






Data availability vs data demand

The challenges of space-based monitoring to support national disaster risk management

Dr. Valerie Graw

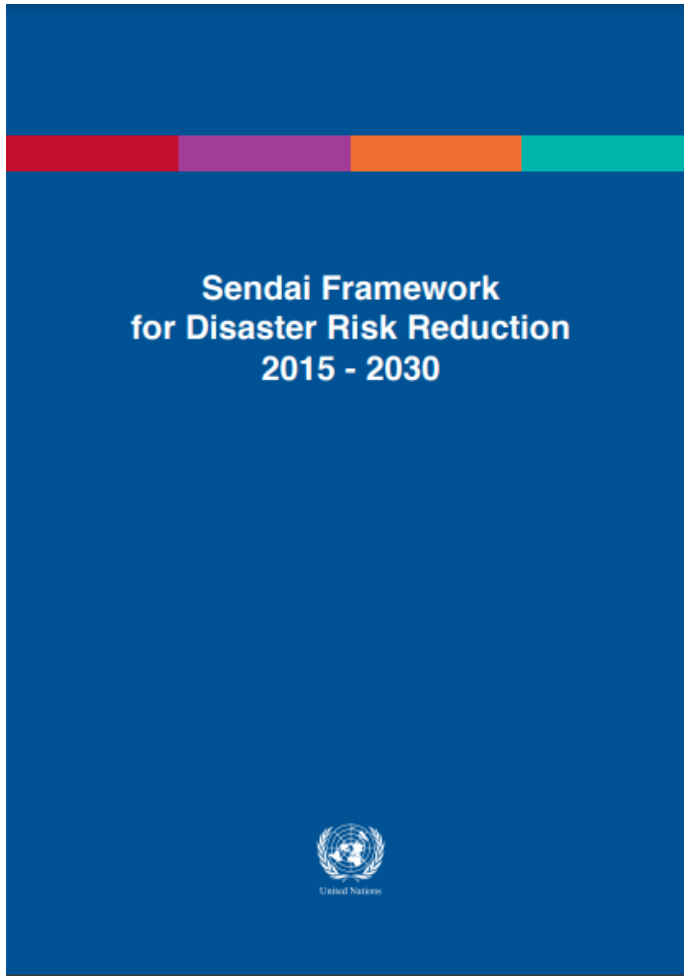
"If you can't measure it, you can't manage it",

(M.F. Espinosa Garcés, President of the UN General Assembly at the COP 24)

Monitoring → *Measuring*

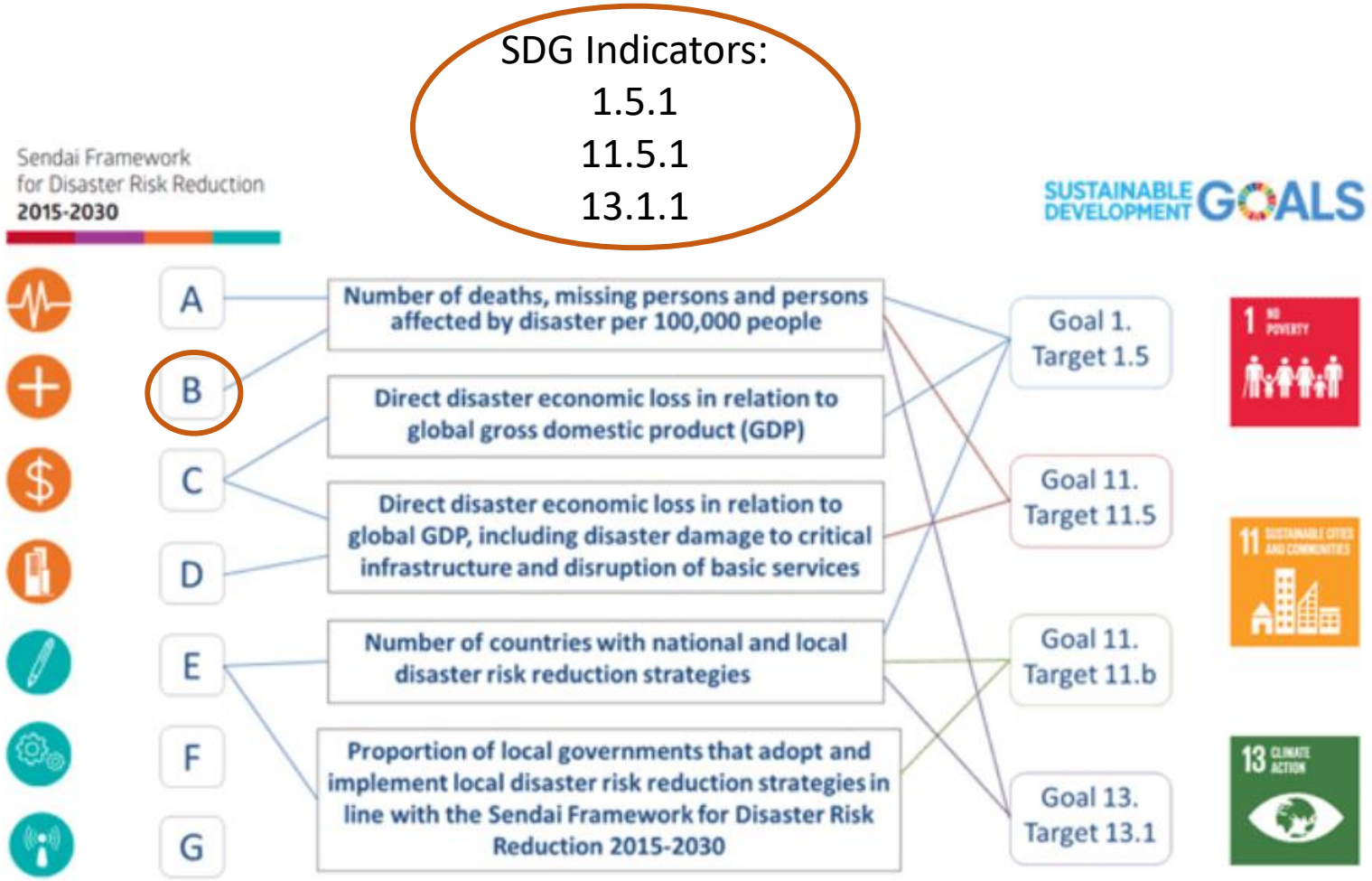
Disaster Monitoring – Identify Risk to Increase Resilience

Sendai Framework for Disaster Risk Reduction (SFDRR)



