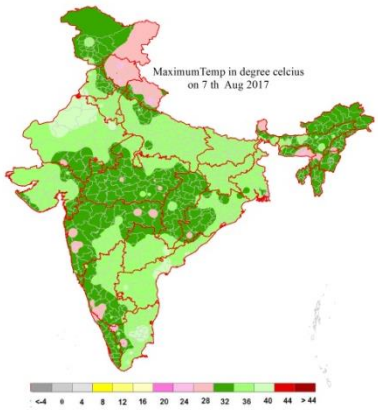
Products/ Agromet products for Agromet Advisory Services

Spatial Daily, Weekly, Fortnightly, Monthly and Seasonal weather parameters

Weather information at different temporal and spatial scale is useful for preparation of Agromet Advisories. In view of that spatial Daily, Weekly, Fortnightly, Monthly and Seasonal scales are being generated utilizing the realized weather observations for the parameters Temperature (Maximum temperature, Minimum temperature, Diurnal temperature), Maximum and Minimum Relative Humidity, Cloud and Wind speed. Synoptic observatory data received in GTS is used to generate maps on Pan India mode.

<table>
<tr><th colspan="3">Realized Weather at Daily Scale</th></tr>
<tr><th>Maximum Temperature</th><th>Minimum Temperature</th><th>Diurnal Temperature Variation</th></tr>
<tr>
<td> 
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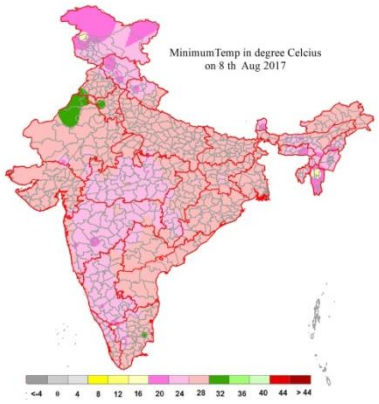
<td> 
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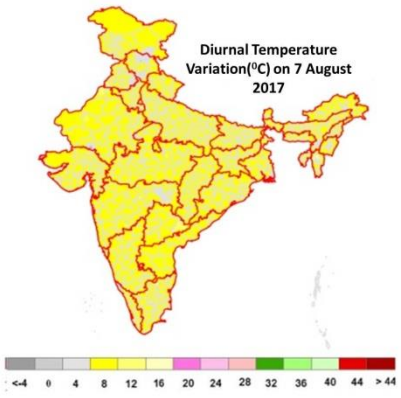
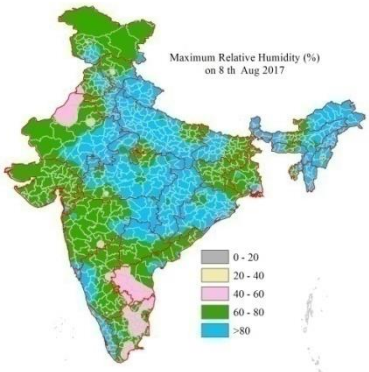
<td> 
</td>
</tr>
<tr><th>Maximum Relative Humidity</th><th>Minimum Relative Humidity</th><th>Cloud Cover</th></tr>
<tr>
<td> 
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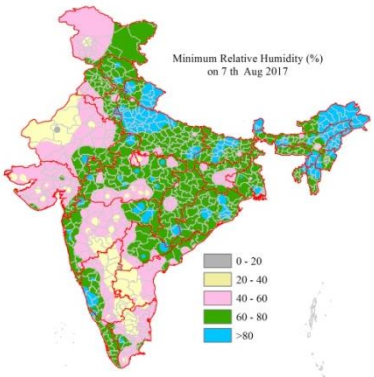
<td> 
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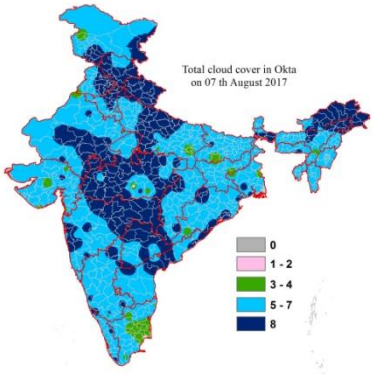
<td> 
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<tr><th colspan="3">Wind Speed</th></tr>
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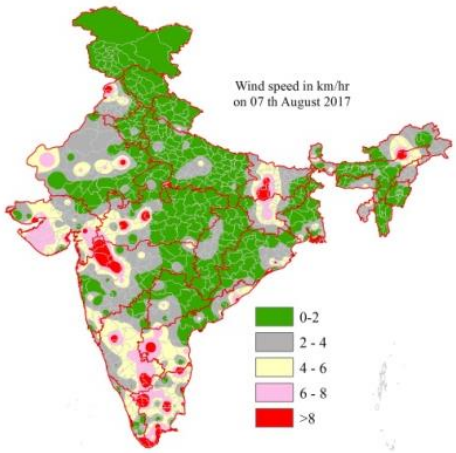
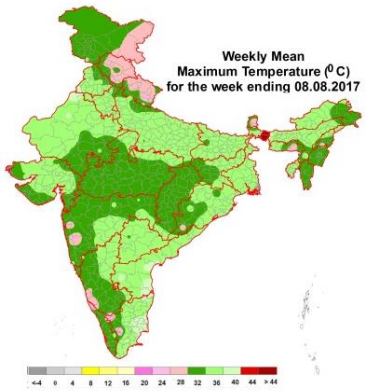
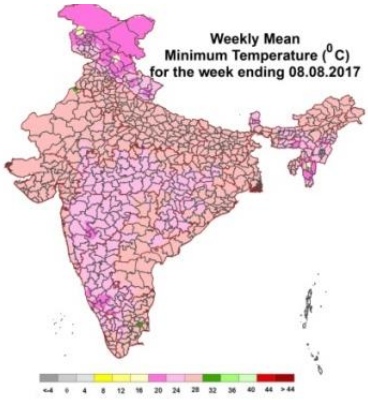
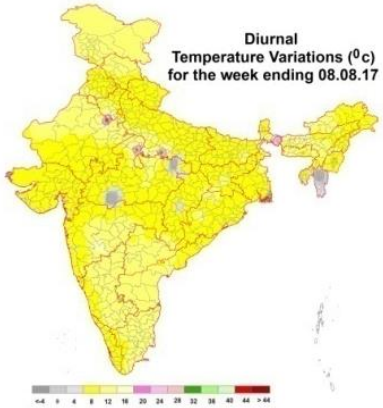
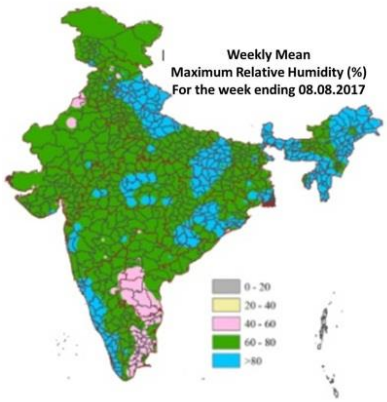
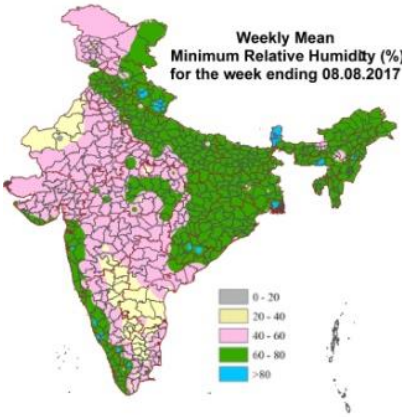
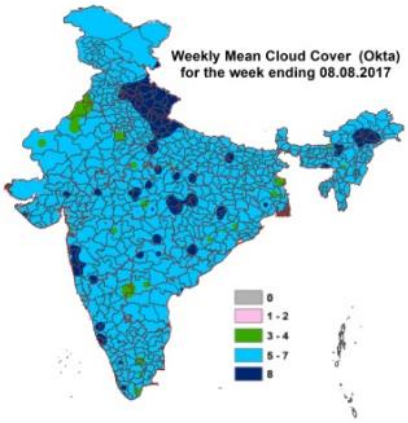
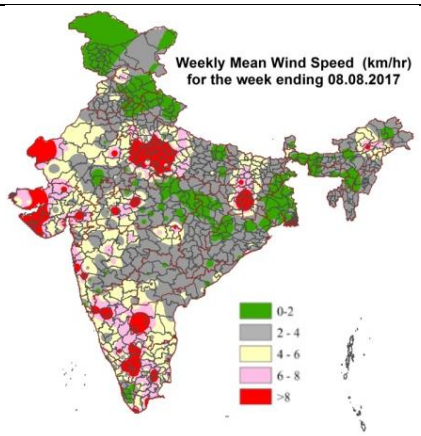


