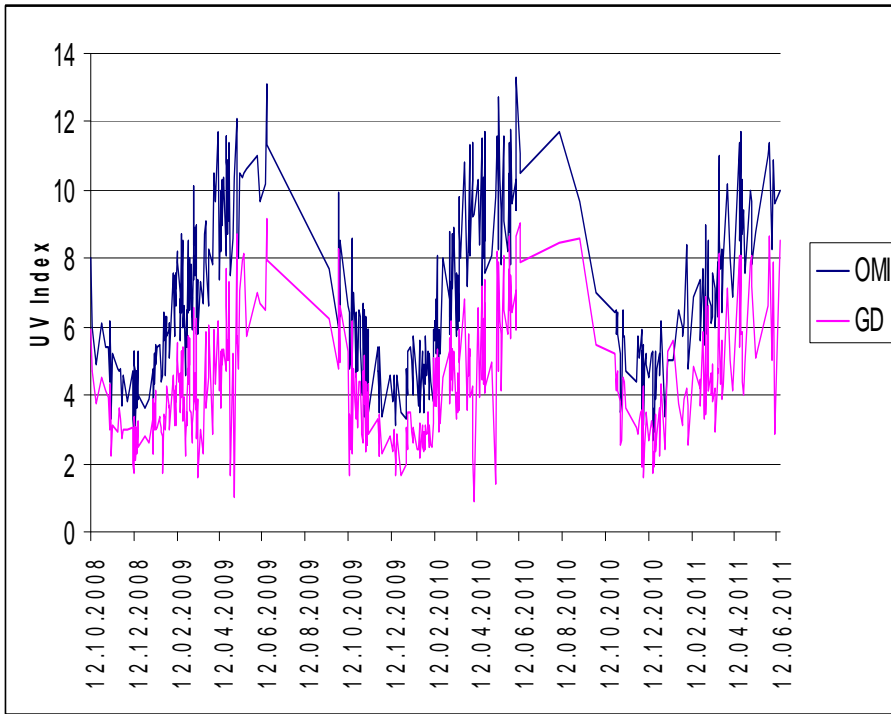
Time series plot of OMI surface albedo of coincidence measurement at satellite overpass time.



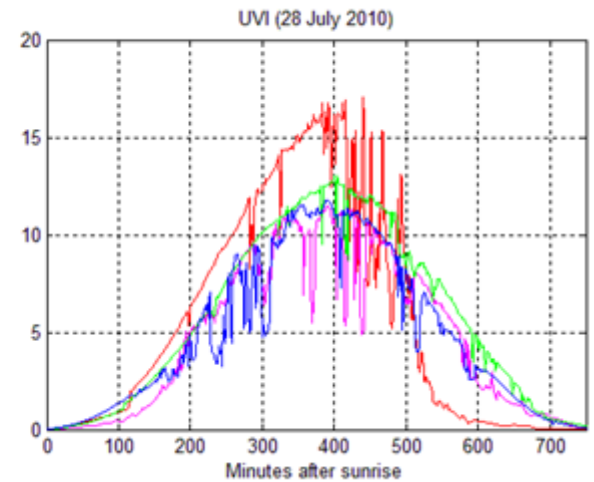
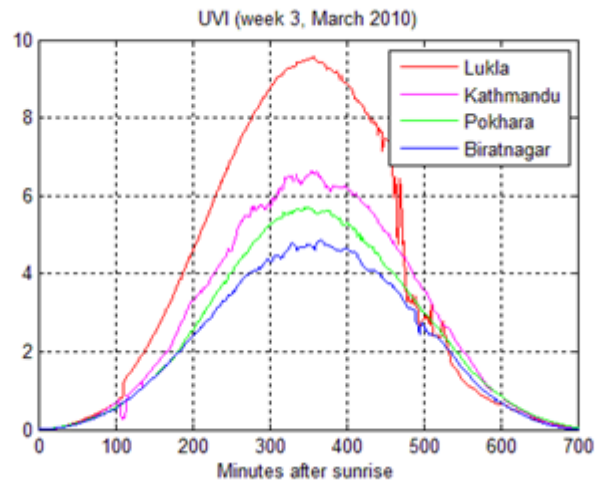
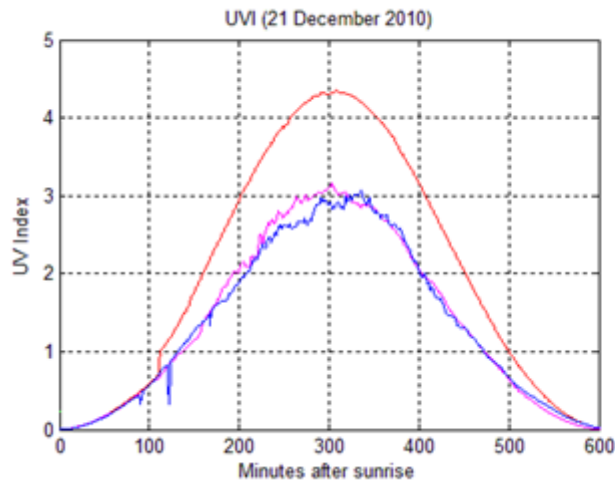
Plot of Lambert Equivalent Reflectivity (LER), and Cloud Optical Depth (CLDOPT) of OMI for coincidence overpass data from Nepal.



