Sand Storms in Iran

Dust storms are recognized as having a very wide range of environmental impacts. Their geomorphologic interest lies in the amount of deflation and wind erosion they indicate and their role in loss formation. Atmospheric mineral-dust loading is one of the largest uncertainties in global climate-change modeling and is known to have an important impact on the radiation budget and atmospheric instability.

Sandstorm is one of the natural disasters that occur in some parts of Iran such as east, south and southwest of the country. It causes some problems in communication roads and urban life. We can refer to some historical events of Iran history which dust storm had important role, such as "Ghadesiyeh" War (Persian Empire and Muslims), and Tabas event (American Delta Force Mission). In last decade IRIMO forecasting center, begins the application of satellite images (MODIS, Meteosat-5 and etc) to forecasting and detection of sand storms in order to reduction of these disasters,

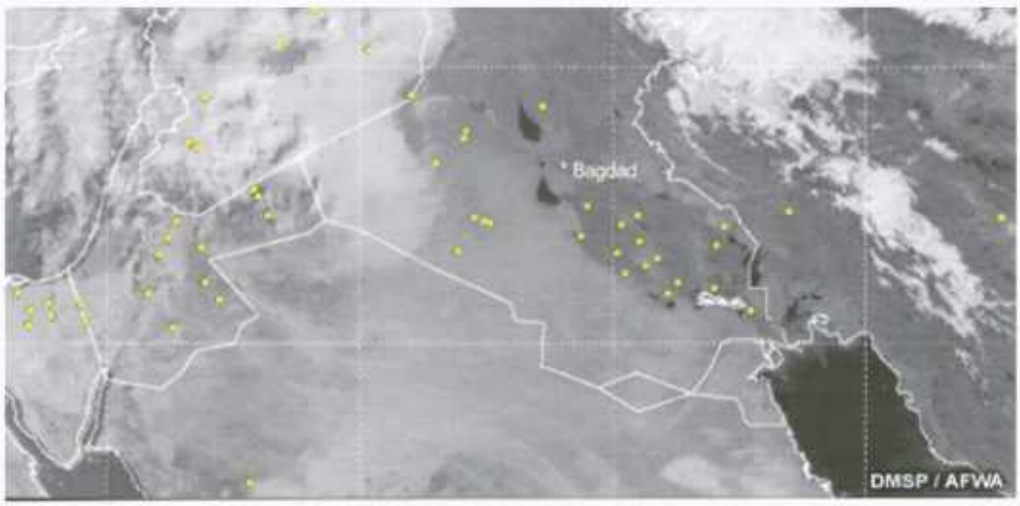

Figure 1. Point Sources of Dust

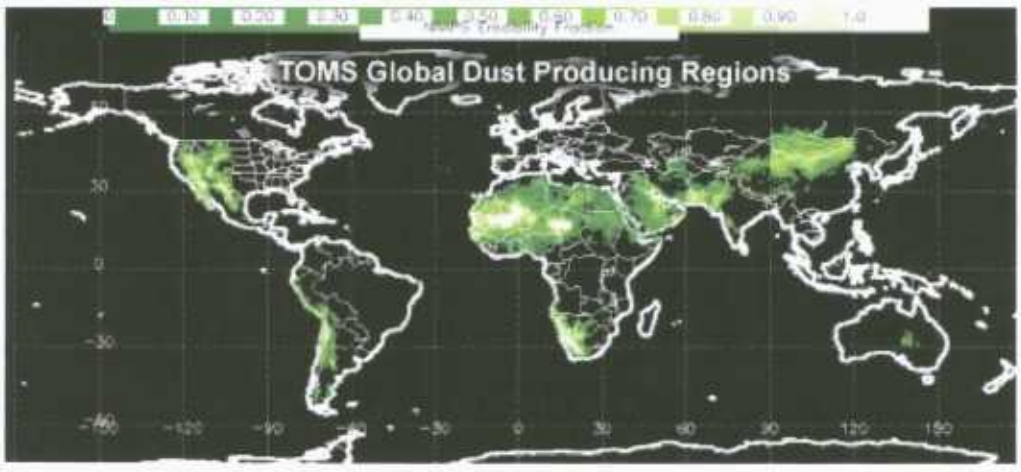

Figure 2. Source Regions from TOMS(Total Ozon Mapping Spectrometer) Aerosol Index