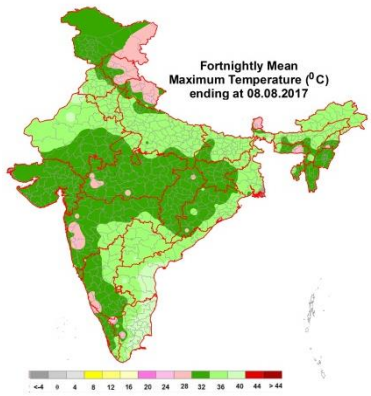
Realized Weather at Weekly Scale

Maximum Temperature	Minimum Temperature	Diurnal Temperature Variation
		
Maximum Relative Humidity	**Minimum Relative Humidity**	**Cloud Cover**
		
Wind Speed		

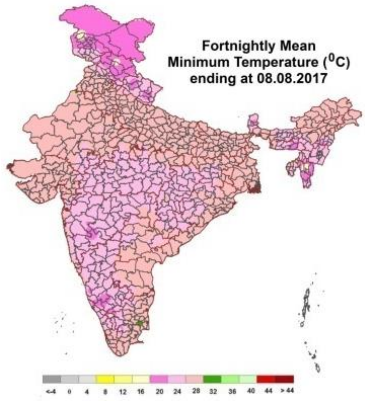


Realized Weather at Fortnightly scale

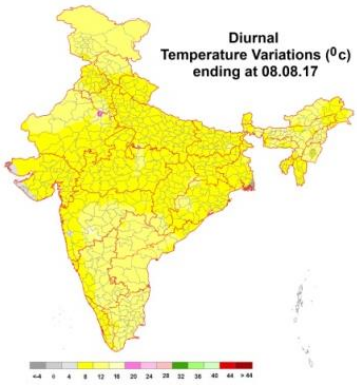
Maximum Temperature



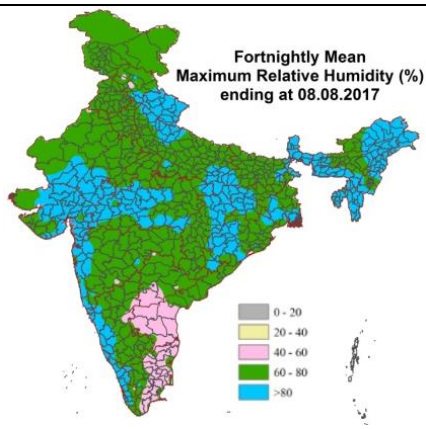
Minimum Temperature



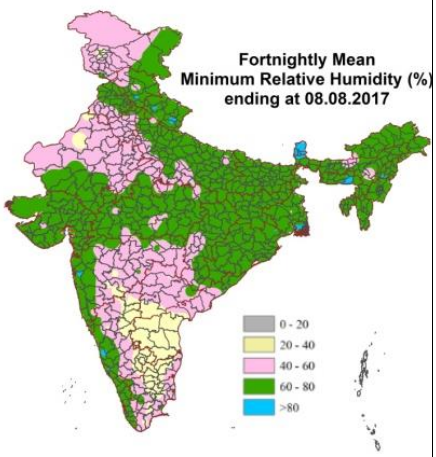
Diurnal Temperature Variation



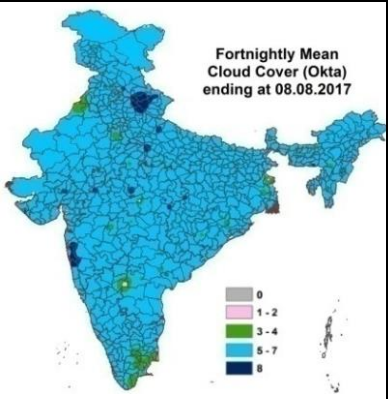
Maximum Relative Humidity



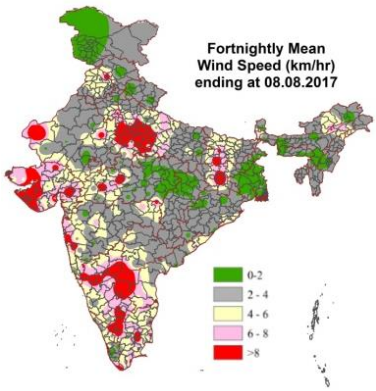
Minimum Relative Humidity



Cloud Cover

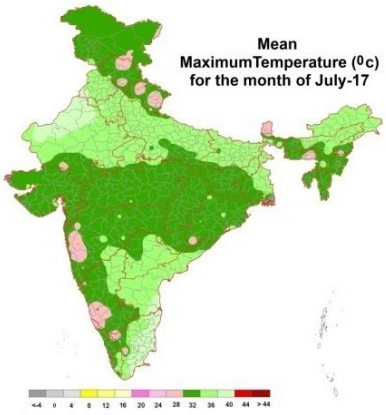


Wind Speed

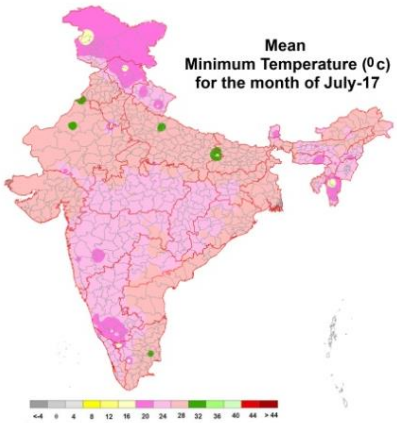


Realized Weather at Monthly Scale