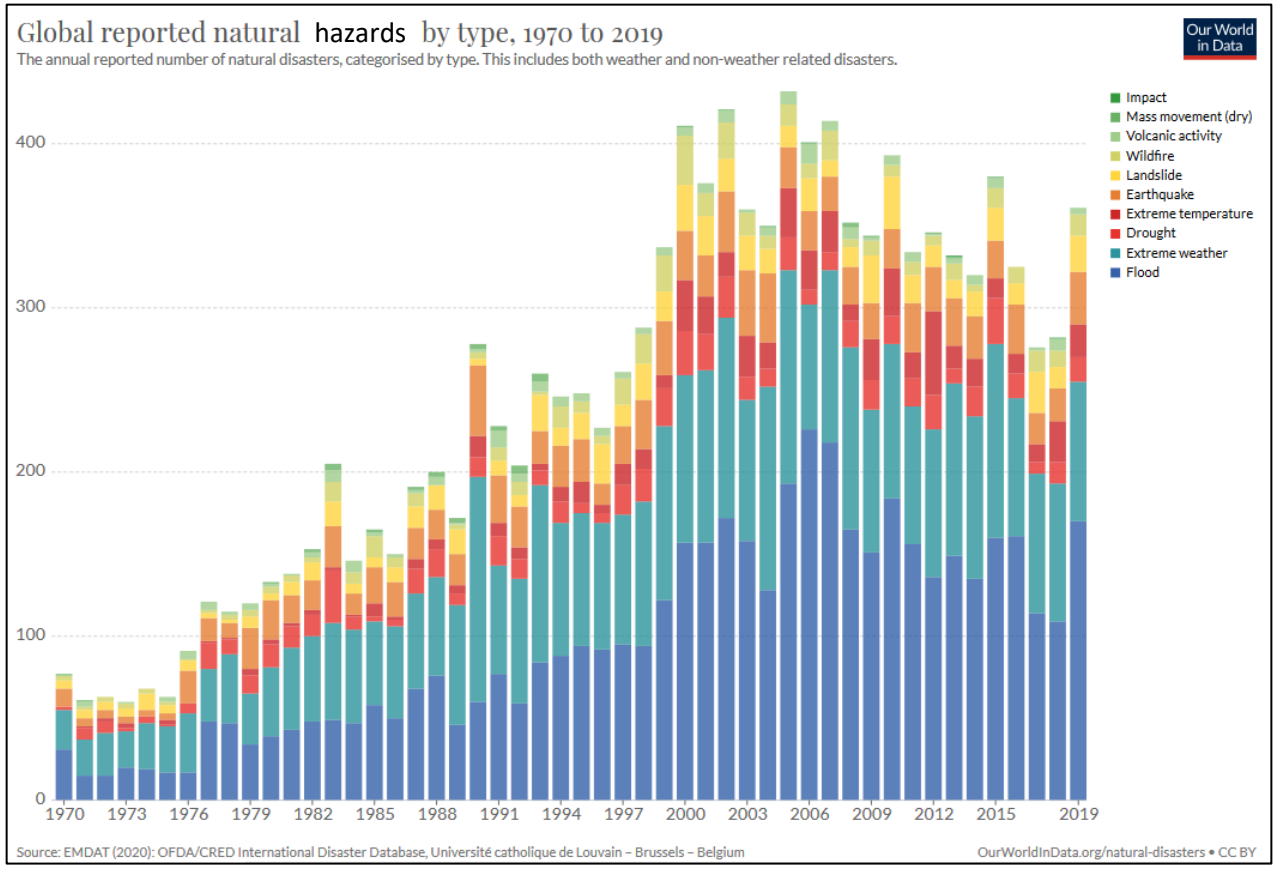
UNISDR/UNDRR (2015)

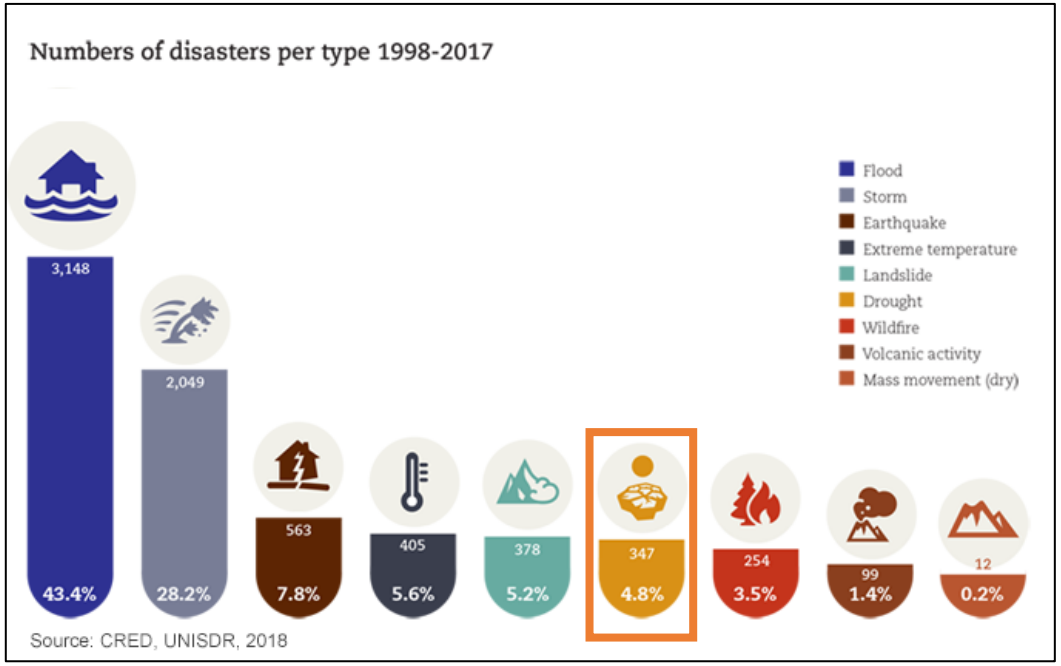
Disaster Monitoring – Different Frameworks same Goals



- Annual Reporting
- Working with a baseline

Disaster Monitoring – Identify Risk to Increase Resilience





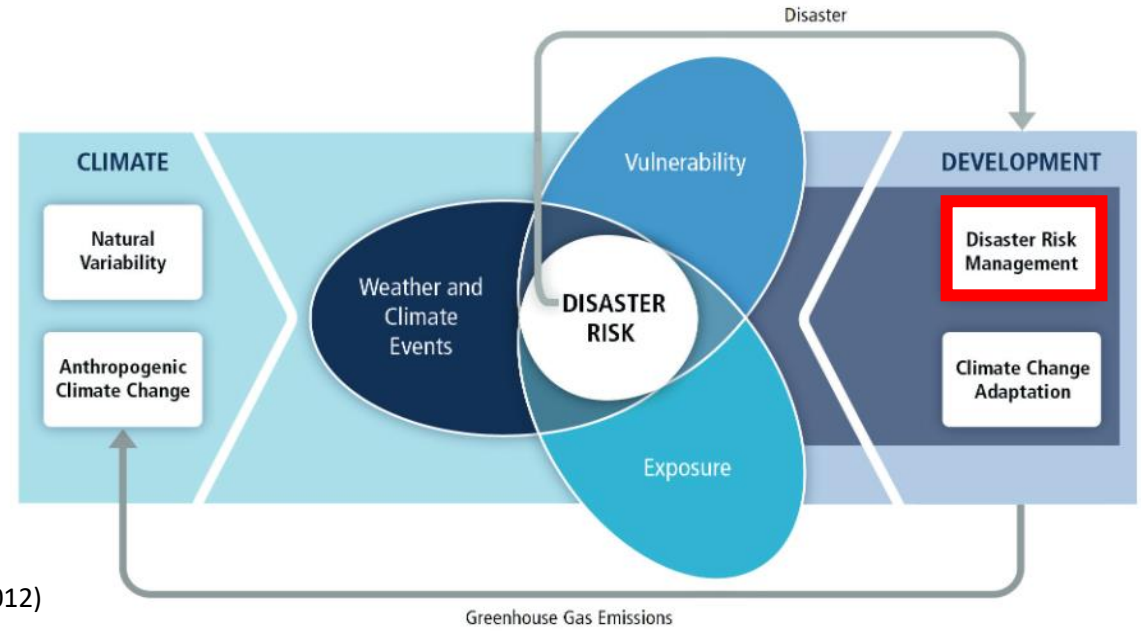
- Floods […] lead to the highest number of people affected […] as they affect human activities and the economy (CRED, 2019)