Figure 3 shows a major dust storm raging in the Kerman Desert, just east of the city of Bam in Southeastern, Iran. Afternoon of February 15, 2004

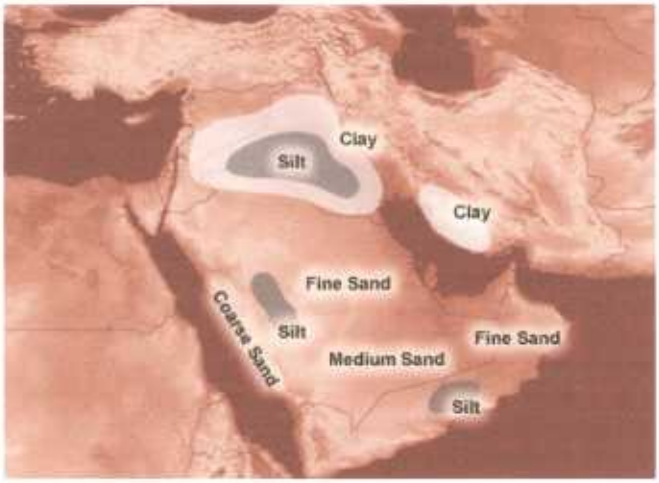

Figure 4: Map of Soil Grain Sizes in Middle East

In the middle East, some areas are much more prone to dust storms than others due differing soils and climate. Even in bare desert, the sandy areas, such as those found on the Arabian Peninsula, and southeast of

Iran, generally do not generate dust storms. It is the areas with silt- and clay-rich soils, most common in Iran and Iraq, which are responsible for most dust storms. In this region, these fine-grained soils are found in areas of dry lake beds and river flood plain deposits.

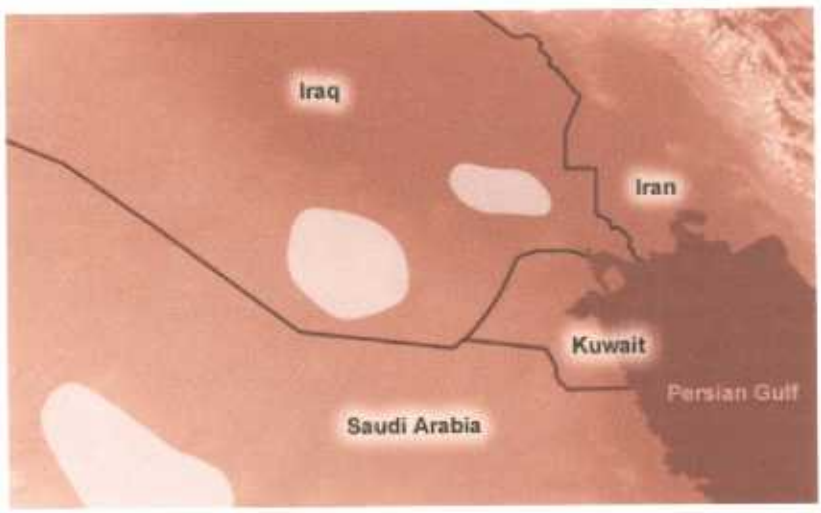

Figure 5. Areas of Highest Dust Storm Occurrence

This map (Figure 5) shows the areas of highest occurrence of dust storms around the northern Persian Gulf. Maps such as this are compiled over several seasons of observations and are invaluable for helping the forecaster anticipate dusty conditions.

These are dust storms caused by prefrontal and postfrontal winds that primarily occur in the winter, and summer dust storms caused by persistent northerlies.

Prefrontal dust storms occur across Jordan, Occupied Palestine, the northern Arabian Peninsula, Iraq, and western Iran as low-pressure areas move across the region.(Figure 6)