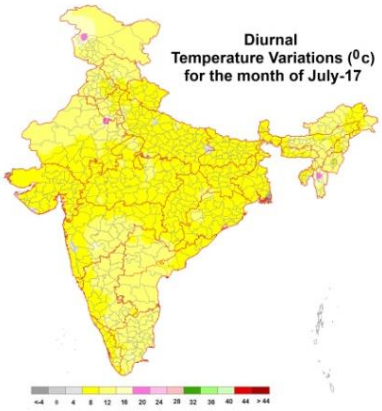
Maximum Temperature



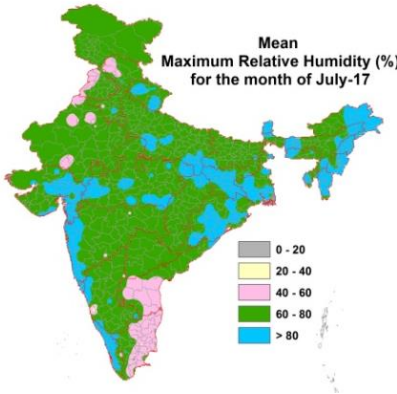
Minimum Temperature



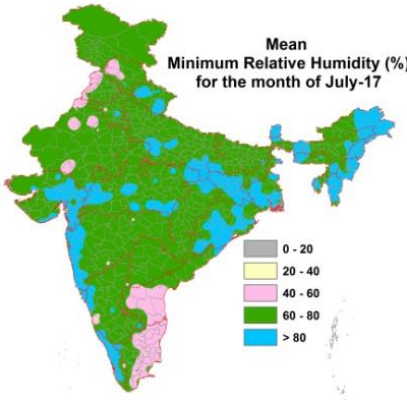
Diurnal Temperature Variation



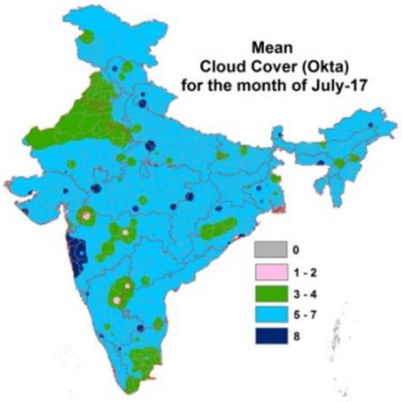
Maximum Relative Humidity



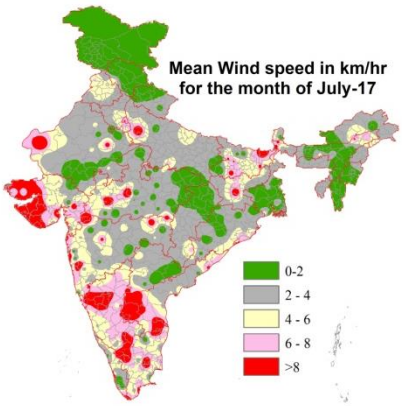
Minimum Relative Humidity



Cloud Cover

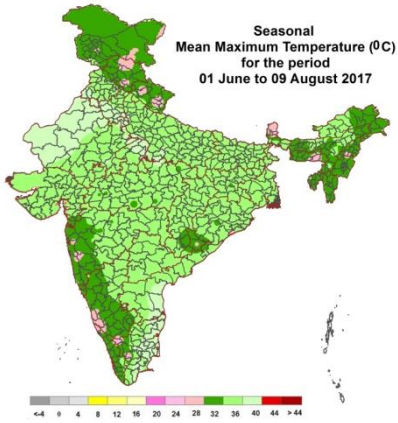


Wind Speed

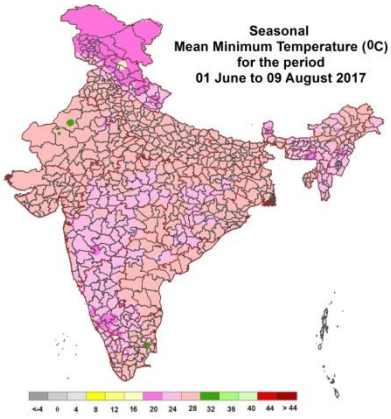


Realized Weather atSeasonal Scale

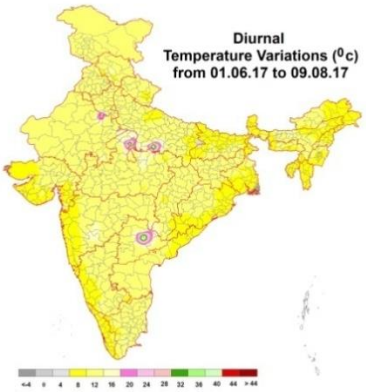
Maximum Temperature



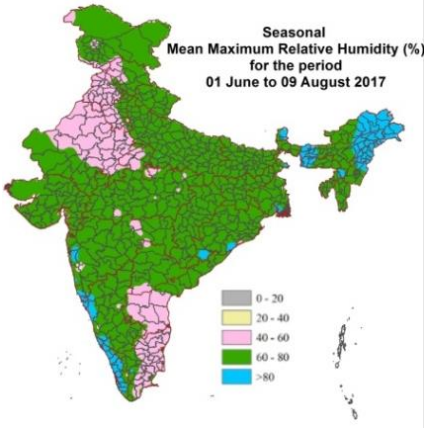
Minimum Temperature



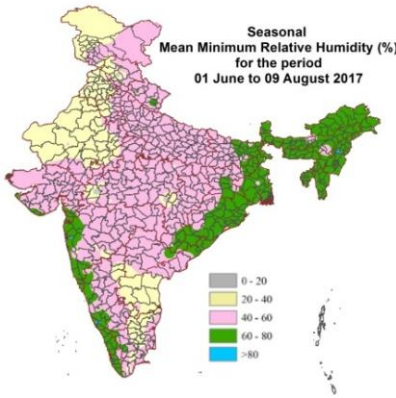
Diurnal Temperature Variation



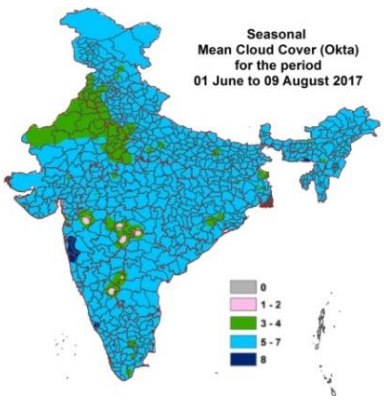
Maximum Relative Humidity



