SDG 14.1 – Coastal Eutrophication

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esri THE SCIENCE OF WHERE

“Saving our planet, lifting people out of poverty, advancing economic growth… these are one and the same fight. We must connect the dots between climate change, water scarcity, energy shortages, global health, food security and women’s empowerment. Solutions to one problem must be solutions for all.”

- Ban Ki-moon

UN Environment Programme - a Custodian Agency - Mandate

GA Resolution A/RES/71/313 - Work of the Statistical Commission pertaining to the 2030 Agenda for Sustainable Development

INDICATOR METHODOLOGIES, COMPARABLE DATA

7. … and urges international organizations to provide the methodologies used to harmonize country data for international comparability and produce estimates through transparent mechanisms;

CAPACITY DEVELOPMENT

11. Urges countries, the United Nations funds and programmes, the specialized agencies, … *to intensify their support for strengthening data collection and statistical capacity-building, including capacity-building that strengthens coordination among national statistical offices, as appropriate and within their mandates*

UNEA Resolution 2/5 Delivering on the 2030 Agenda for Sustainable Development

UNEA Resolution 2/13 Sustainable management of natural capital for sustainable development and poverty eradication

Ministerial declaration of the UNEA-3 "Towards a pollution-free planet

GEO GROUP ON EARTH OBSERVATIONS

UN environment programme

NOAA

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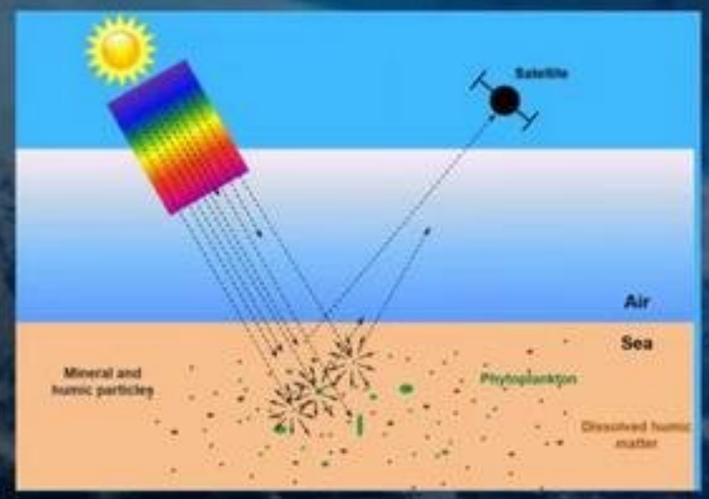
Index of Coastal Eutrophication

What is Eutrophication?

Eutrophication is a process driven by enrichment of waters by nutrients, especially compounds of nitrogen or phosphorus, leading to increased growth, primary production, and biomass of algae resulting in adverse changes in the balance of organisms and water quality.

