Part A

In the paper Do Satellite Data Portals Reach Out to the Diverse End Users around the World?, the author found the interesting phenomena that many end users were unaware of the many evolved satellite data portals already in existence because these Internet portals were not highly visible in the Google search engine. He called upon the scientific community to increase the visibility of satellite data suggesting solutions like utilizing search engine optimization (SEO), which is the process that improves the visibility of websites using the natural algorithmic structure of the search results.

I played with the Google search engine for some time, and realized the importance of making the satellite data more visible and of efficient search methods. First, I typed keywords of "satellite data", the top search results displayed homepages describing satellite data, which was difficult to obtain the data; when I typed more specifically "satellite data precipitation", the top search results only showed some homepages describing satellite data of a few missions without popular data portals like GIOVANNI. If I typed keywords like "remote sensing data" or "remote sensing data precipitation", the search results were even further away than what I expected.

I would type keywords like those above if I did not know what satellite mission data I wanted or had little knowledge about satellite products. If, however, I knew satellite data portal GIOVANNI, and typed GIOVANNI, the ninth search result would give the webpage I wanted. If I typed "GIOVANNI satellite", however, the webpage would appear first in the research results. One useful way, I discovered, to search for useful webpages of satellite data portal would be to directly type "satellite data portal", and a few data portal websites would appear, like GIOVANNI from NASA, Vertex from Alaska satellite, FEWS NET from USGS, and CeNCOOS data portal. Personally, I would like some webpages or documents to be created, which would list some links to satellite data websites along with some descriptions about them. And I found one table on Wikipedia that gives an overview of major remote sensing systems and datasets and summarizes their applications. With webpages like that, we could obtain a better idea of satellite products available, and the process of looking for data would become much faster and more convenient.

Human beings have spent an immense amount of money on developing satellite technology and improving satellite products over the past few decades. To make the most of the benefits the satellite brings, it is imperative that the scientific community come up with better ways to make the satellite data more visible and accessible to global users. As for end users, they need to master more efficient methods or some useful tricks of searching for the satellite data they need.

Part B

Data

Satellite Data

The satellite precipitation data are TRMM 3B43 Monthly Rainfall from October 2000 to September 2007 with the spatial resolution of 0.25 by 0.25 degree. The study domain is the region between 43°N – 50.25°N, -125°W – 117.25°W, which cover the windward and leeward sides of the Cascades in Washington State.

Observed Data

The observed precipitation data are from Livneh's daily rainfall with the spatial resolution of 0.0625 by 0.0625 degree. The spatial and temporal resolutions are processed to match that of satellite data.

Analysis

Multi-year mean precipitation for satellite data and observed data are both calculated. They are shown in Fig 1 and Fig 2, respectively. The difference between multi-year mean precipitation of satellite data and observed data is shown in Fig 3.

Fig 1 shows that there is significantly different precipitation distribution on either side of the Cascades. The windward side has much larger precipitation than the leeward side. Two sides are divided along -121.25°W. The multi-year mean spatial average precipitation of the windward side and leeward side are 4.59 mm/day and 1.34 mm/day, respectively.