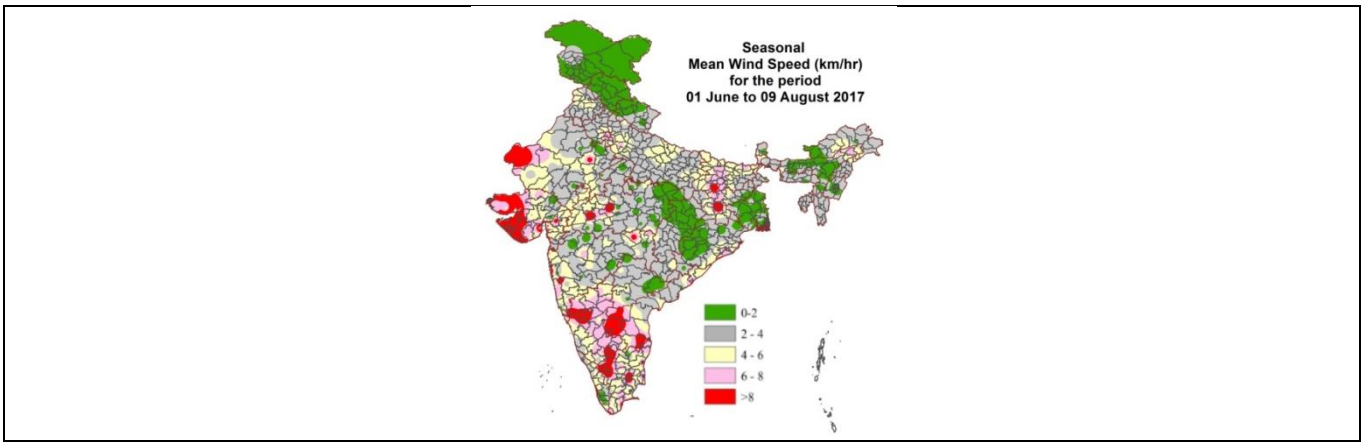
Minimum Relative Humidity



Cloud Cover

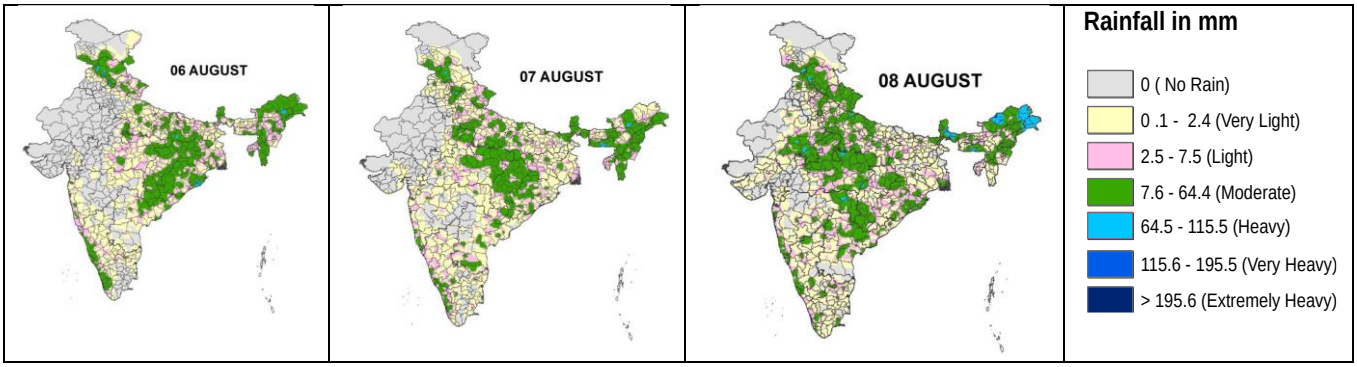


Wind Speed



Daily Spatial Rainfall

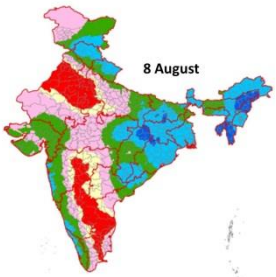
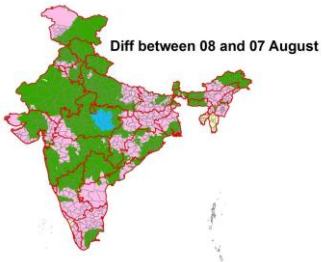
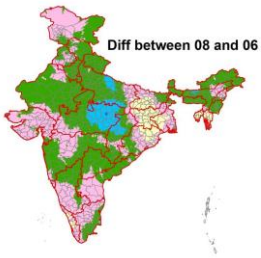
Gridded rainfall data generated daily over India at a grid resolution of 0.25° X0.25° of measured rainfall from the large number rain-gauge stations distributed over India is interpolated at 0.25° X0.25° and spatial district rainfall is generated.



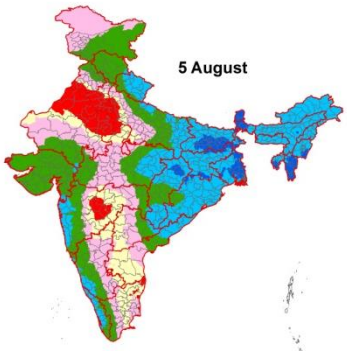
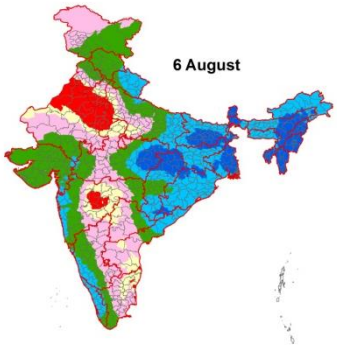
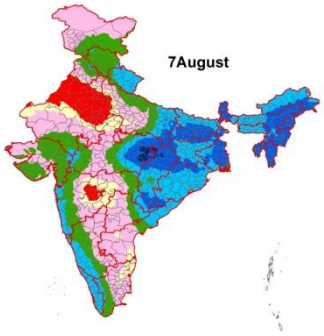
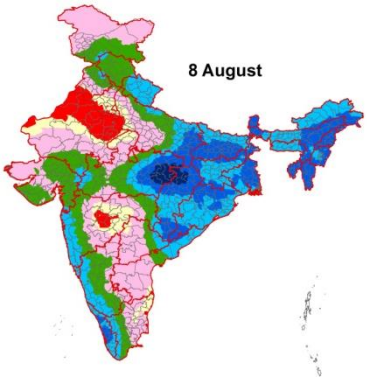
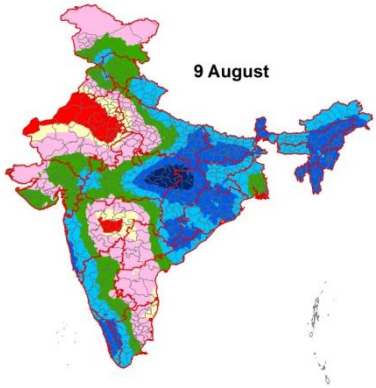
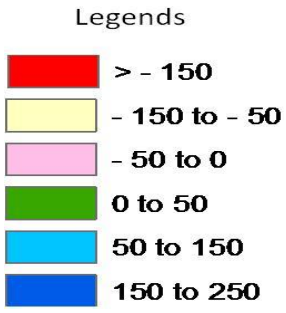
Agromet Products