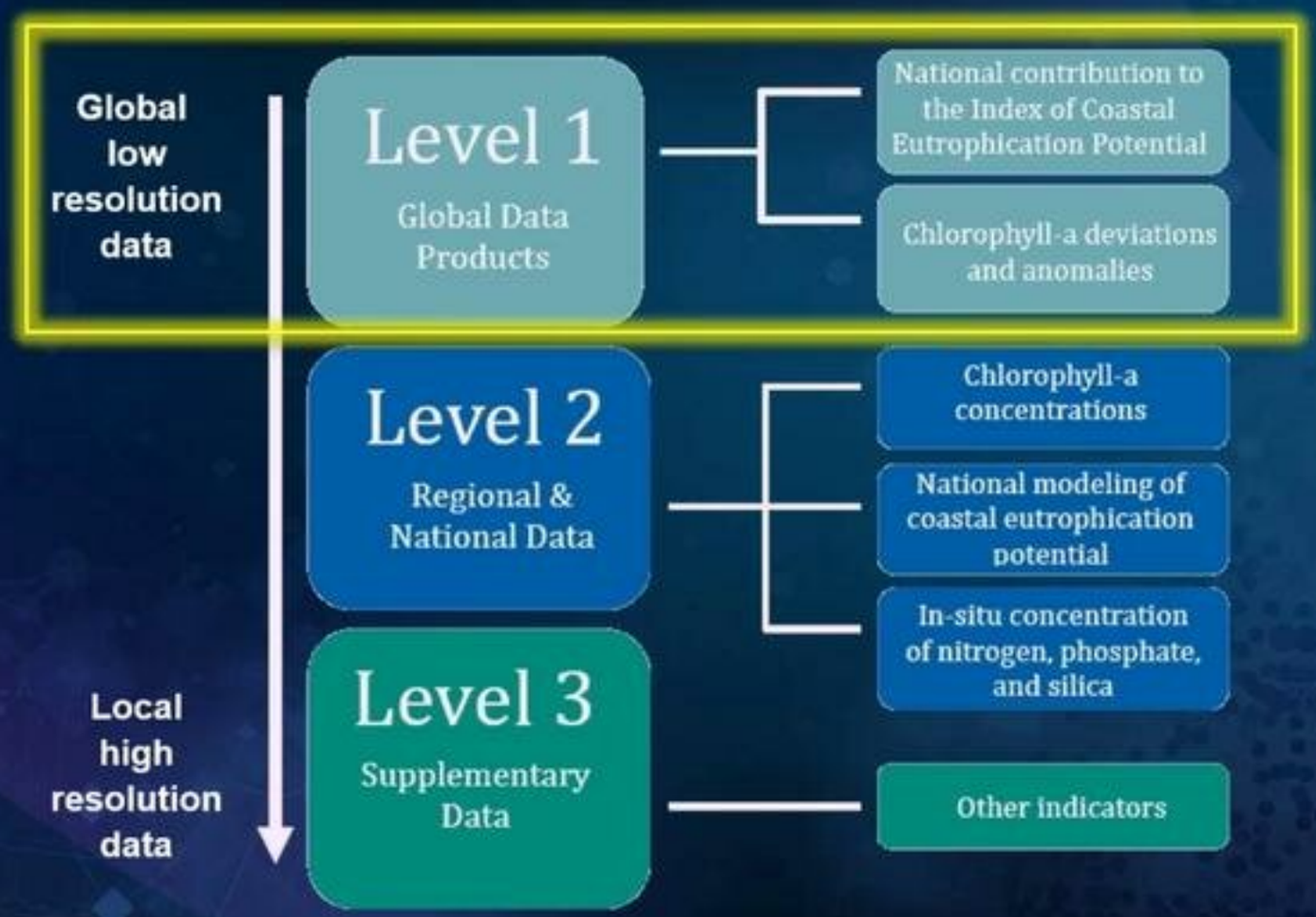
Index of Coastal Eutrophication



Overview

- Goal
  - Quantify the number and severity of eutrophication events in nearshore waters globally
- Methodology based on using satellite-derived chlorophyll measurements
- Esri supported implementation of methodology within a GIS
  - Refined results based on several test cases
  - Lots of iterating and discussions
- Final methodology adopted by UN in the most recent update of the "Global Manual of Ocean Statistics"