Disaster Monitoring – Identify Risk to Increase Resilience

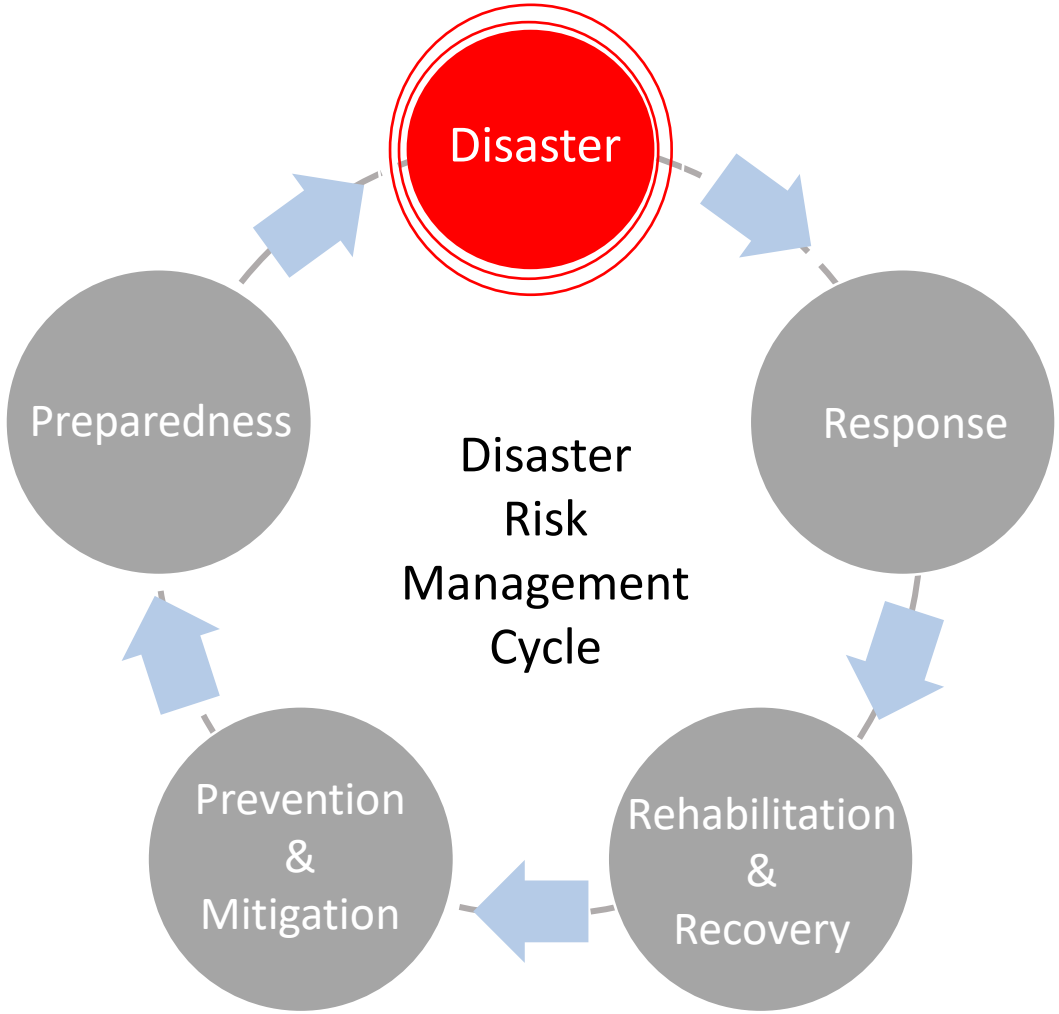
$$Risk = Hazard * Exposure * Vulnerability$$

$$Resilience$$

$$Adaptation$$

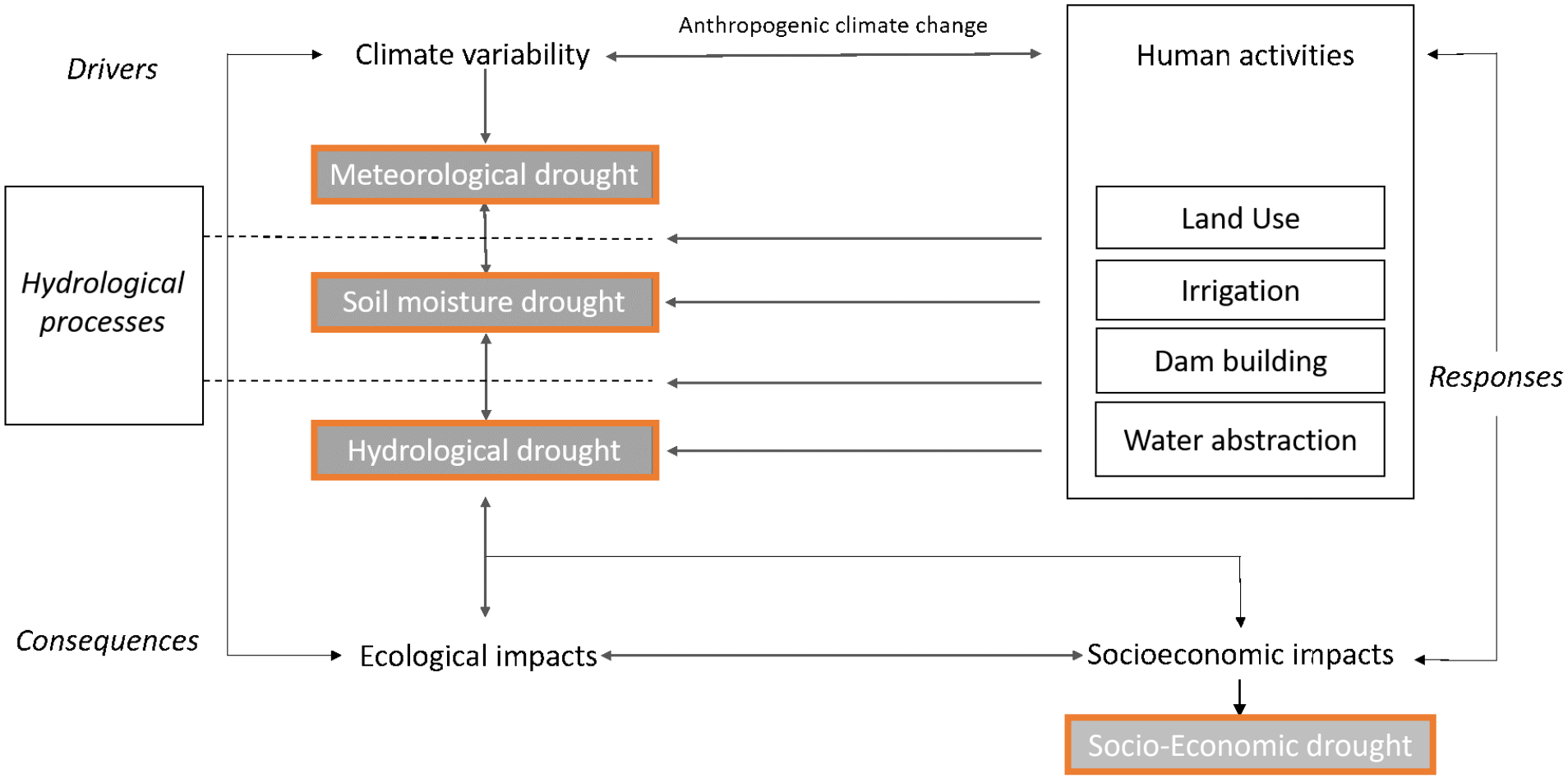


IPCC (2012)



