REMOTE SENSING DROUGHT MONITORING AND ASSESSMENT BASED ON MODIS DATA IN MONGOLIA

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- Introduction
- Specifications of Mongolia
- Climate change in Mongolia
- Disaster situation
- Drought Monitoring
  - Operational RS works
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In the recent years, climate change has been one of our major problem.

Furthermore, drought is the single most important weather-related natural disaster.

Therefore, we need to use spatial techniques of Remote Sensing for drought monitoring
Mongolia is a landlocked country located in Central Asia. The highland with an area of 1,565,000 km$^2$ and a population of 3 million. The country is bordered by Russia to the north and China to the south, east and west. 

- **Land locked**
- **Different Natural zones**
- **Severe Continental Climate**
  (4 seasons, long winter, short summer)
- **Economy based on Agriculture/Animal Husbandry** (> 40 mln livestock, pasture > 90%)
- **Less industry (mining)**
- **Low density of human population**
  3. million/1,565 mln sq.km
  50% - in capital city (UB)
- **Few bigger cities and towns**

**Mongolia nature and geography**
Mongolia has one of the coldest climates in the world, with temperatures dropping below -25$^\circ$C for several months each year. And but summer is hot and not so long. Therefore Mongolia is known to the world as a country of "Blue Sky."
CLIMATE CHANGE IN MONGOLIA

CURRENT SITUATION:

Annual mean Air temperature change trend since 1940
Increased in 2.1 degree C

Annual precipitation change trend since 1940
Decreased in 7%
**Major Disaster in Mongolia**

- **Drought, Dzud, (Fire)**
  - Dzud - harsh winter (cold + heavy snow)
  - **Drought** occurs every year affecting 30 – 70% of total area => inadequate pasture, hay and fodder.
  - Drought in summer followed by dzud in winter => livestock losses.

**Dust storm**

**Dzud (Winter storms)**

**Wildfire**

Winter storms
DROUGHT MONITORING

The intensity, frequency and area of natural hazards/natural disasters are increasing (L. Natsagdorj et al., 2004)
Pasture & Drought monitoring using satellite data

**National Remote Sensing Center** – responsible for Satellite data receiving, processing and servicing (**Aqua, Terra/MODIS, Soumi-NPP, NOAA, MetOp-B, FY-2**).

**MODIS/NDVI data, 250m, 10 daily**

**Biomass and pasture, NOAA 19 data, 10 days**

**MODIS/ Drought index, 10 days**

For a full understanding, these visual representations would be essential, but they are not included here.
<table>
<thead>
<tr>
<th>Month</th>
<th>1st 10 day</th>
<th>2nd 10 day</th>
<th>3rd 10 day</th>
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<tbody>
<tr>
<td>May</td>
<td><img src="image" alt="Map May 1st 10 day" /></td>
<td><img src="image" alt="Map May 2nd 10 day" /></td>
<td><img src="image" alt="Map May 3rd 10 day" /></td>
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<tr>
<td>June</td>
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<td><img src="image" alt="Map June 2nd 10 day" /></td>
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<tr>
<td>July</td>
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<tr>
<td>August</td>
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<td><img src="image" alt="Map August 2nd 10 day" /></td>
<td><img src="image" alt="Map August 3rd 10 day" /></td>
</tr>
</tbody>
</table>
VCI Drought index

1\textsuperscript{st} 10 day

2\textsuperscript{nd} 10 day

3\textsuperscript{rd} 10 day

May

June

July

August
Drought mapping was made combined by 3 regions which has more than 50% correlation including forest, steppe, desert steppe. The correlations between RS Drought index and SPI index calculated by meteorological parameter were different in various natural zones separately.

Natural regional made from mapping of land cover classification by MODIS data in 2010.

<table>
<thead>
<tr>
<th>Natural zones</th>
<th>Soil moisture 10cm vs RS indices</th>
<th>AI vs RS indices</th>
<th>SPI vs RS indices</th>
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</thead>
<tbody>
<tr>
<td>Forest</td>
<td>r &gt;45 (NDDI, VHI, TCI...)</td>
<td></td>
<td></td>
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<tr>
<td>Steppe</td>
<td>r &gt;45 (VSWI)</td>
<td>r &gt;49 (TCI)</td>
<td>r &gt;46 (TCI, VSWI)</td>
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<tr>
<td>Desert Steppe</td>
<td>r &gt;45 (VHI)</td>
<td>r &gt;45 (TCI, VHI)</td>
<td>r &gt;46 (TCI)</td>
</tr>
</tbody>
</table>
Combined by Drought indices

Forest

Steppe

Desert steppe

Combine
Field measurement

The joint field work.
1. Institute of Remote Sensing and Digital Earth Chinese Academy of Sciences
2. Meteorological institute of Mongolia

Total: 2000 km
Fixed filed area

150 km * 2 = 300 km * 2 days = 600 km
# Field Measurement

Field work for drought

Before cutting Biomass

After cut Biomass

Soil moisture
Drought Monitoring system from RADI of CAS China
Drought Monitoring maps of Mongolia

June, 2017

July, 2017

1st August, 2017

2nd August, 2017

3rd August, 2017
THANK YOU FOR ATTENTION!