Scalable Methodology

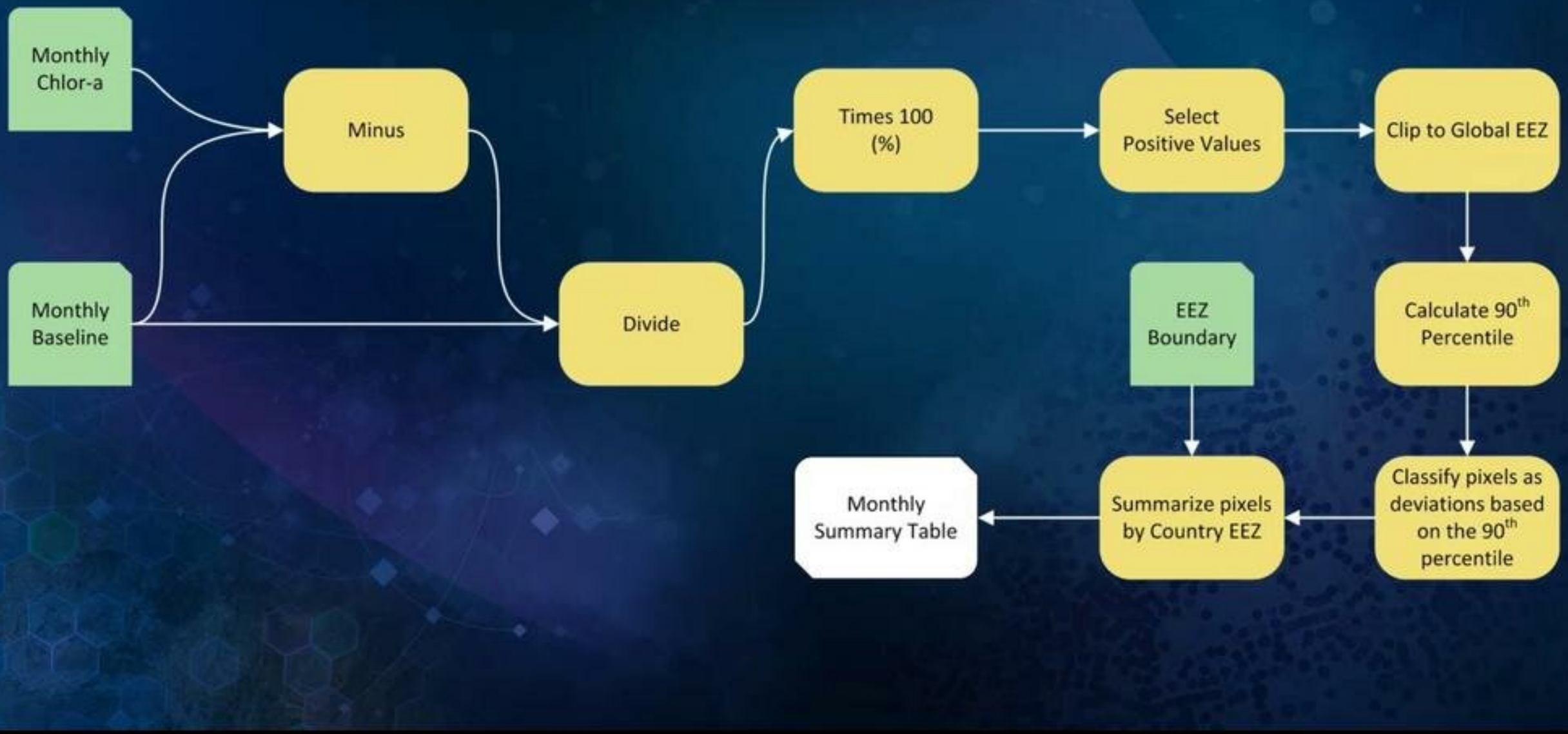


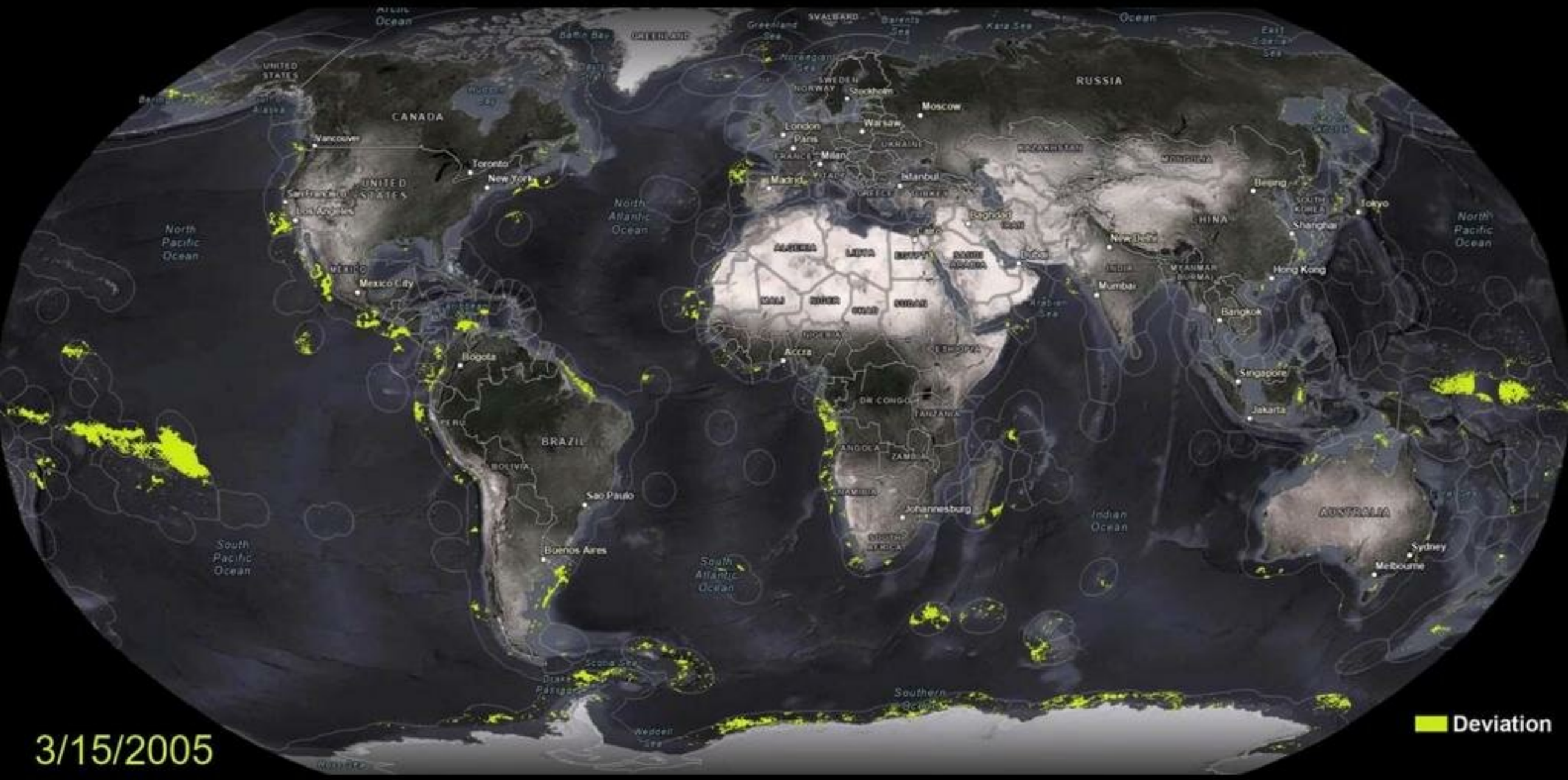
ArcGIS Pro

- Repeatable and understandable workflow that can be easily tuned or modified
  - Series of ModelBuilder models

- **Sub-indicator 1:** What are the annual trends for a country?
  - PML Chlorophyll-a Product
  - Annual: Looking at monthly means between 2005 to 2019
    - Comparing against monthly baseline (2000-2004)
    - Reporting percentage of each countries EEZ impact based on number of pixels above 90th percentile