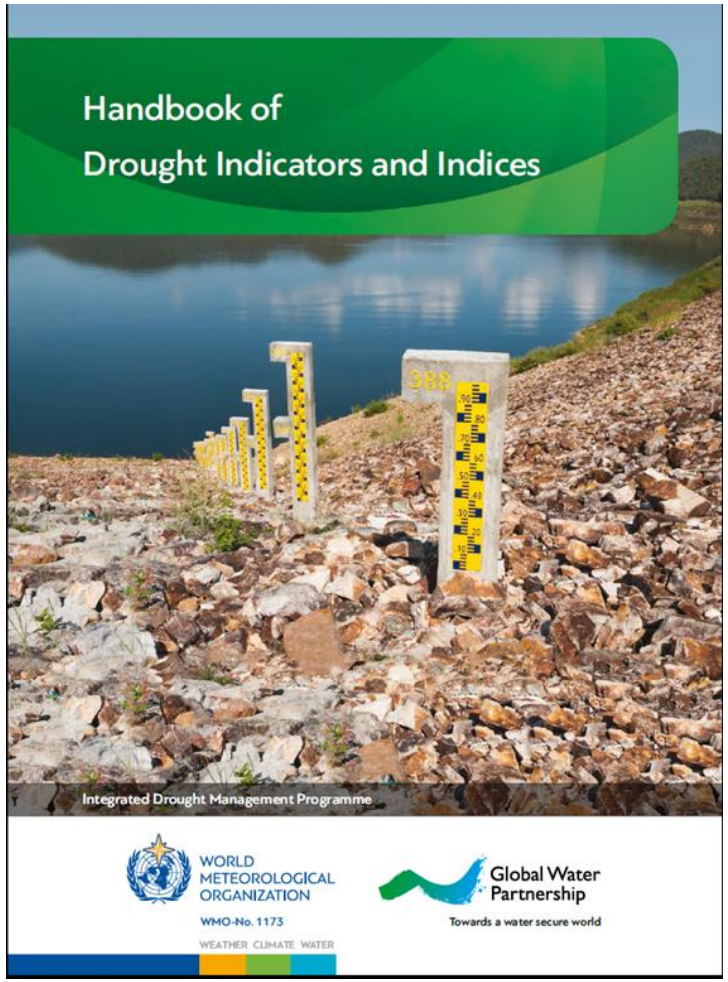
Drought Monitoring

Different Types of Drought



According to Graw et al. 2019; adapted from van Loon et al, 2016

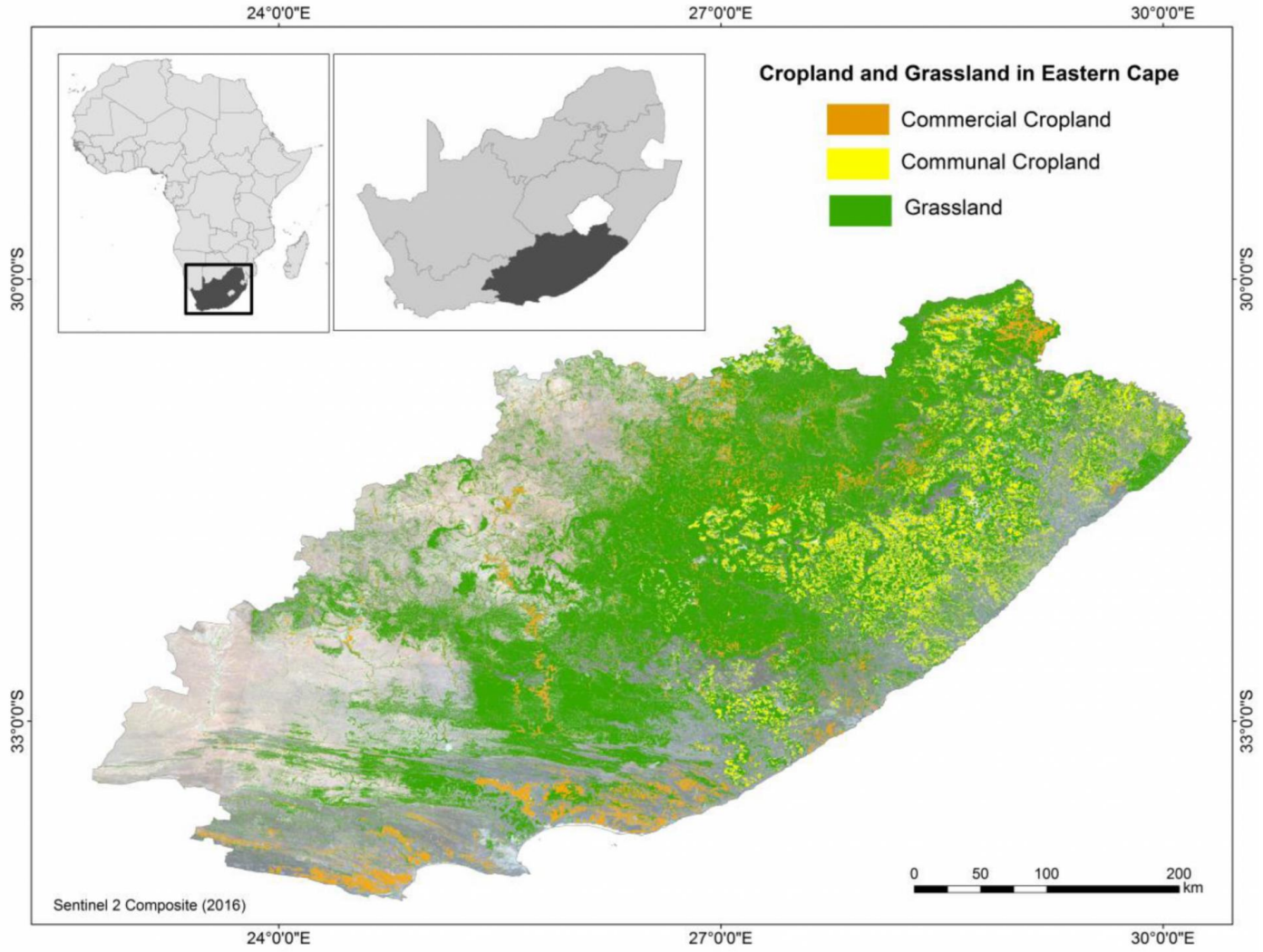
EO-based Drought Indices



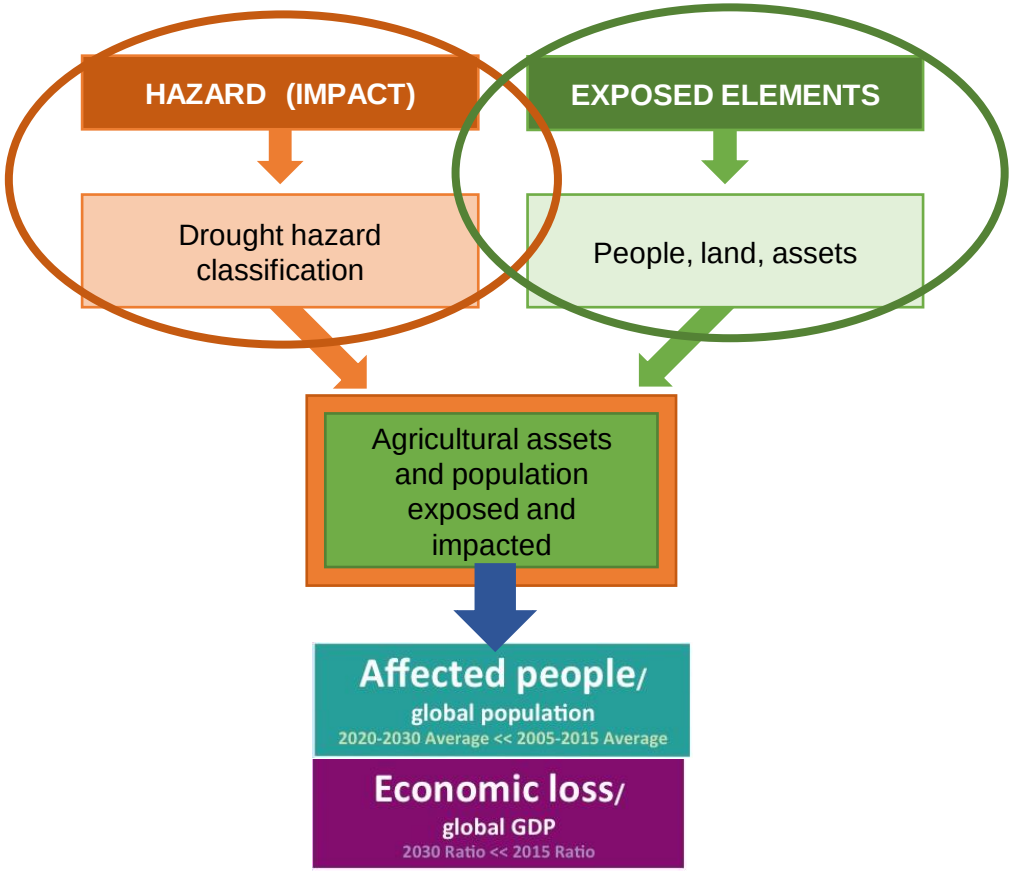
https://www.droughtmanagement.info/literature/GWP_Handbook_of_Drought_Indicators_and_Indices_2016.pdf