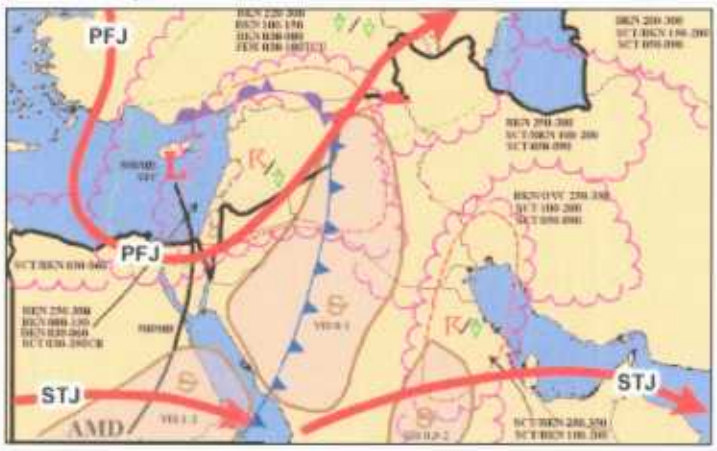

Figure 6

Figure 7: DMSP VIS Image 0614 UTC 16-Apr-84

In the winter months, frontal passage leads to strong northwesterly winds on the backside of the front. The resulting dust storm is referred to as a Shamal, from the Arabic for north. The Shamal produces the most widespread hazardous weather known to the region.

This graphic shows a cold front generated sandstorm stretching to the west of the Persian Gulf. (Figure 7)

The winter Shamal is generally characterized by durations of either 24-36 hours or 3-5 days. The 24-36 hour Shamal begins with passage of the front

The 3-5 day Shamal occurs 1-3 times a winter and produces the strongest winds and highest seas found in the Gulf.

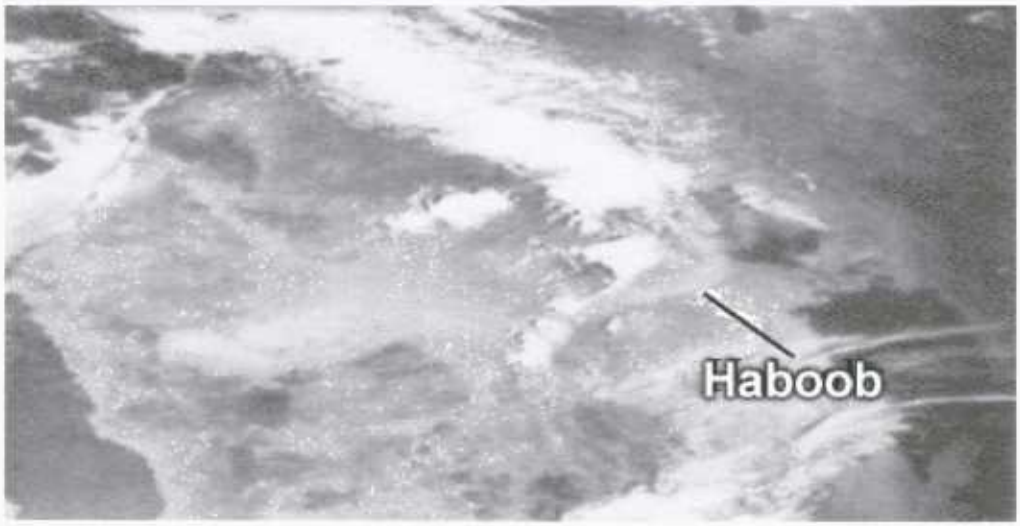

Figure 8: Haboob Near the Persian Gulf

Figure 8 is a visible satellite image that shows a Haboob near the Persian Gulf. The Haboob is associated with a thunderstorm system to the north. The convection is related to summer conditions with moist inflow from the Persian Gulf. The Zagros Mountains along the Iran/Iraq border produce enough.

Wind of 120 days

In summer, the monsoon system often causes two disasters in Iran such as Heavy Rainfall which include Flash Flood and Dust Storms that called "Sistan Wind of 120 days". This system results maximum in precipitation in the northern mountain regions of Pakistan, but generally suppresses rainfall over Iran and Afghanistan. Dust storms are prevalent through much of the region and are often associated with the "Wind of 120 days", the highly persistent winds of the warm season which blow from north to south. These storms occur throughout the year in the desert high plains. In Iran, south of Khorasan, east of Kerman, and south of Systan&Baluchestan provinces have been affected by the above mechanisms. Therefore due to this fact that those areas are very strategic, forecasting of these disasters are very important. In recent years, in IRIMO, some researches have been carried out in order to forecasting of this summer disasters, such as using satellite images and numerical dust storm prediction models.