Sub-indicator 1: Workflow





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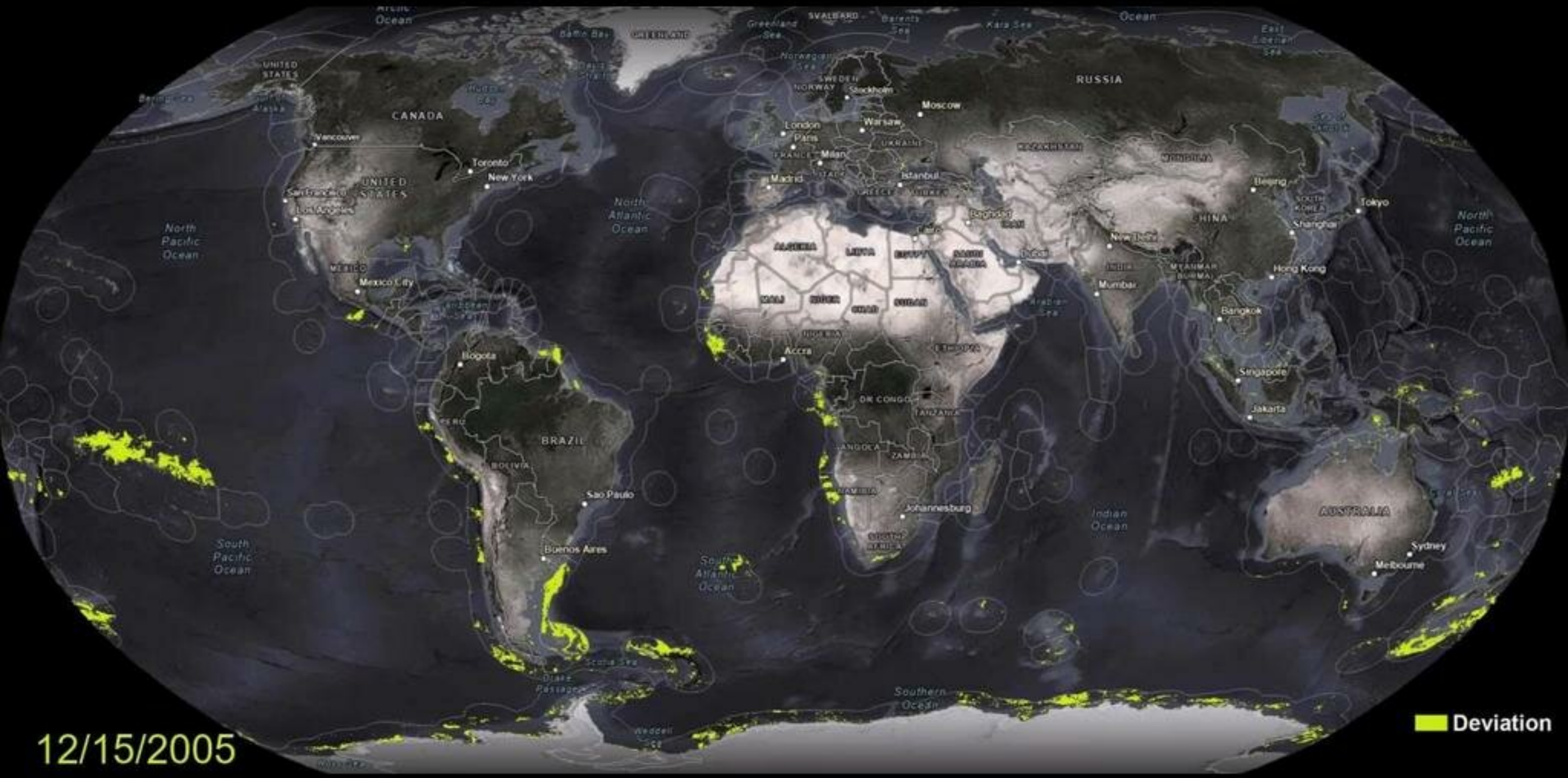