Realized & forecast Soil Moisture on pan India Mode

Soil moisture information is used in preparation of agromet advisories in respect of sowing, irrigation, mulching etc. Daily soil moisture has been computed by Soil Water Balance (SWB) technique based on the method of Thornthwaite and Mather (1955). Spatial district rainfall values extracted in GIS are used as data source to generate daily realized soil moisture. In addition to daily soil moisture data, cumulative difference between two consecutive days for soil moisture are also made. Presently static PET of 144 stations interpolated in GIS is being used in the model. Shortly it will be replaced with dynamic PET to be received under collaborative project with SAC, Ahmedabad.

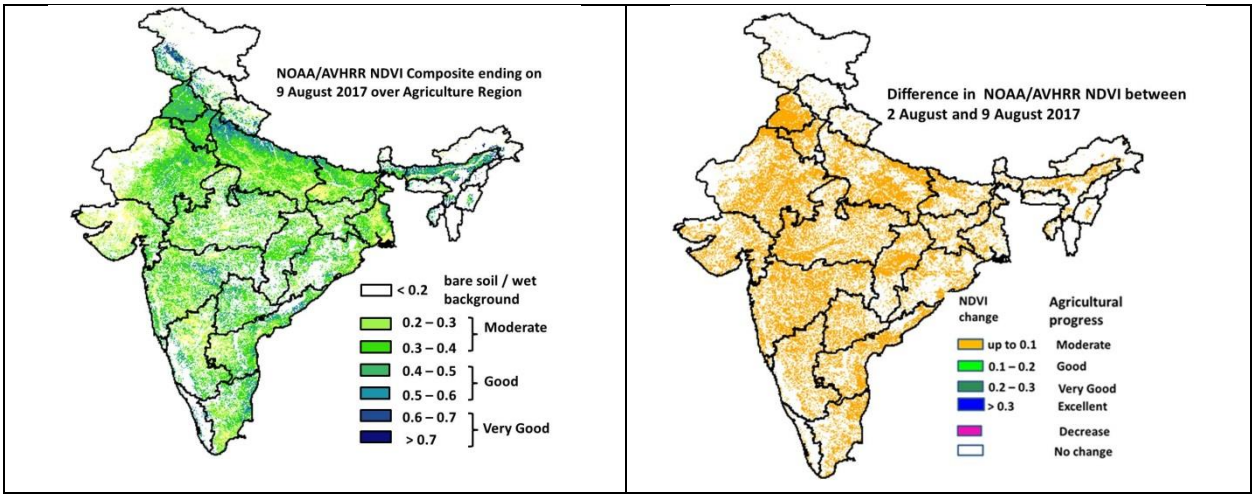
Daily Soil moisture	Difference between two consecutive days	Difference between three consecutive days	Colour scale
			

Soil moisture Forecast is made based on quantitative rainfall forecast**.** NWP Model output of T 1534 (Rainfall) is value added by RMCs/MCs on every Tuesday and Friday and the same is being used to generate soil moisture forecast at district level. Soil moisture information along with forecast can be used for irrigation scheduling, early warning of dry spells, and crop yield forecasting etc.

Soil moisture forecast Day 1	Soil moisture forecast Day 2	Soil moisture forecast Day 3
		
Soil moisture forecast Day 4	**Soil moisture forecast Day 4**	**Colour Scale**
		

Satellite Product: Normalised Difference Vegetation INDEX (NDVI)

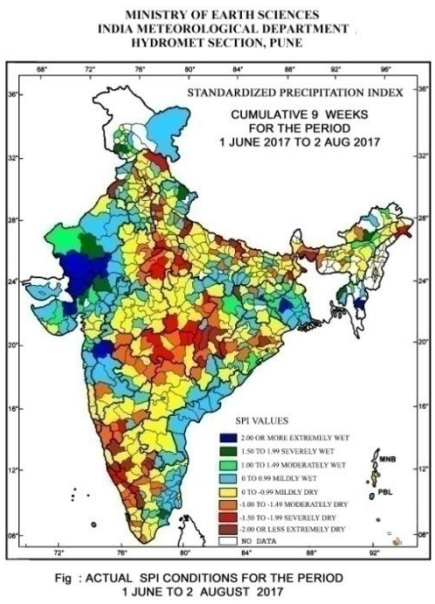
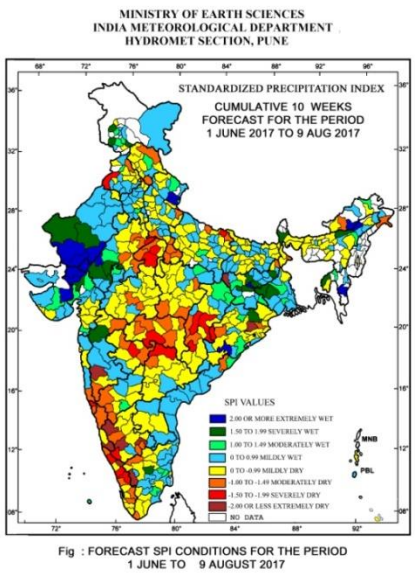
The Normalised Difference Vegetation Index (NDVI) is an index of plant "greenness" or photosynthetic activity, and is one of the most commonly used vegetation indices. Many factors affect NDVI values like plant photosynthetic activity, total plant cover, biomass, plant and soil moisture, and plant stress. Weekly NDVI products are being operationally generated from NOAA VHRR. This dataset contains gridded daily Normalized Difference Vegetation Index (NDVI) derived from the NOAA Climate Data Record (CDR). The data are projected on a 0.05 degree x 0.05 degree global grid. In addition to country as a whole, NDVI is also extracted state-wise. Besides, difference of NDVI between the two successive weeks is also computed.



* NDVI has been generated using the Agricultural Mask prepared by SAC Ahmedabad.