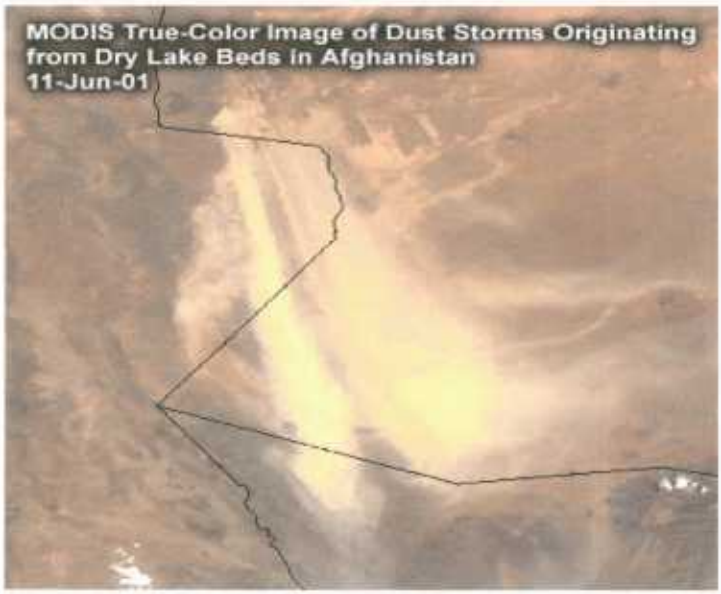

Figure 1.Dust Storm originating from dry lake beds in Afghanistan

Figure 1 shows long plumes of dust coming off of dry lake beds in western Afghanistan using MODIS true-color image. It could be noted that the dry lakes appear as point sources in this satellite view. These lake beds repeatedly provide the source material for dust storms.

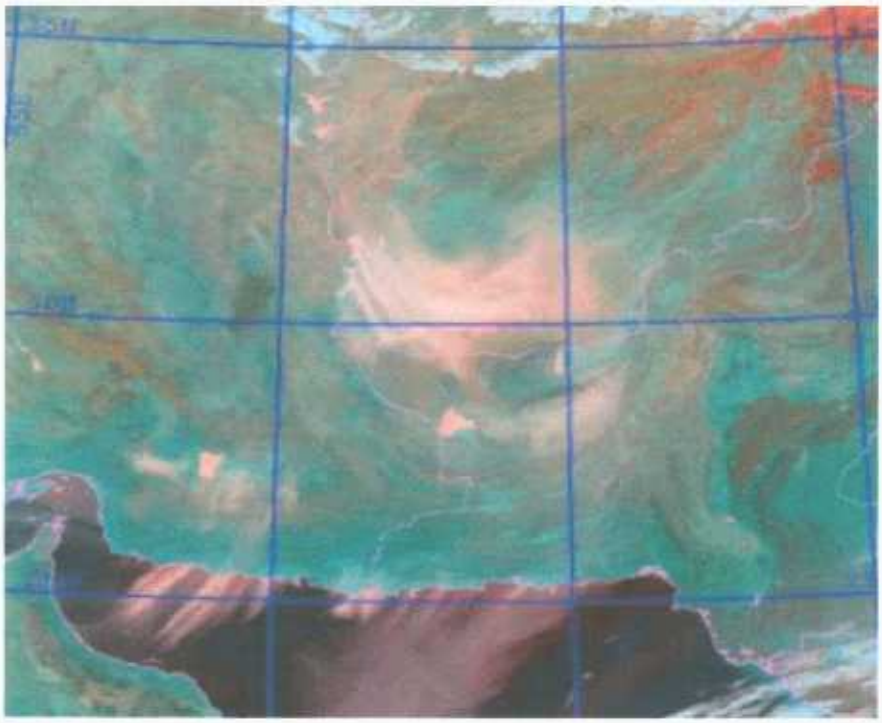

Figure 2. Dust Storm in SW Asia 10-Oct-01

MODIS Dust Product Image of a Dust Storm in SW Asia 10-Oct-01.This satellite image (Figure 2) shows a MODIS dust product image of dust storms in Afghanistan and to the south in Iran and Pakistan This image also shows plumes of dust coming of Iran and Pakistan