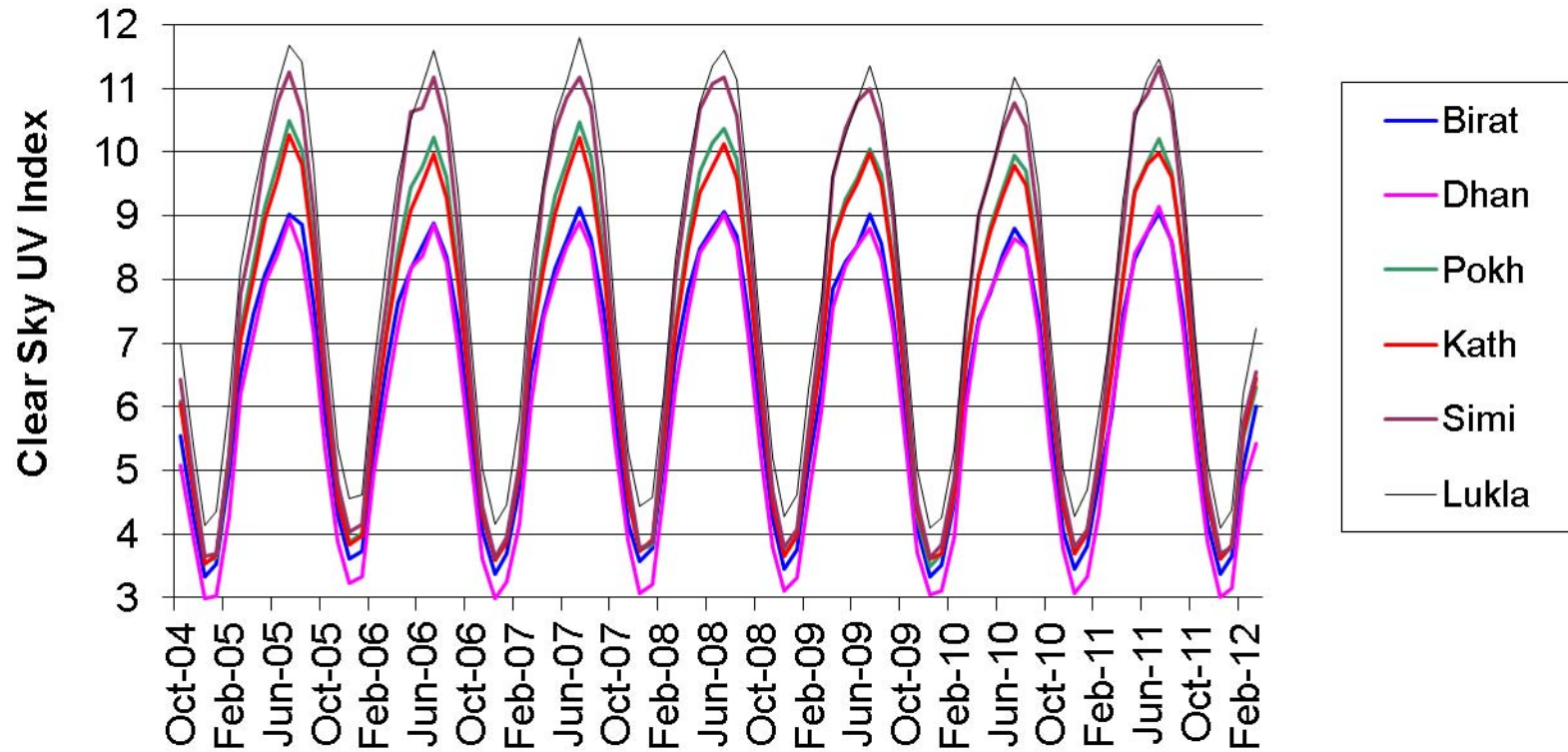
Plot showing dependence of relative differences (biases) on cloud transmission factor for Lukla station