- Observation of Vegetation and Phenology
  - Normalized Difference Vegetation Index (NDVI)
  - Enhanced Vegetation Index (EVI)
  - Vegetation Drought Response Index (VegDRI)
  - Temperature Condition Index (TCI)
  - Normalized Difference Water Index (NDWI)
  - Vegetation Health Index (VHI)
  - …
- Satellite RS-based methods achieve much higher added value
  - good spatial resolution
  - temporal dynamic
  - consistent data

Disaster Monitoring – National Drought Risk Monitoring



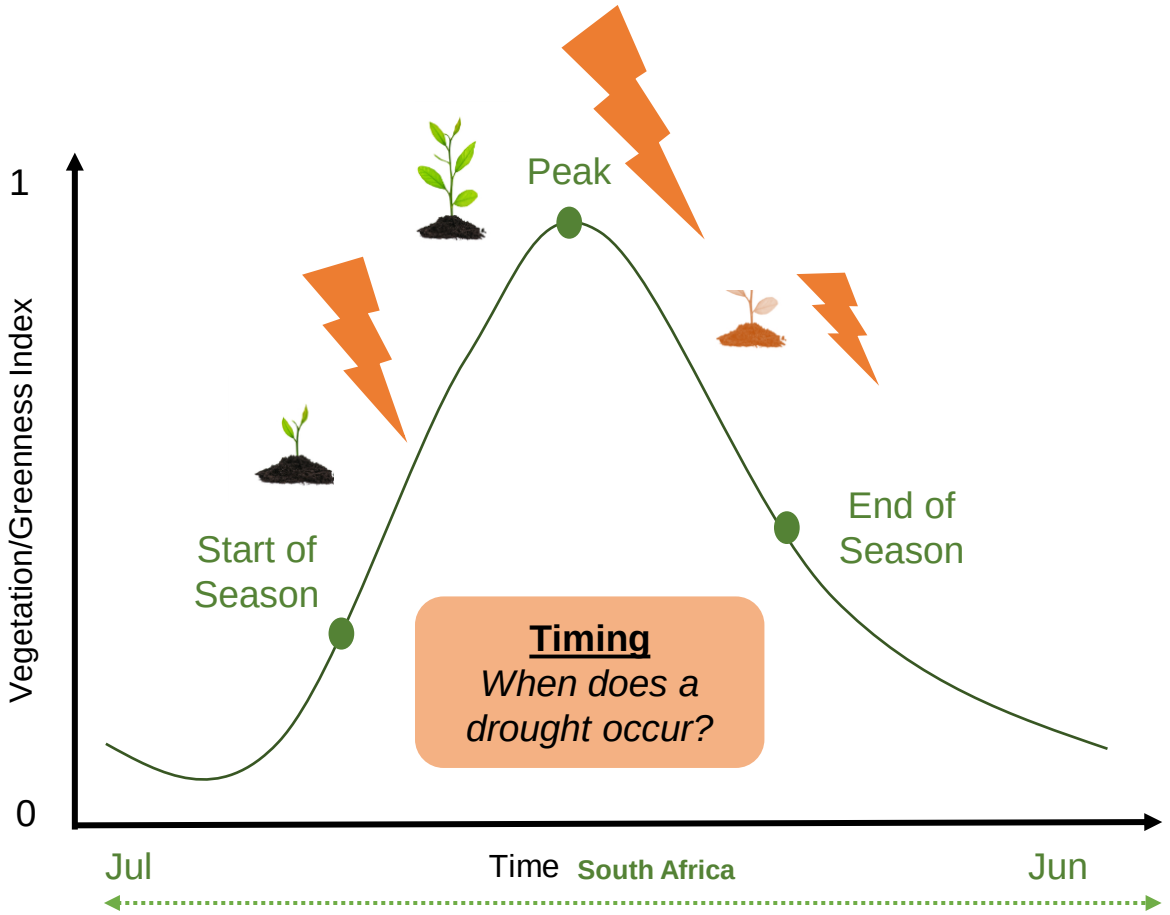
- How to report on SFDRR Indicators?



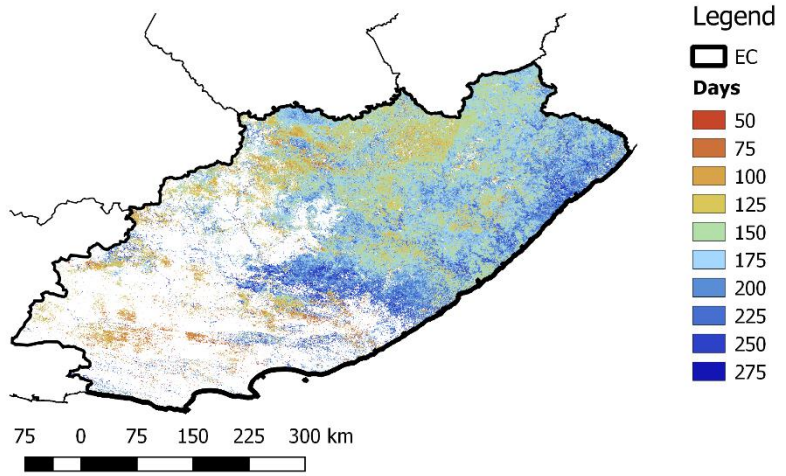
Graw et al. (2017)