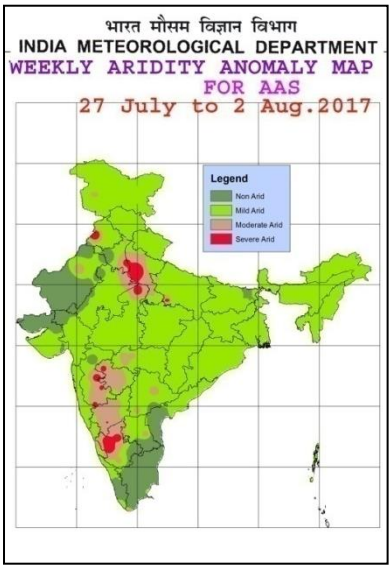
Products generated in Climate Data and Management Services, IMD,Pune

1. Standard Precipitation index: The Realized Standardized Precipitation Index (SPI) along with its forecast is a useful tool used for monitoring dry spells as well as Meteorological drought and subsequently decision are made on sowing, irrigation etc. It allows to determine the rarity of a drought at a given time scale (temporal resolution) of interest for any rainfall station with historic data. It can also be used to determine periods of anomalously wet events. Two SPI district maps one for the Actual for the period 1st June to present week and other for the cumulative forecast for further one week that can be used in Agromet Advisories. Forecast map is based on GFS district rainfall forecast

 Fig : ACTUAL SPI CONDITIONS FOR THE PERIOD 1 JUNE TO 2 AUGUST 2017	 Fig : FORECAST SPI CONDITIONS FOR THE PERIOD 1 JUNE TO 9 AUGUST 2017
Cumulative Nine weeks SPI (realized)	Cumulative 10 weeks forecast (Nine weeks realized and one week forecasted values)

2. **Aridity Anomaly maps:** Aridity Anomaly Map gives information about the moisture stress experienced by growing plant. This analysis would indicate qualitatively retardation in the plants growth and so poor yields. Indirectly, this may also be helpful for irrigation scheduling, the amount and the time at which the water is badly needed by the plant. The Aridity Index is worked out on weekly / biweekly basis during the monsoon, country as a whole, and selected sub-divisions (Tamil Nadu & Puduchery, Kerala, South Interior Karnataka and Andhra Pradesh) are worked out.

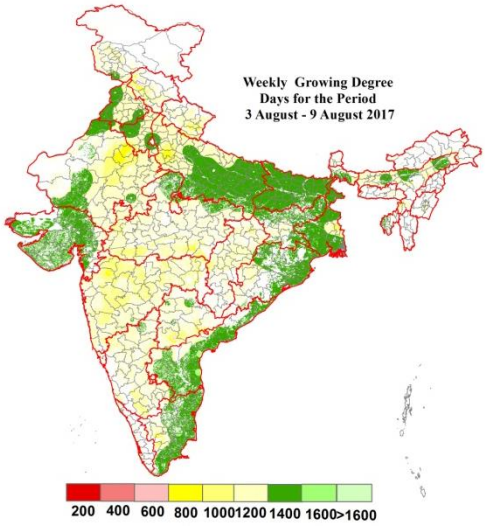
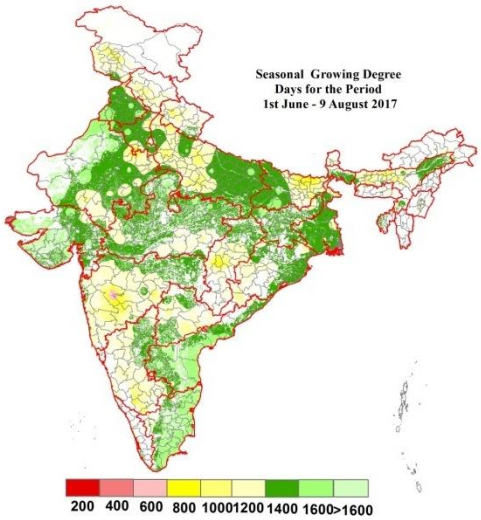
.



MoreAgromet products

1. Anomaly for weather parameters: Anomaly of different weather parameters from long term average will also be generated on different temporal and spatial scales.

2. Growing Degree days: Growing degree days (GDD) is a weather-based indicator for assessing crop development. It is a calculation used as a measure of heat accumulation used to predict plant and pest development rates such as the date that a crop reaches maturity. GDD units can be used to: assess the suitability of a region for production of a particular crop; estimate the growth-stages of crops, weeds or even life stages of insects; predict maturity and cutting dates of forage crops; predict best timing of fertilizer or pesticide application; estimate the heat stress on crops; plan spacing of planting dates to produce separate harvest dates. These maps will be prepared on weekly and season scale for both the crop growing seasons. Maximum and minimum temperatures obtained from synoptic observations are used for computation of GDD. For *kharif* crops, 10^0C is taken as based temperature and it will be 5^0C for *rabi* crops.

Weekly Growing Degree days	Season Growing Degree days
	

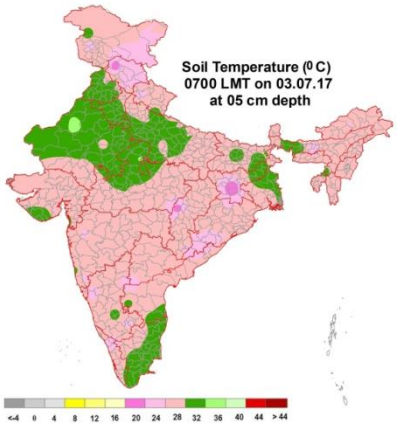
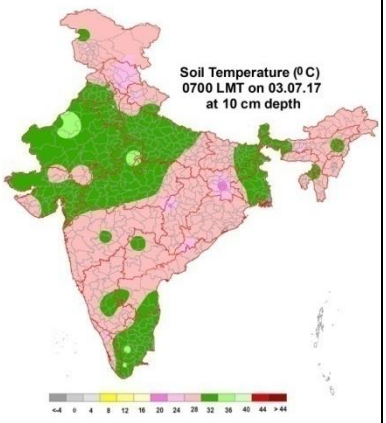
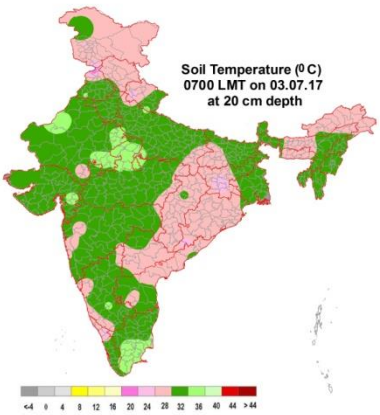
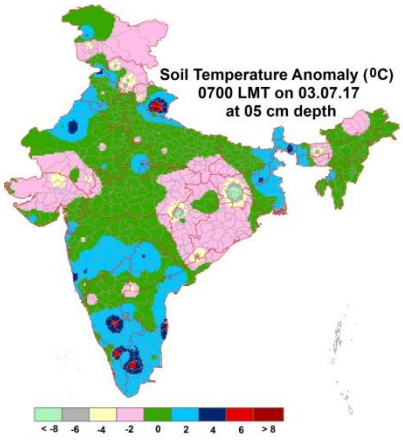
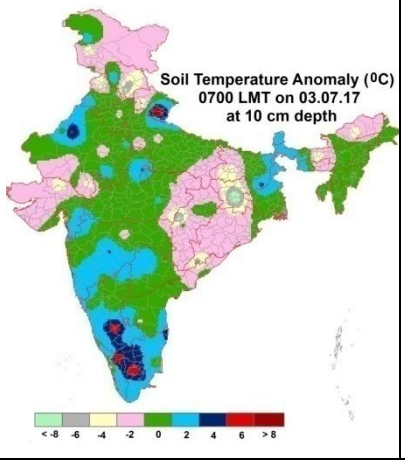
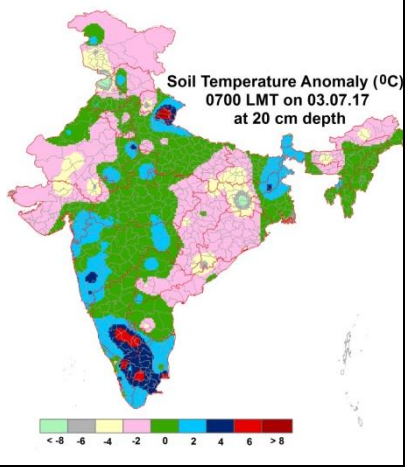
* Growing Degree days has been prepared by superimposing Agricultural Mask developed by SAC Ahmedabad.