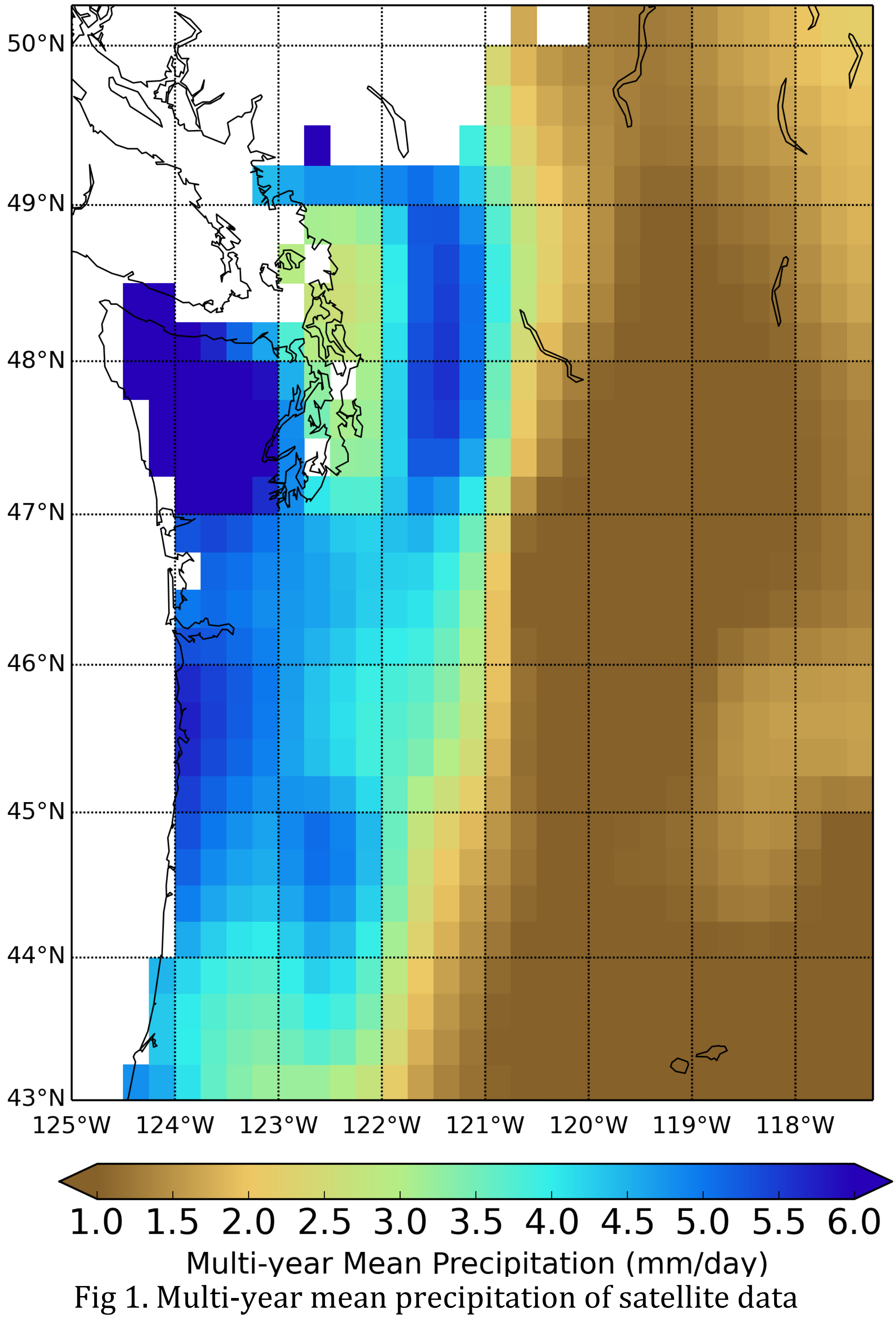

Fig 1. Multi-year mean precipitation of satellite data

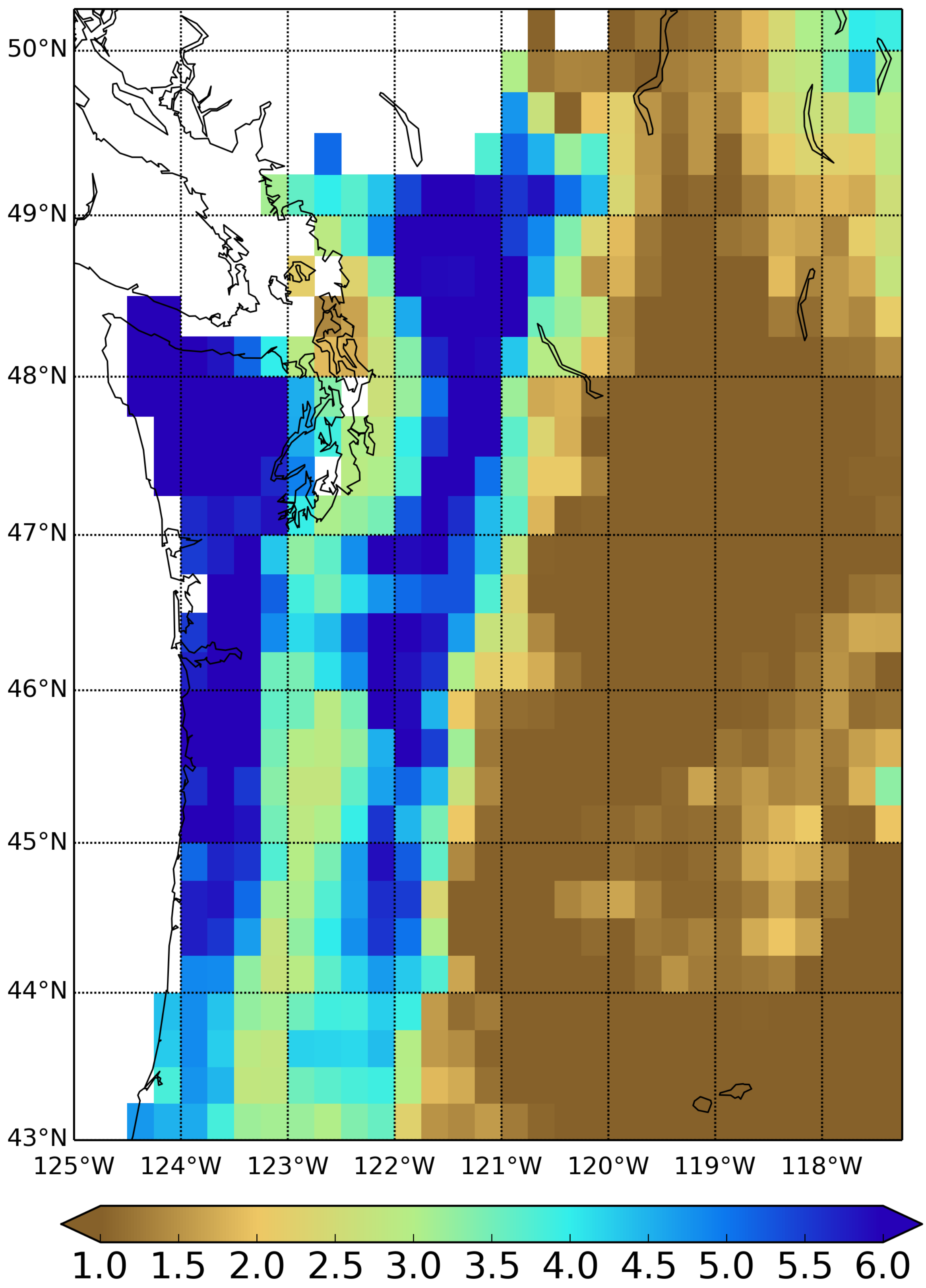

Fig 2. Multi-year mean precipitation of observed data

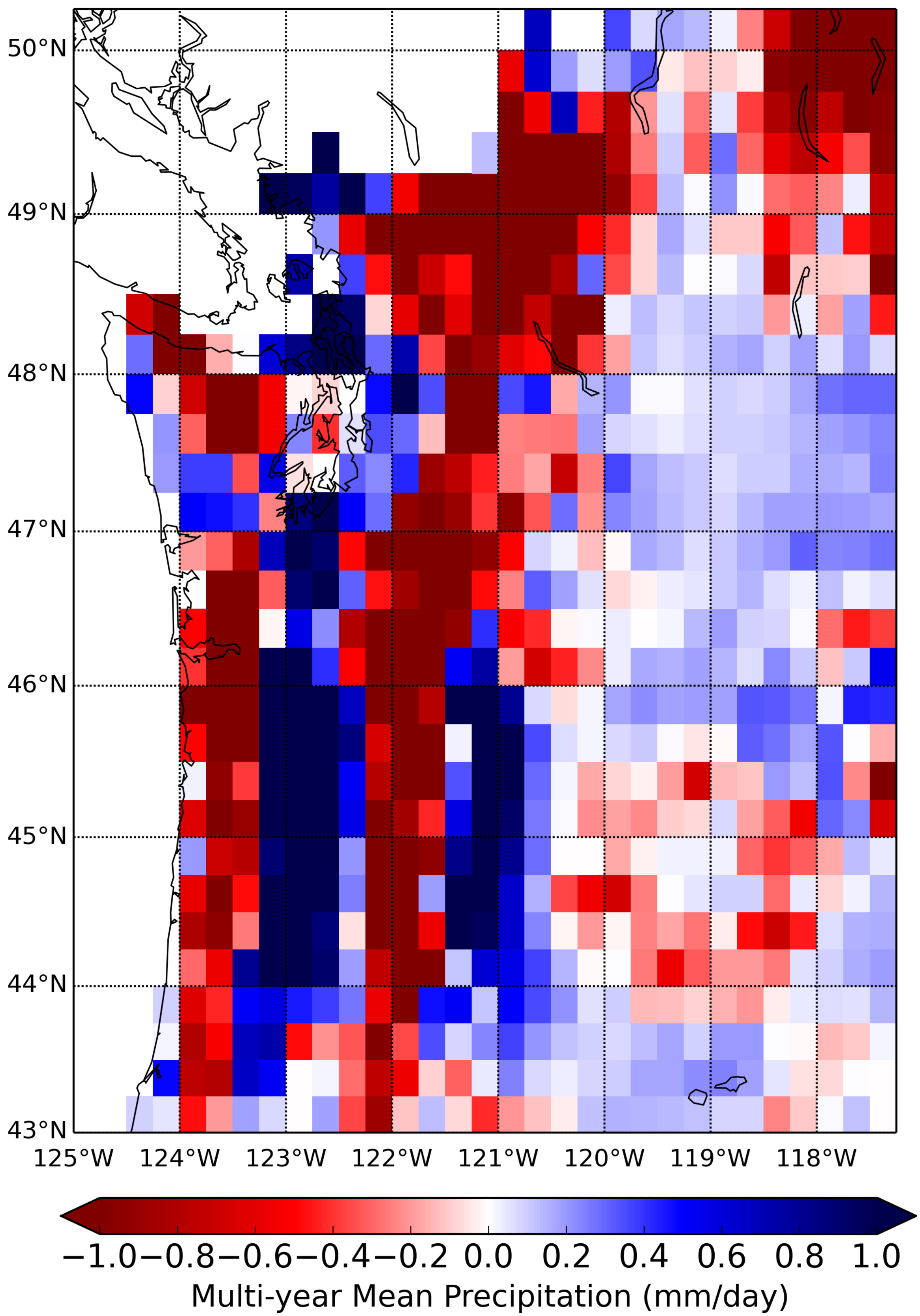

Fig 3. Difference between satellite data and observed data

Fig 3 shows there are larger anomalies in the windward size than in the leeward side, which is largely due to the higher intensity of precipitation in the windward side. The positive and negative anomaly patterns seem to have something to do with the elevation.

A boxplot of the difference is shown in Fig 4. Fig 4 shows that anomalies are generally between -1 and 1 mm/day apart from a few outliers. Fifth percentile of anomalies lies around 0, and anomalies are distributed symmetrically.