Disaster Monitoring – National Drought Risk Monitoring

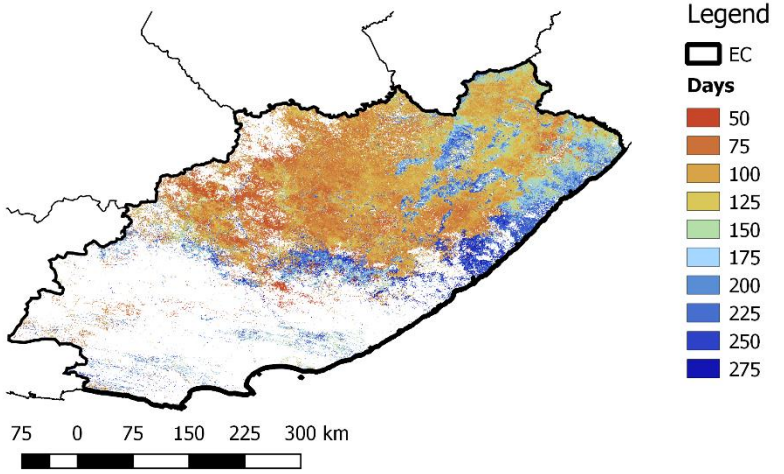
Seasonality Parameters – Drought Timing



Phenometrics - Length of Season - 2011/12



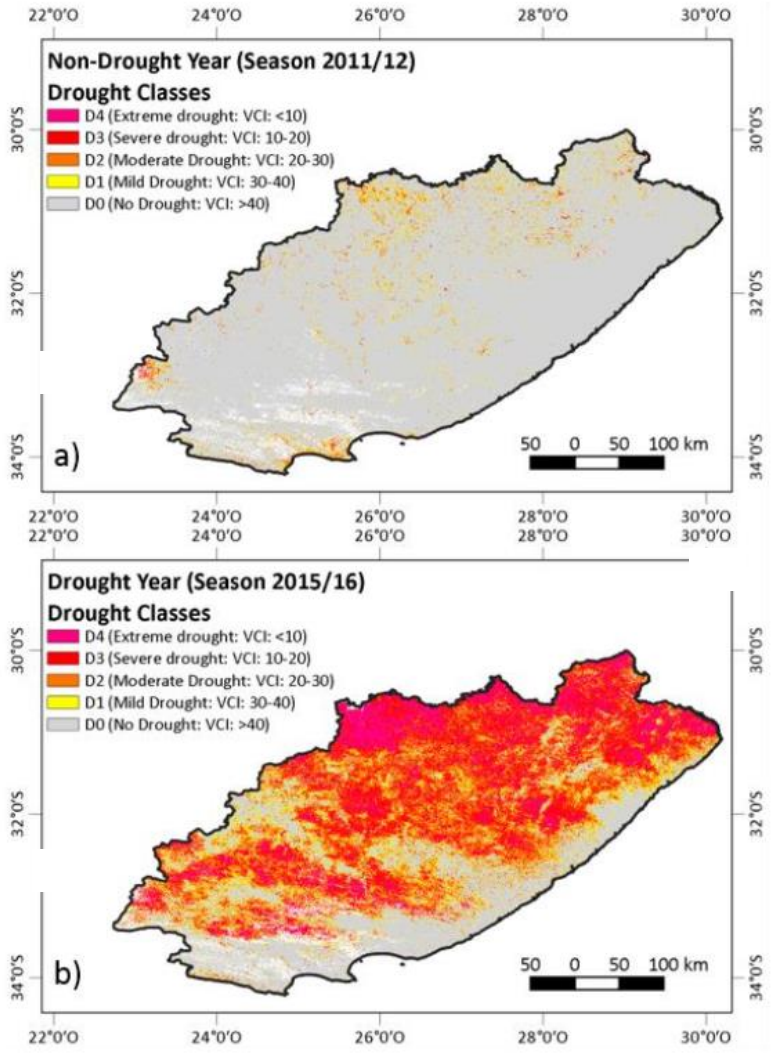
Phenometrics - Length of Season - 2015/16



Graw et al. (2019); Graw et al. (2020a)

Disaster Monitoring – National Drought Risk Monitoring

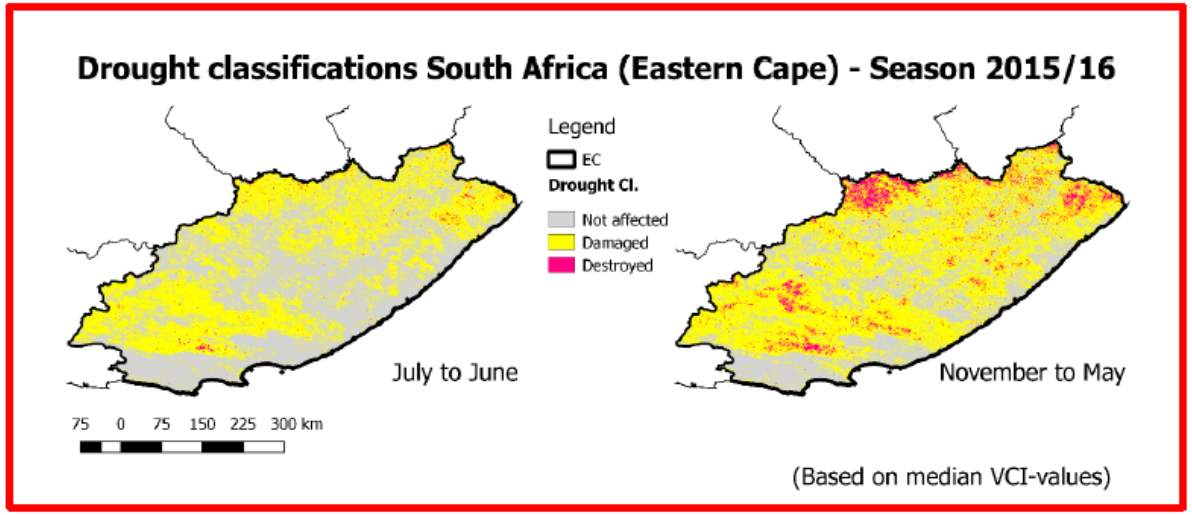
WLC Vegetation Condition Index (VCI)



SFDRR Indicator B-5a: Number of workers in agriculture with crops damaged or destroyed

Drought Hazard Severity Classes	Value in final output	VCI Values (weighted over season)
No Drought (D0)	0	>40
Mild Drought (D1)	1	30–40
Moderate Drought (D2)	2	20–30
Severe Drought (D3)	3	10–20
Extreme Drought (D4)	4	<10

Vegetation condition	Value in final output	VCI Values (weighted over season)
Not affected (H0)	0	>40
Damaged (H1)	1	10–40
Destroyed (H2)	2	<10

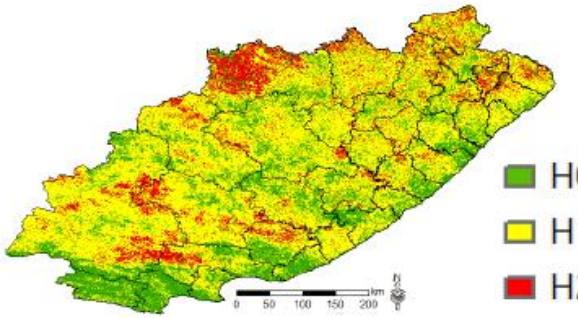


Error propagation? Yes

More close to national reporting? Yes

SFDRR Indicator B-5a: Number of workers in agriculture with crops damaged or destroyed

B-5a: Number of workers in agriculture with crops damaged or destroyed



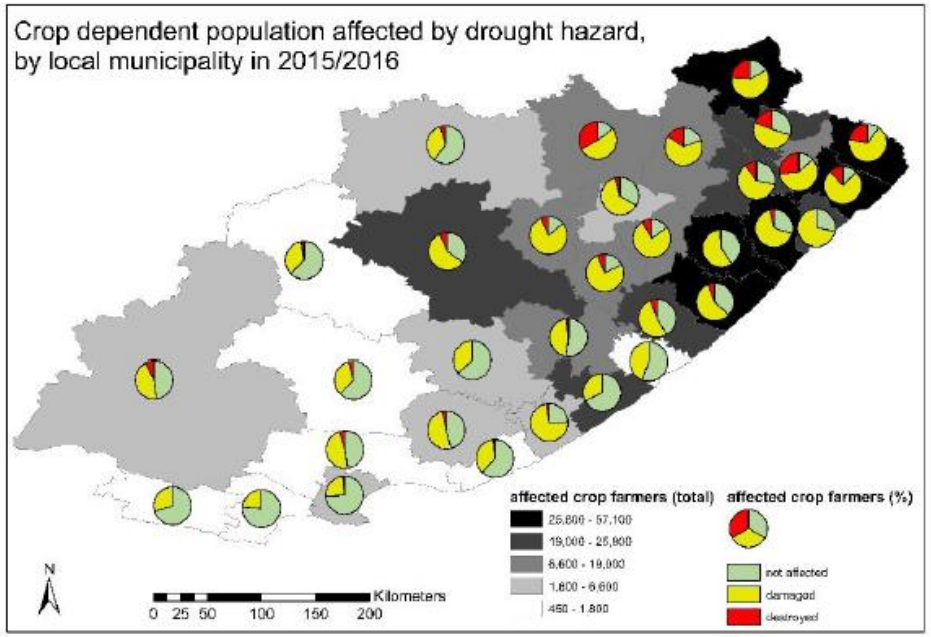
H0 (VCI > 40)
H1 (VCI 10 to 40)
H2 (VCI <=10)

Data from Statistics South Africa

Data from EVIDENz

Data from environmental affairs, GEOTERRA IMAGE

Households involved in crop production	X	Number of people per household	=	Number of crop-dependent people
Number of crop-dependent people	÷	Hectares of cropland	=	Density of crop-dependent population per hectare of cropland
Density of crop-dependent population per hectare of cropland	X	Hectares of cropland in hazard classes (from C2-2a)	=	



Measure to Manage!