Figure 3. Dust Front in Afghanistan

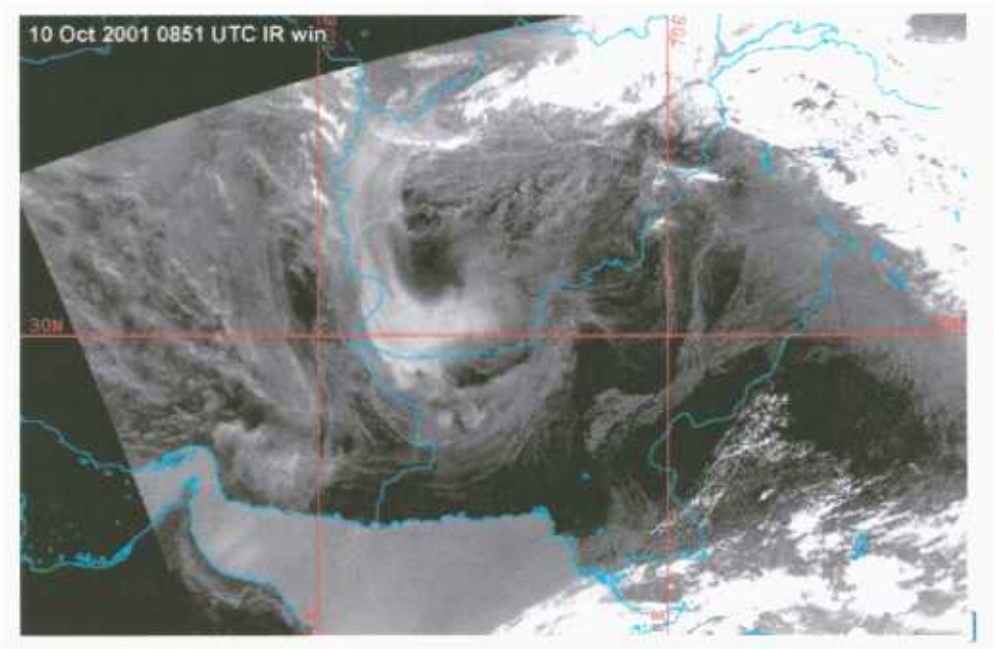

Figure 4. Dust Storm in SW Asia 10-Oct-01

As we have seen throughout this module, satellite imagery plays a crucial role in locating blowing dust. This section explores the the capability of dust detection for different sensors aboard different satellites. It also looks at new dust enhancement products that help forecasters see blowing dust on images.

Figure 5. EUMETSAT 2001, 10 Oct 2001 1030 UTC VIS

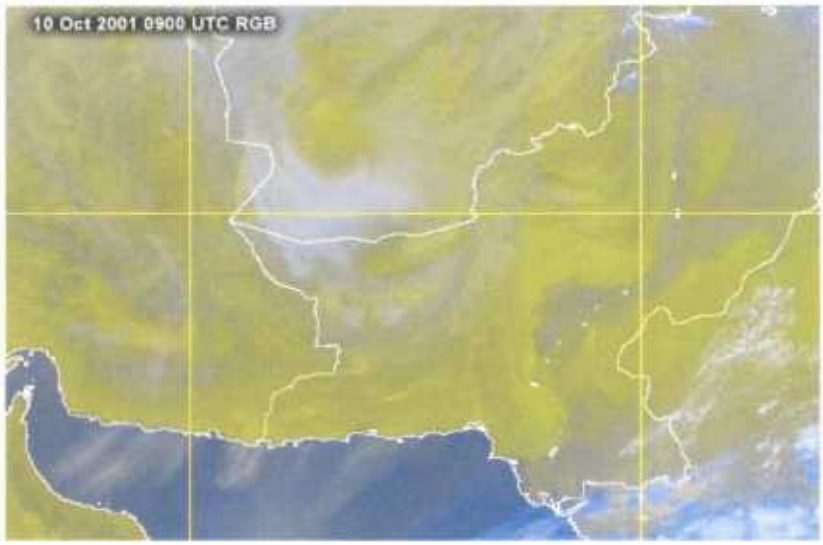

Figure 6. combines both the visible and infrared images into a single false-color product- 10 Oct 2001

The swathe of desert that stretches from Iran through Afghanistan and Pakistan into northwest India has been recognized as a source of atmospheric soil dust

Figure 7 shows four major source areas with AI (aerosol index) values of >0.8 the Makran coastal zone, stretching from southeastern Iran into neighboring Pakistan; a broad area of central Pakistan; an area at the convergence of the borders of Iran, Afghanistan, and Pakistan that comprises the Seistan Basin, Registan,