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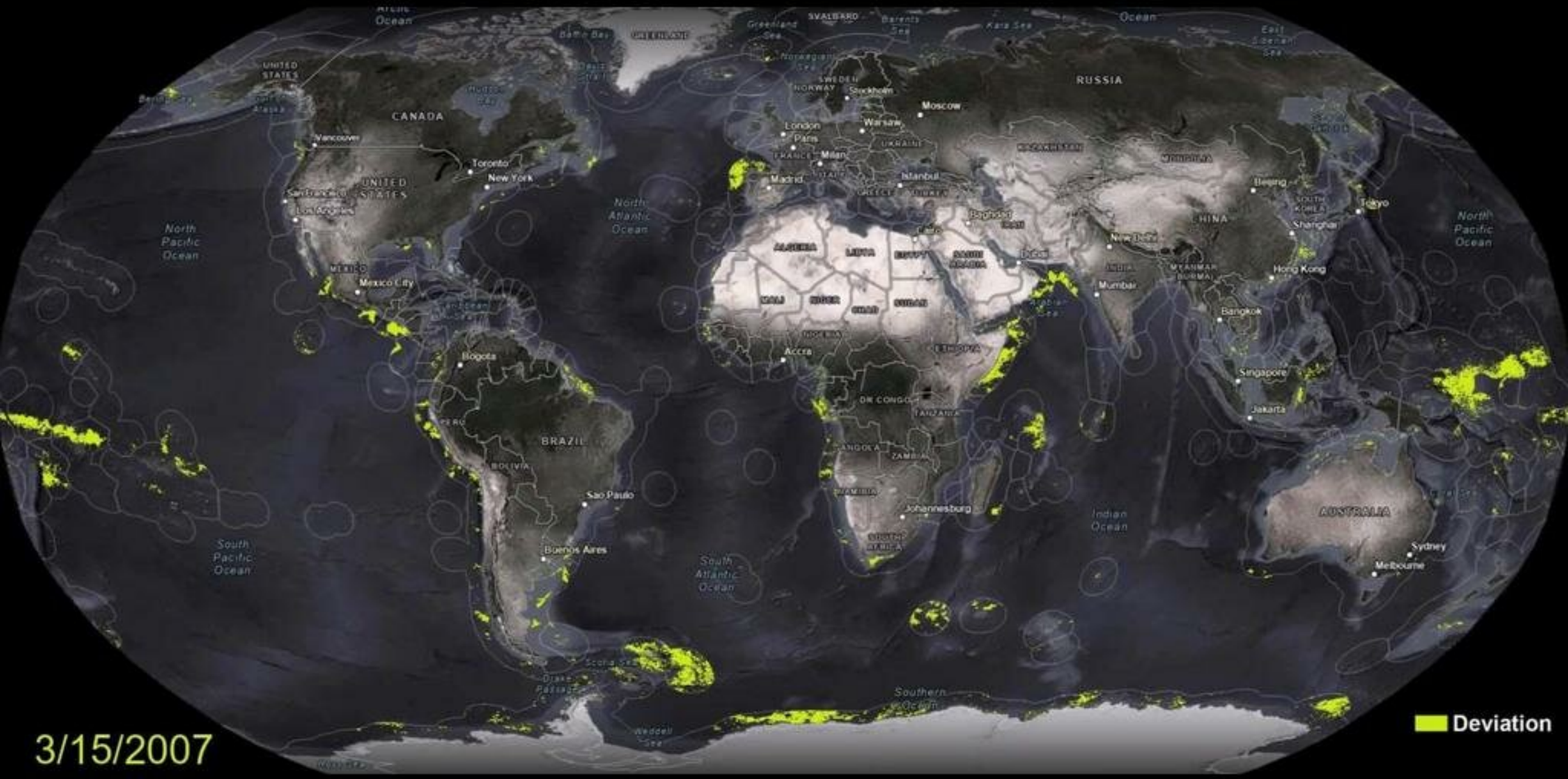