3. Soil temperature& its anomaly at different depths

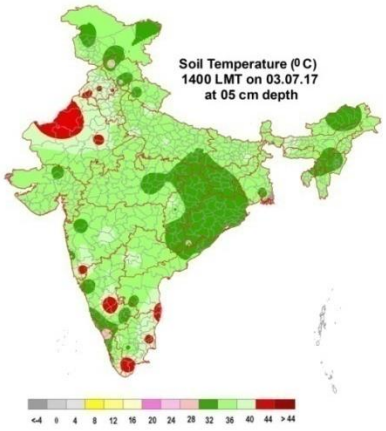
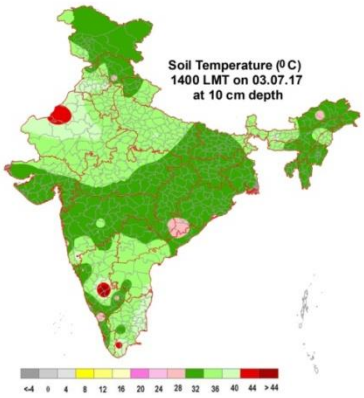
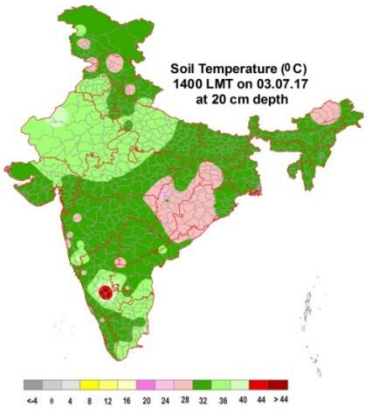
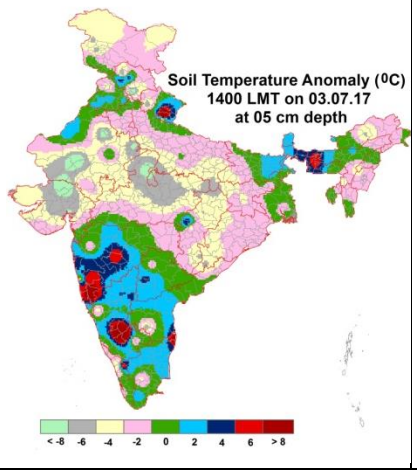
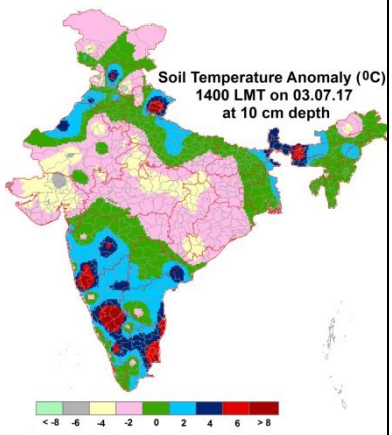
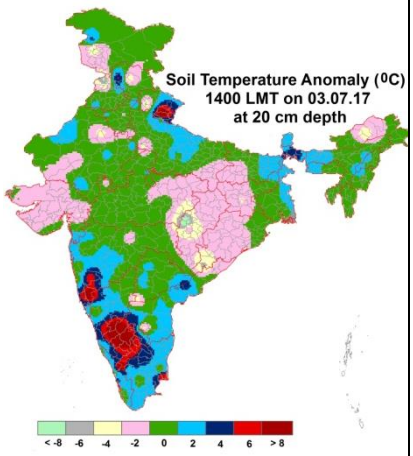
The soil layer of the earth is critical in maintaining plant life, offering mechanical support, and supplying water and nutrients. In affects plant growth directly, that is all crops practically slow down their growth. It is useful tool during germination and can also give information of soil borne pest and disease information.

Presently 153 stations are recording soil temperature at different depths at 07LMT and 14 LMT and transmitting to Agrimet Division through different modes. Soil temperatures recorded at these stations are used for spatial spread on pan India mode at different depths (5cm, 10cm, 20 cm).

Presently Agrimet Division has archived more than 20 years of soil temperatures data from stations. Work has been undertaken to generate normals for these stations as per WMO standards and will be spatially spread over GIS to derive district soil temperature normal at different depths. Soil temperature anomaly will also be generated at different depths after calculation of daily normals.

RealisedSoil Temperature at different depths at 07 LMT		
Soil temperature at 5 cm	**Soil temperature at 10 cm**	**Soil temperature at 20 cm**
		
Soil Temperature Anomaly at different depths at 07 LMT		
Soil temperature Anomaly at 5 cm	**Soil temperature Anomaly at 10 cm**	**Soil temperature Anomaly at 20 cm**
		

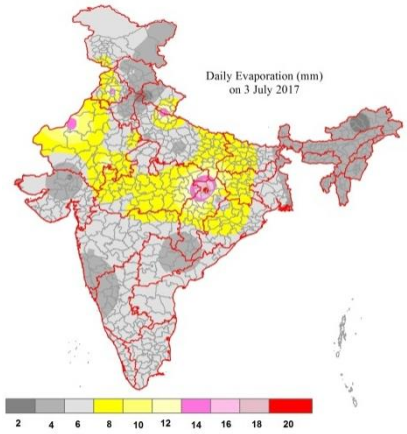
Realised Soil Temperature at different depths at 1400 LMT

Soil temperature at 5 cm	Soil temperature at 10 cm	Soil temperature at 20 cm
		
Soil Temperature Anomaly at different depths at 1400 LMT		
Soil temperature Anomaly at 5 cm	**Soil temperature Anomaly at 10 cm**	**Soil temperature Anomaly at 20 cm**
		

4. Evaporation from Evaporation network and anomaly

Evaporation information can be useful to decide water management practices particularly in respect of irrigation scheduling) which is ultimately improve crop productivity. While plants need water to grow properly, water is often a scarce resource in many agricultural areas. By reducing the effects of evaporation through mulching etc., farmers can better utilize the water from rainfall and other natural sources and use less water while irrigating agricultural crops.