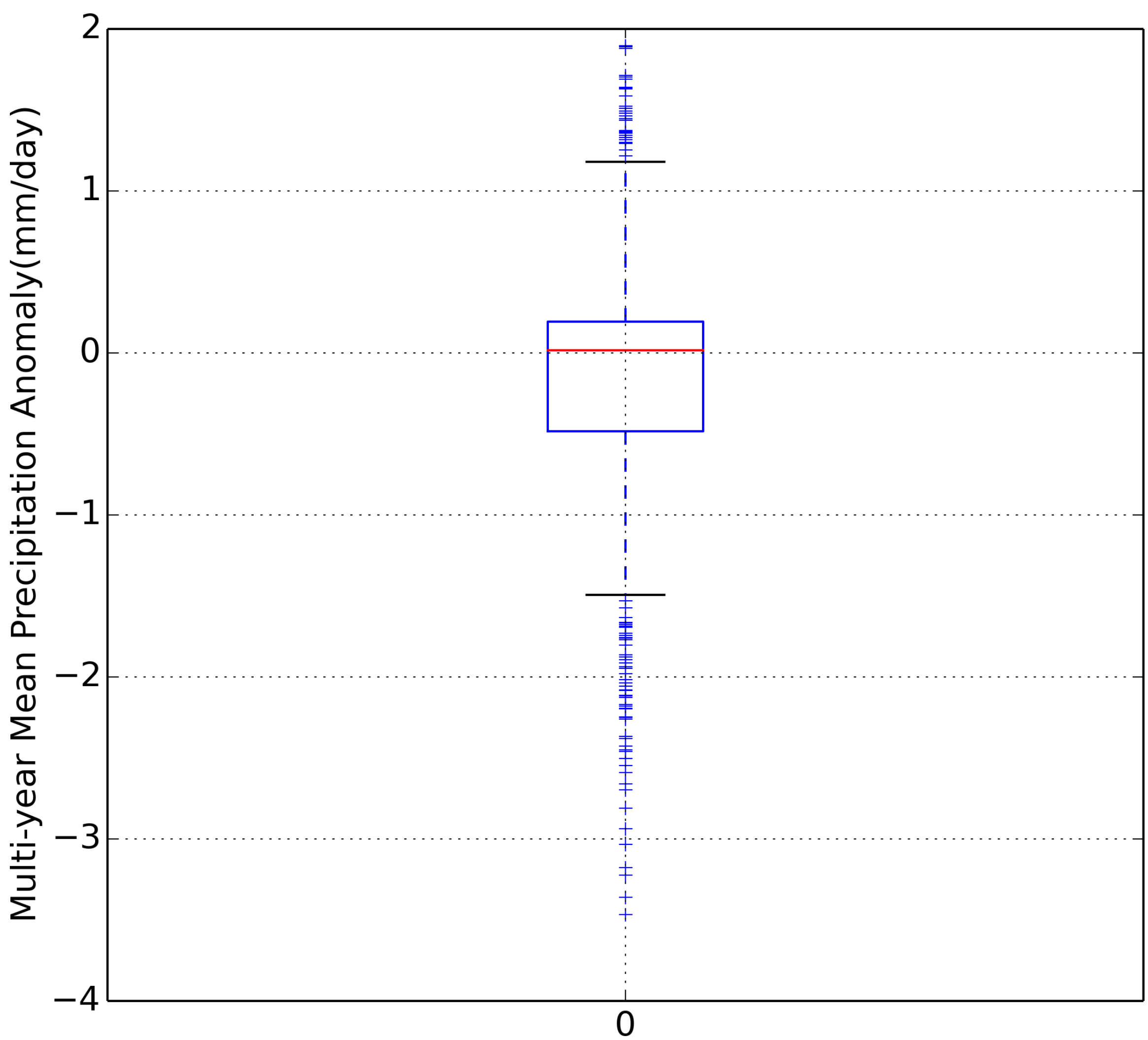

Fig 4 Boxplot of anomalies between multi-year mean precipitation of satellite and observed data

The annual spatial average precipitation of the satellite data is shown in Fig 5, which shows some trends of very wet years corresponding to ENSO.