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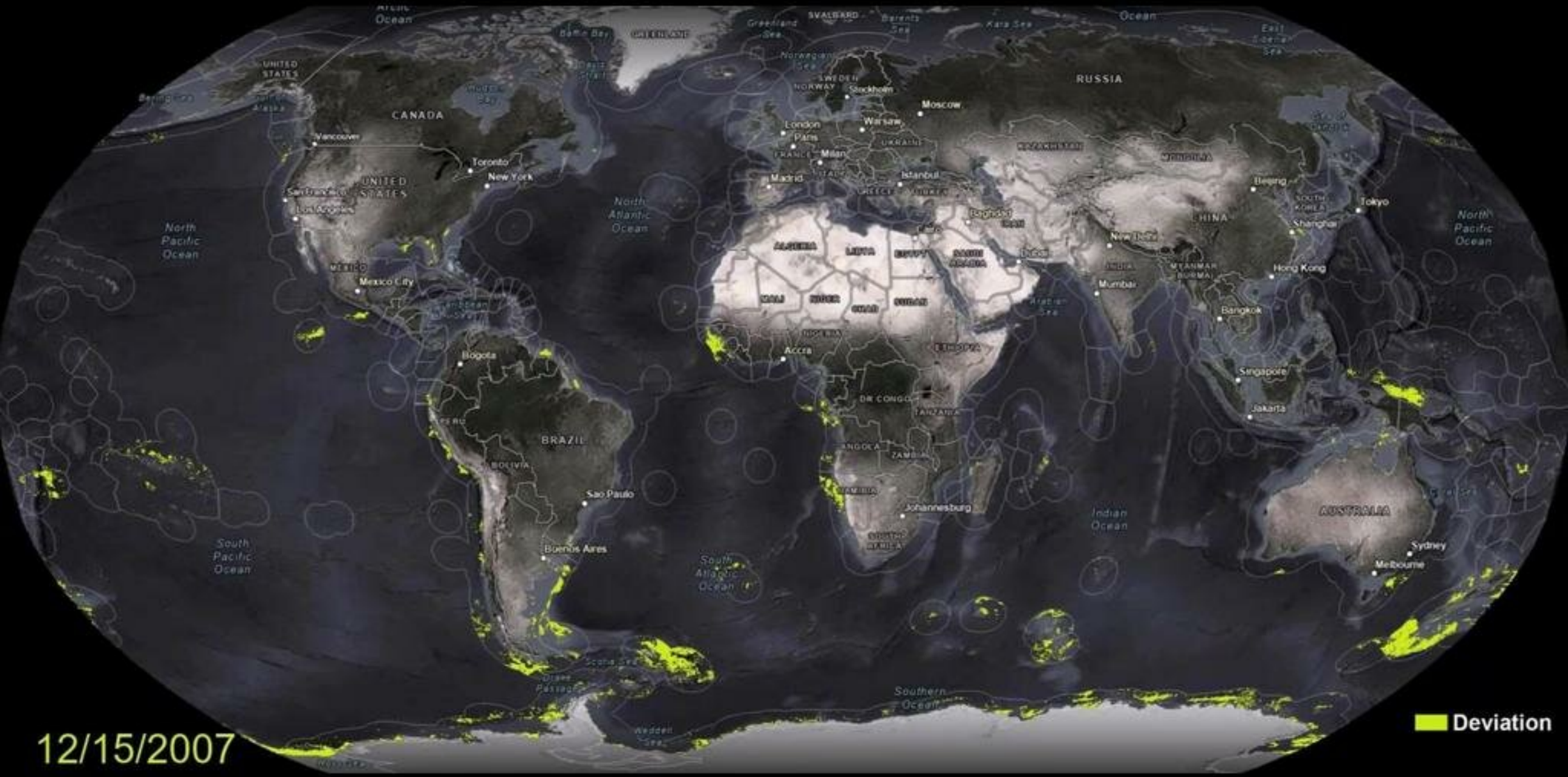