Drought-stressed Vegetation

Vegetation Condition Index (VCI)

VCI Percentage	Drought Severity Level
> 35	no drought
20 to 35	moderate drought
10 to 20	severe drought
< 10	extreme drought

Kogan, 1995

Standardized Vegetation Index (SVI)

SVI Value	Drought Severity Level
0 to 0.05	very poor
0.05 to 0.25	poor
0.25 to 0.75	average
0.75 to 0.95	good
0.95 to 1	very good

Peters et al. 2002

Vegetation Health Index (VHI)

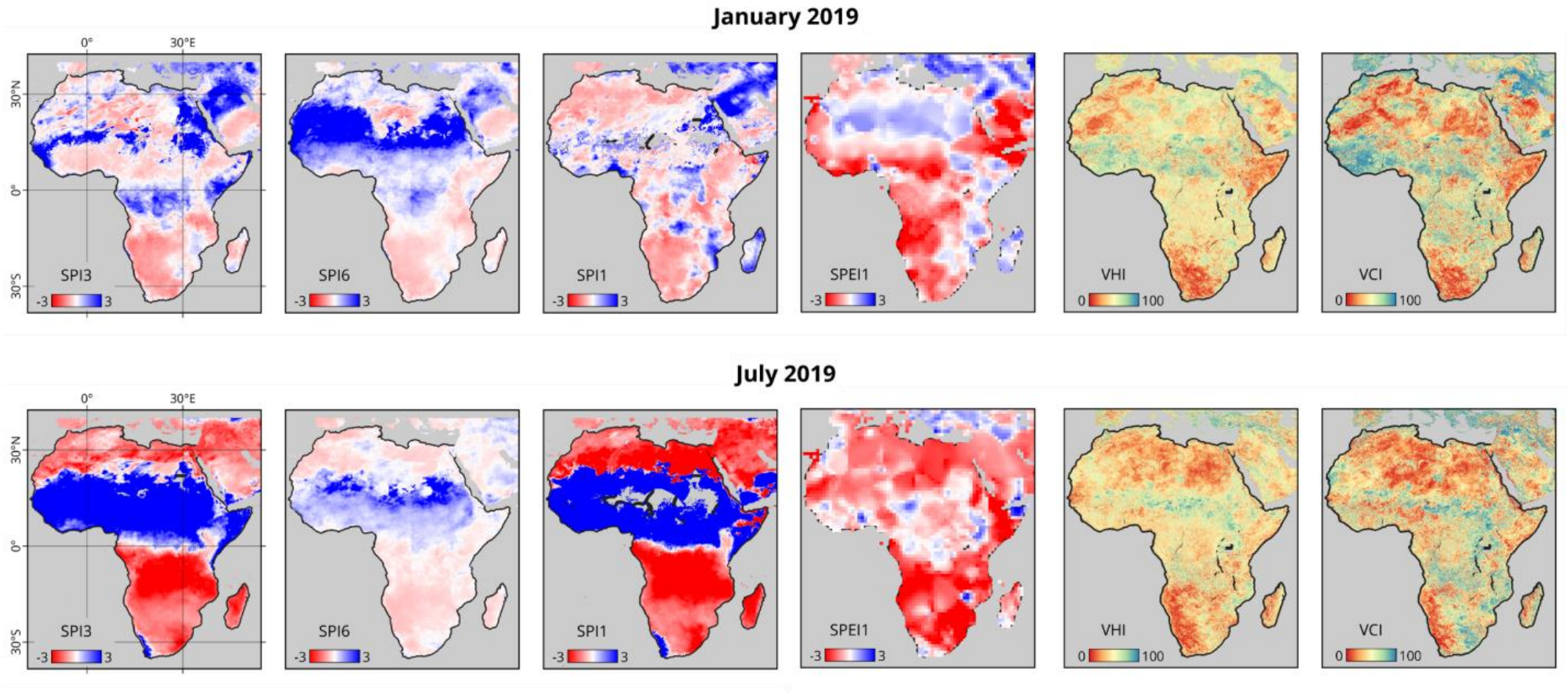
VCI Percentage	Drought Severity Level
> 40	no drought
30 to 40	light drought
20 to 30	moderate drought
10 to 20	severe drought
< 10	extreme drought

Bhuiyan et al. 2006

...

Thresholds?

Drought Hazard vs. Drought Impact



Graw et al. (subm.)

Flood Monitoring

Disaster Monitoring – Support national **flood** management

- On 13th August 2020 the International Charter Space and Major Disasters was activated due to floods in Sudan
- Project Management for the Activation to support eh Ministry of Agriculture and Natural Resources in Sudan