Presently 143 stations are recording evaporation at 830 hrs IST and transmitting to Agrimet Division through different modes. Work has been undertaken to generate normals for these stations as per WMO standards and will be spatially spread over GIS to derive district evaporation normal



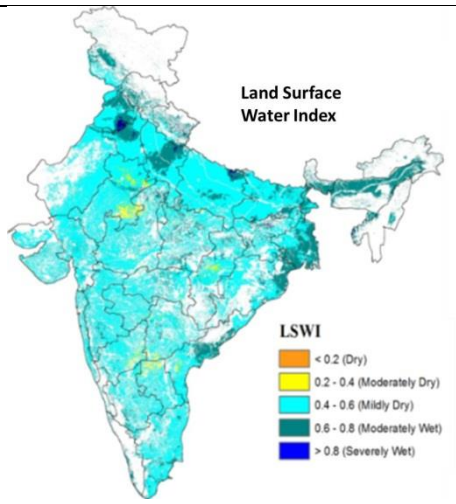
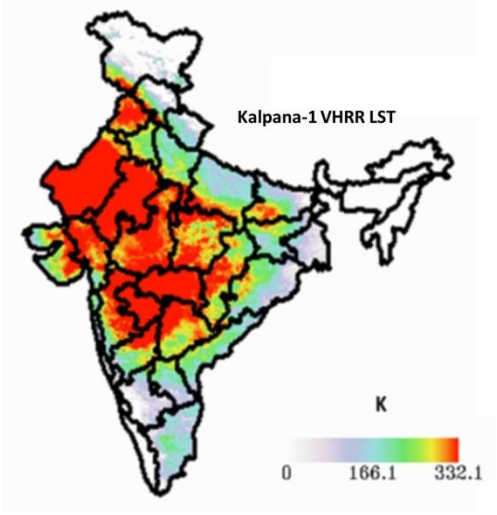
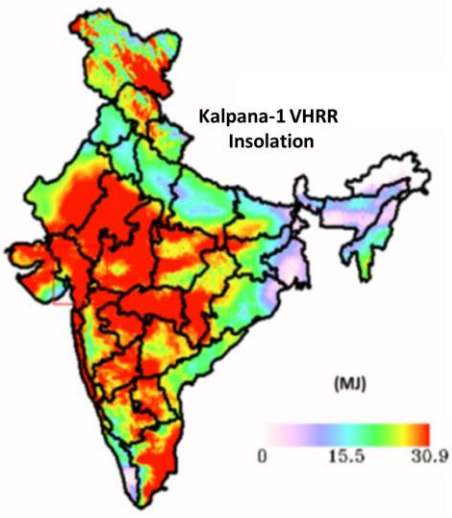
Daily Evaporation

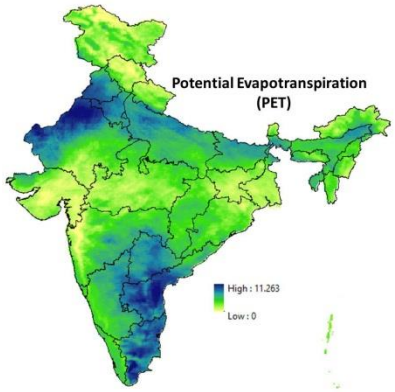
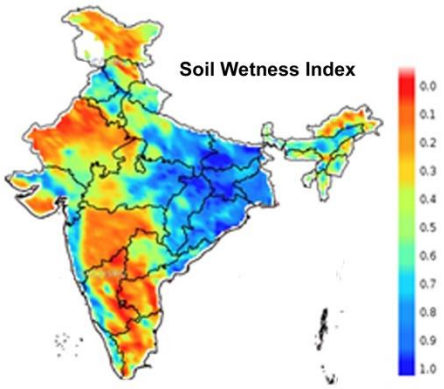
5. Standardized Precipitation Evapotranspiration Index (SPEI)

The Standardized Precipitation Evapotranspiration Index (SPEI) is an extension of the widely used Standardized Precipitation Index (SPI).The SPEI considers not only precipitation but also evapotranspiration (PET) data on its calculation. The gridded daily rainfall and dynamic PET will be used to calculate the SPEI. Dynamic Potential evapotranspiration (PET) from SAC, Ahmedabad will be used in the model to generate SPEI.

Satellite derived Agromet Products

Satellite-based information are used widely in monitoring agriculture. Satellite image data have the potential to provide real-time analysis for large areas of attributes of a growing crop that can assist in making timely management decisions that affect the outcome of the current crop. Hence in addition to NDVI other siatellite products developed by SAC Ahmedabad and NRSC like Potential Evapotranspiration, Land Surface Water Index(LSWI), LST, Insolation and Soil wetness Index will also used.

	1. Land Surface Water Index is known to be sensitive to the total amount of liquid water in vegetation and its soil background which helpful for drought assessment, particularly in the early crop season. 2. The critical growth stage is sensitive to moisture stress affects the growth directly. Therefore LSWI can act as tool for crop specific irrigation advisories. 3. It can be helpful for detection of fungal diseases and soil borne pests. 4. It can also be used as a tool for conserving moisture in field, timely intercultural operations can be suggested to the farmers.
	1. It is one of the important components for modeling environmental changes in climatological, hydrological, and agricultural studies. It is a proper change indicator to show the thermal changes in relation with land use changes. 2. LST represents SURFACE soil temperature in case of bare soil and canopy temperature in fully covered soil. It can be used as sowing date determination. This is an accurate measurement tool for indicating the energy exchange balance between the atmosphere and the Earth.
	1. Insolation can be used to assess cold coverage, its temporal persistence on a given location and directionally of spread. This may help in issue of advisories on inter-cultural operations.

	1.It is one of the important parameter used in various indices such as Aridity Index. Soil Moisture and SPEI etc. 2. PET values indicate the amount of water that has been lost, and which needs to be replaced, through irrigation and/or rainfall. Therefore it will be helpful for selection of irrigation method and irrigation scheduling with effective use of water
	Surface Soil Wetness Index can be used for 1.Dry Spell monitoring 2. Agricultural drought monitoring 3. Root zone soil moisture monitoring 4. Irrigation and Irrigated area monitoring