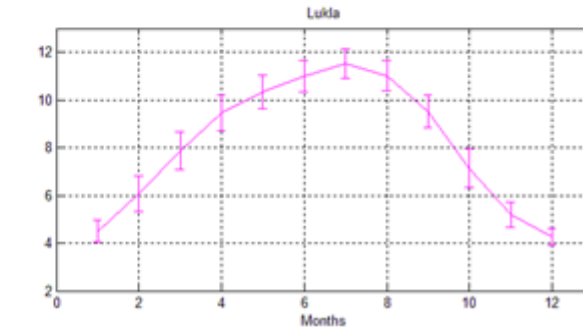
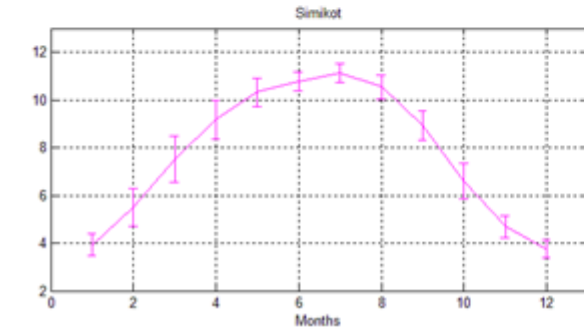
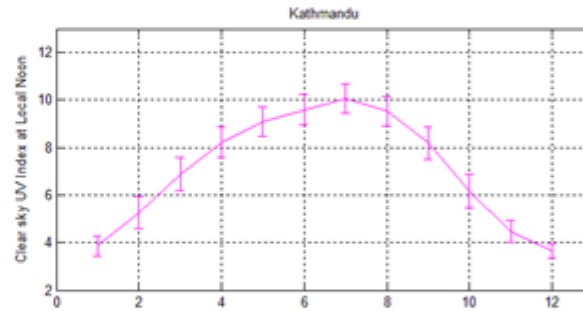
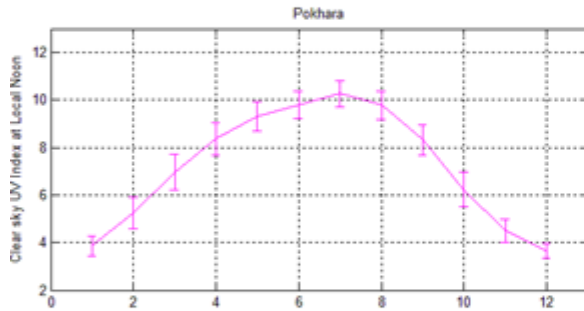
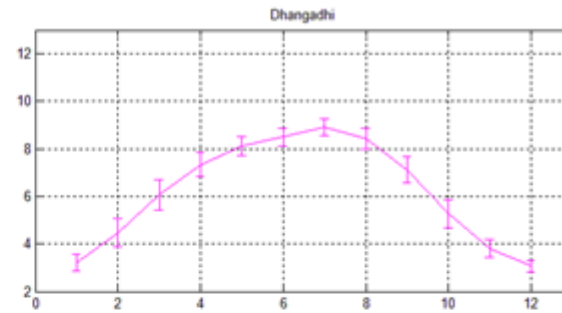
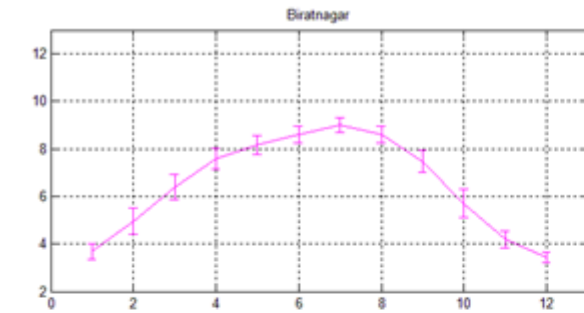
- **OMI and ground UVI for cloud free condition (left)**
- **Empirical correction = $GD/OMI = 0.633$**
- **Residual after the correction for clear sky condition (right).**



- **Diurnal pattern of ground measured UV index**
- **21 December 2010 (left)**
- **21 March 2010 (middle)**
- **28 July 2010 (right)**
- **Lukla (2850 m, red), Kathmandu (1350 m, magenta)**
- **Pokhara (850 m, green), and Biratnagar (70 m, blue).**



Time series of monthly average UVI for all six sites of Nepal Himalayas from October 2004 to March 2012 using OMI UVI



Monthly average UV index climatology for clear sky days at local noon (with error bar $\pm 1\sigma$ of the standard deviation).

Sites	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Alt (m)
Lukla	Yellow	Orange	Red	Red	Red	Purple	Purple	Purple	Red	Orange	Yellow	Yellow	2850
Simikot	Yellow	Yellow	Orange	Red	Red	Purple	Purple	Red	Red	Orange	Yellow	Yellow	2800
Kathmandu	Yellow	Yellow	Orange	Red	Red	Red	Red	Red	Red	Orange	Yellow	Yellow	1350
Pokhara	Yellow	Yellow	Orange	Red	Red	Red	Red	Red	Red	Orange	Yellow	Yellow	850
Biratnagar	Yellow	Yellow	Orange	Red	Red	Red	Red	Red	Orange	Orange	Yellow	Yellow	70
Dhangadhi	Yellow	Yellow	Orange	Orange	Red	Red	Red	Red	Orange	Yellow	Yellow	Yellow	190

Exposure Category	UVI Range	Colour Code	Protection Level
Low	<=2.5	Green	No protection required
Moderate	2.6 - 5.5	Yellow	Protection required
High	5.6 - 7.5	Orange	Protection required
Very High	7.6 - 10.5	Red	Extra protection required
Extreme	>10.5	Purple	Extra protection required

- **Level of UV index for clear sky days at local noon for six sites of Nepal using empirically corrected OMI monthly average data from 2004-2012.**
- **Colours are coded according to the international colour codes for UV index (WHO, 2002)**

Thank you