13 AUGUST 2020

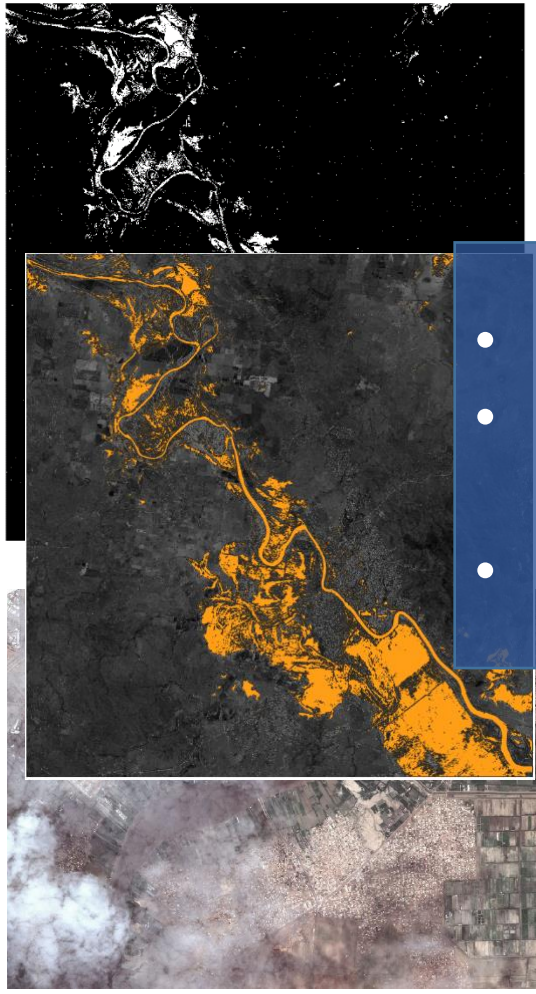
Flood in Sudan

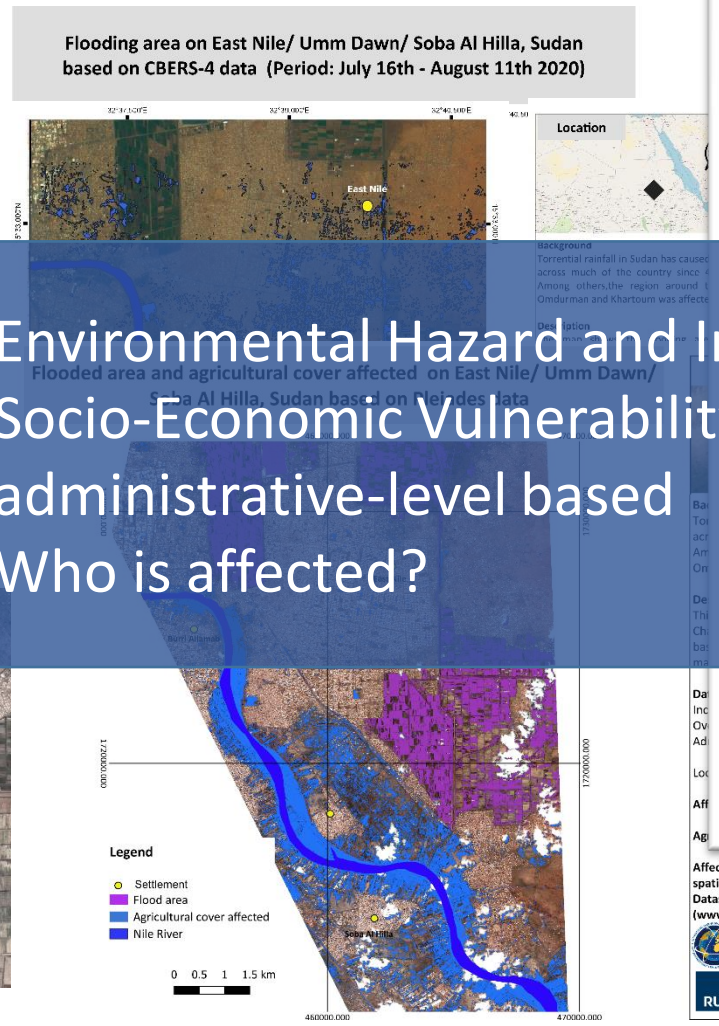
Browse activations on map ▸

Type of Event:	Flood
Location of Event:	Sudan
Date of Charter Activation:	2020-08-13
Time of Charter Activation:	15:49
Time zone of Charter Activation:	UTC+02:00
Charter Requestor:	UNOOSA/UN-SPIDER on behalf of Ministry of Agriculture and Natural Resources in Sudan
Activation ID:	667
Project Management:	Ruhr-University Bochum

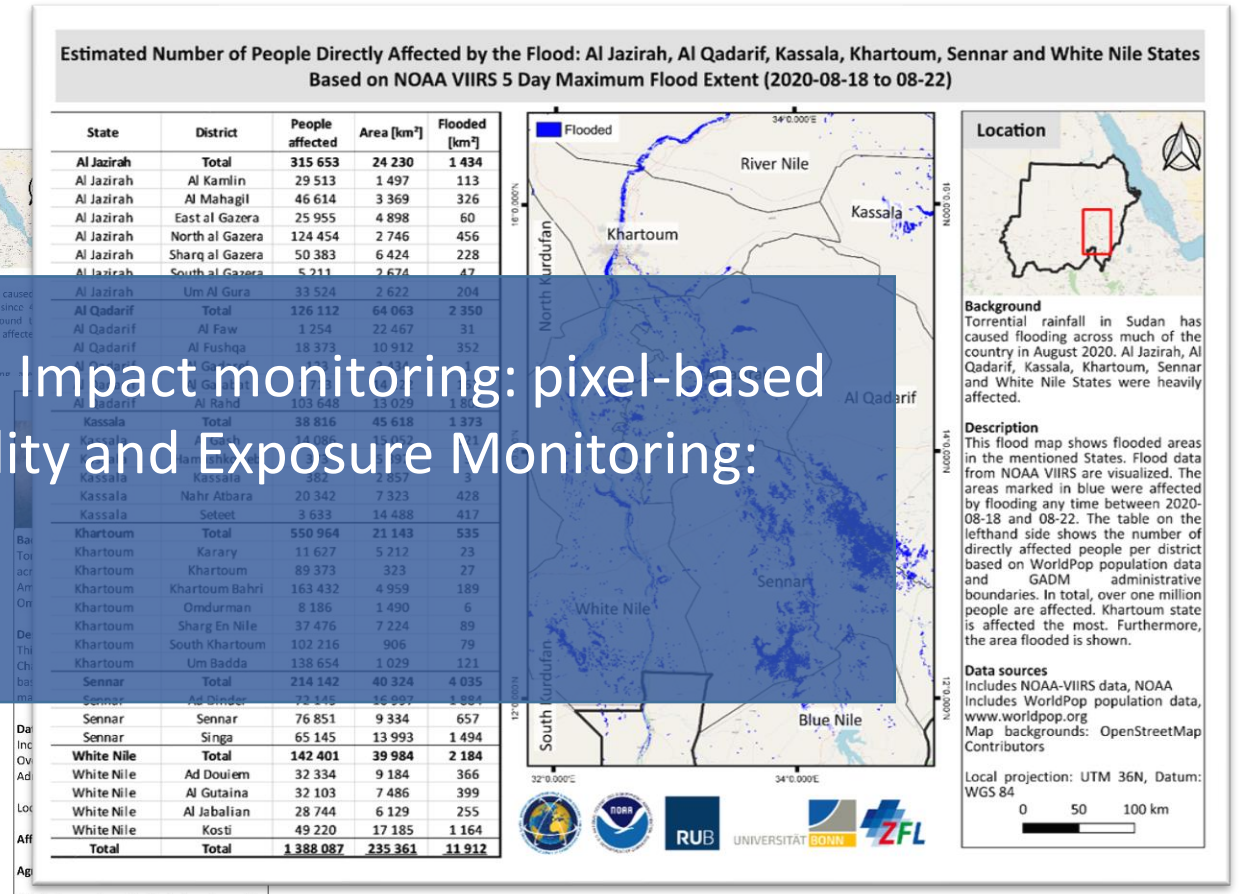
Disaster Monitoring – Support national disaster management

Disaster Monitoring → Response → Support Disaster Management





- Environmental Hazard and Impact monitoring: pixel-based
- Socio-Economic Vulnerability and Exposure Monitoring: administrative-level based
- Who is affected?



State	District	People affected	Area [km²]	Flooded [km²]
Al Jazirah	**Total**	**315 653**	**24 230**	**1 434**
Al Jazirah	Al Kamlin	29 513	1 497	113
Al Jazirah	Al Mahagil	46 614	3 369	326
Al Jazirah	East al Gazera	25 955	4 898	60
Al Jazirah	North al Gazera	124 454	2 746	456
Al Jazirah	Sharq al Gazera	50 383	6 424	228
Al Jazirah	South al Gazera	5 211	2 674	47
Al Jazirah	Um Al Gura	33 524	2 622	204
Al Qadarif	**Total**	**126 112**	**64 063**	**2 350**
Al Qadarif	Al Faw	1 254	22 467	31
Al Qadarif	Al Fushqa	18 373	10 912	352
Al Qadarif	Al Rahd	103 648	13 029	1 807
Kassala	**Total**	**38 816**	**45 618**	**1 373**
Kassala	Kassala	382	2 857	3
Kassala	Nahr Atbara	20 342	7 323	428
Kassala	Seteet	3 633	14 488	417
Khartoum	**Total**	**550 964**	**21 143**	**535**
Khartoum	Karary	11 627	5 212	23
Khartoum	Khartoum	89 373	323	27
Khartoum	Khartoum Bahri	163 432	4 959	189
Khartoum	Omdurman	8 186	1 490	6
Khartoum	Sharg En Nile	37 476	7 224	89
Khartoum	South Khartoum	102 216	906	79
Khartoum	Um Badda	138 654	1 029	121
Sennar	**Total**	**214 142**	**40 324**	**4 035**
Sennar	Ad Dinder	73 146	16 997	1 804
Sennar	Sennar	76 851	9 334	657
Sennar	Singa	65 145	13 993	1 494
White Nile	**Total**	**142 401**	**39 984**	**2 184**
White Nile	Ad Douiem	32 334	9 184	366
White Nile	Al Gutaina	32 103	7 486	399
White Nile	Al Jabalian	28 744	6 129	255
White Nile	Kosti	49 220	17 185	1 164
Total	**Total**	**1 388 087**	**235 361**	**11 912**

Graw et al. (2020b)

Measure to Manage!

Guide National Disaster Risk Management with EO Data

- EO-based monitoring supports the **identification of variables** and responds to **uncertainties**
- **Who is affected? Involve** those who are left behind for adequate monitoring and reporting –> participatory approaches / network of institutions
- Data knowledge and Validation of results
- **Interdisciplinary** towards **transdisciplinary** research and action – *understanding* of approaches and frameworks
- In the **golden age of data availability and accessibility** the monitoring and modelling of complex environmental systems is a challenge to be met
- **Capacity building:** the best tool or platform will not make any difference if there is no one on the ground who knows about it or understands it

Thank you

for your attention!

valerie.graw@rub.de