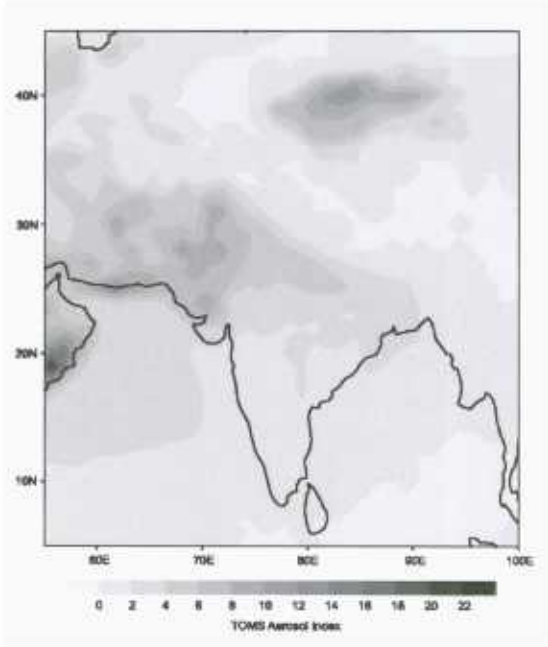

Figure 7. Annual average (Total Ozon Mapping Spectrometer) TOMS aerosol index (AI) values (×10) for southwest Asia, includes area of the Iran and northwestern Baluchistan;

Coastal Baluchistan/Makran appears as the most active source area according to the TOMS data, whereas Middleton's (1986a) map (Figure 8) shows the Seistan Basin area to have the most frequent dust-storm activity. Middleton highlights the plains of Afghan Turkestan as an area where annual dust-storm frequency exceeds thirty and two areas in Iran (around Yazd in the center and along the border with Turkmenistan) as having twenty or more dust storm days annually. None of these areas appears significant according to the TOMS data.

The Iran/Afghanistan/Pakistan border area is known as the Dasht-i-Margo. Dust sources are found in lowland parts of this mountainous region, including the Seistan Basin. Sediments available for deflation are fed into the basin from the surrounding mountains. Specific source areas are likely to be alluvial fans and ephemeral lakes.

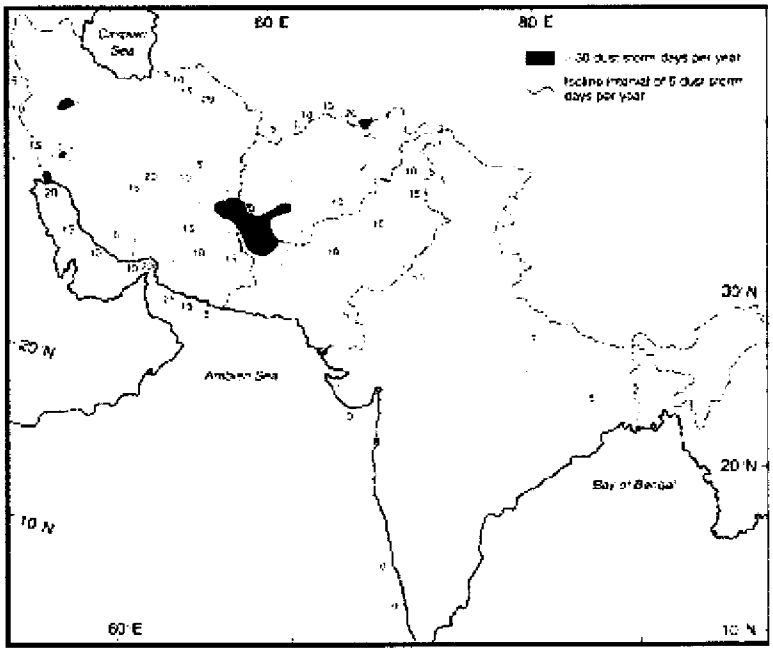

Figure 8. Distribution of surface-observed dust-storm frequencies in southwest Asia. Source: after Middleton (1986a).

It is important to forecasting the sand storms in this region. Because of locating of this region in the transit way of middle Asia countries and south ports of Iran exportation, several transportations, the importance of agriculture and; and carrying out several militarily operations.