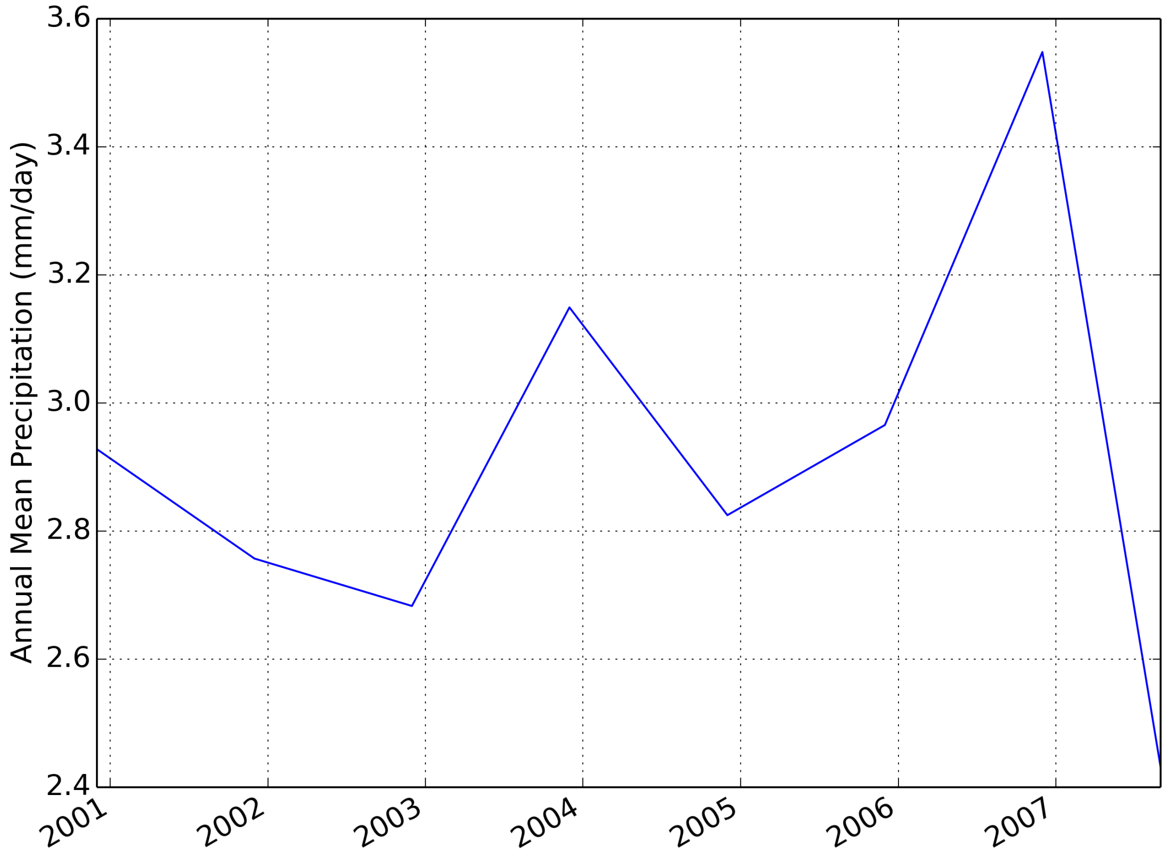

Fig 5. Annual mean of precipitation from satellite data

Conclusions

There is significantly different precipitation distribution on either side of the Cascades. The windward side, clearly, has larger precipitation. The satellite precipitation data captures some trends of very wet years corresponding to ENSO. The anomalies of satellite data are generally between -1 and 1 mm/day. The pattern of uncertainty seems to have something to do with elevation.

Reference

1. Hossain, Faisal, 2012: Do Satellite Data Portals Today Reach Out to Diverse End Users Around the World?. *Bull. Amer. Meteor. Soc.*, **93**, 1633–1634.
2. Livneh, Ben, et al. "A Long-Term Hydrologically Based Dataset of Land Surface Fluxes and States for the Conterminous United States: Update and Extensions*." *Journal of Climate* 26.23 (2013).