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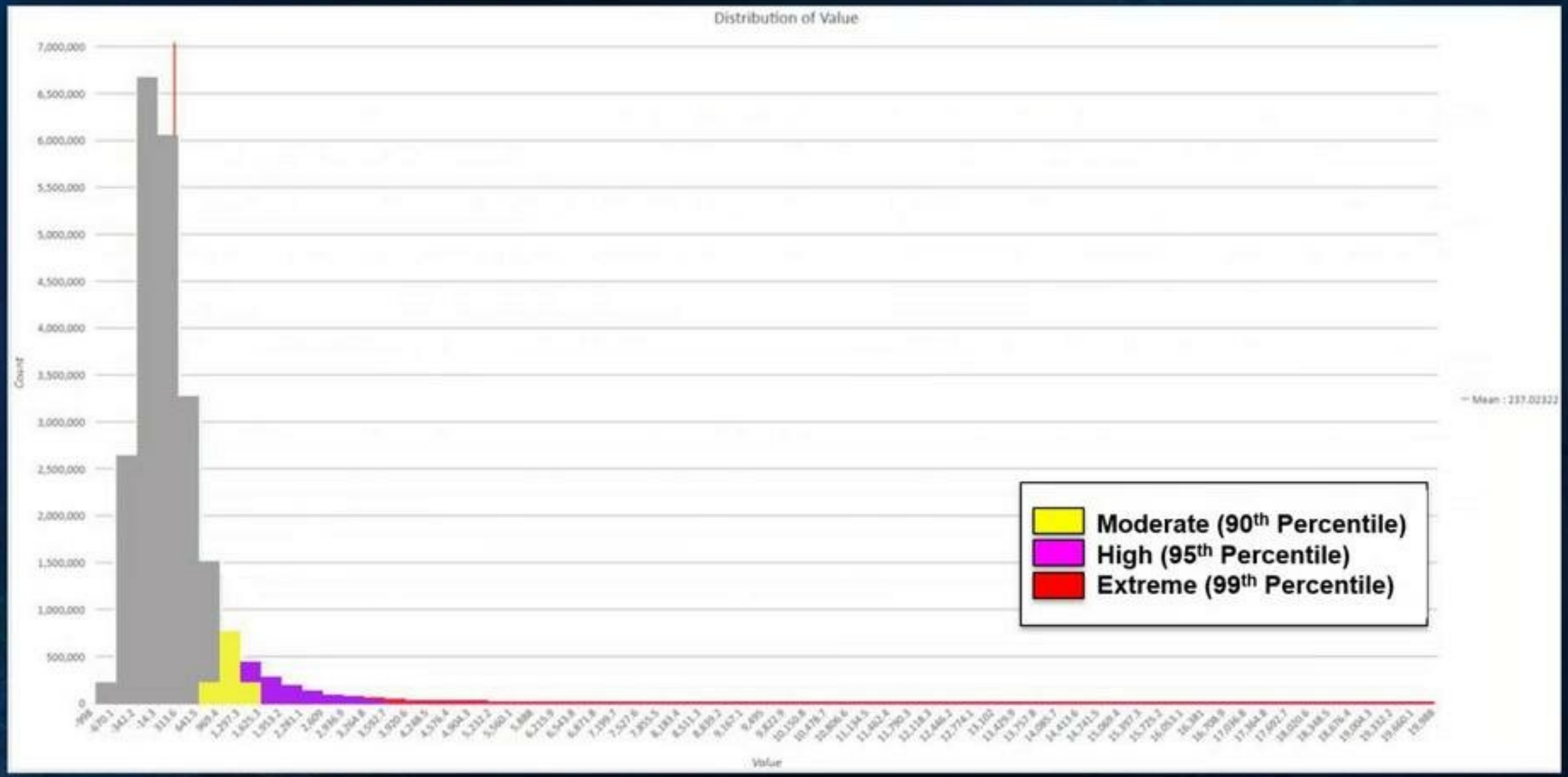
ArcGIS Pro

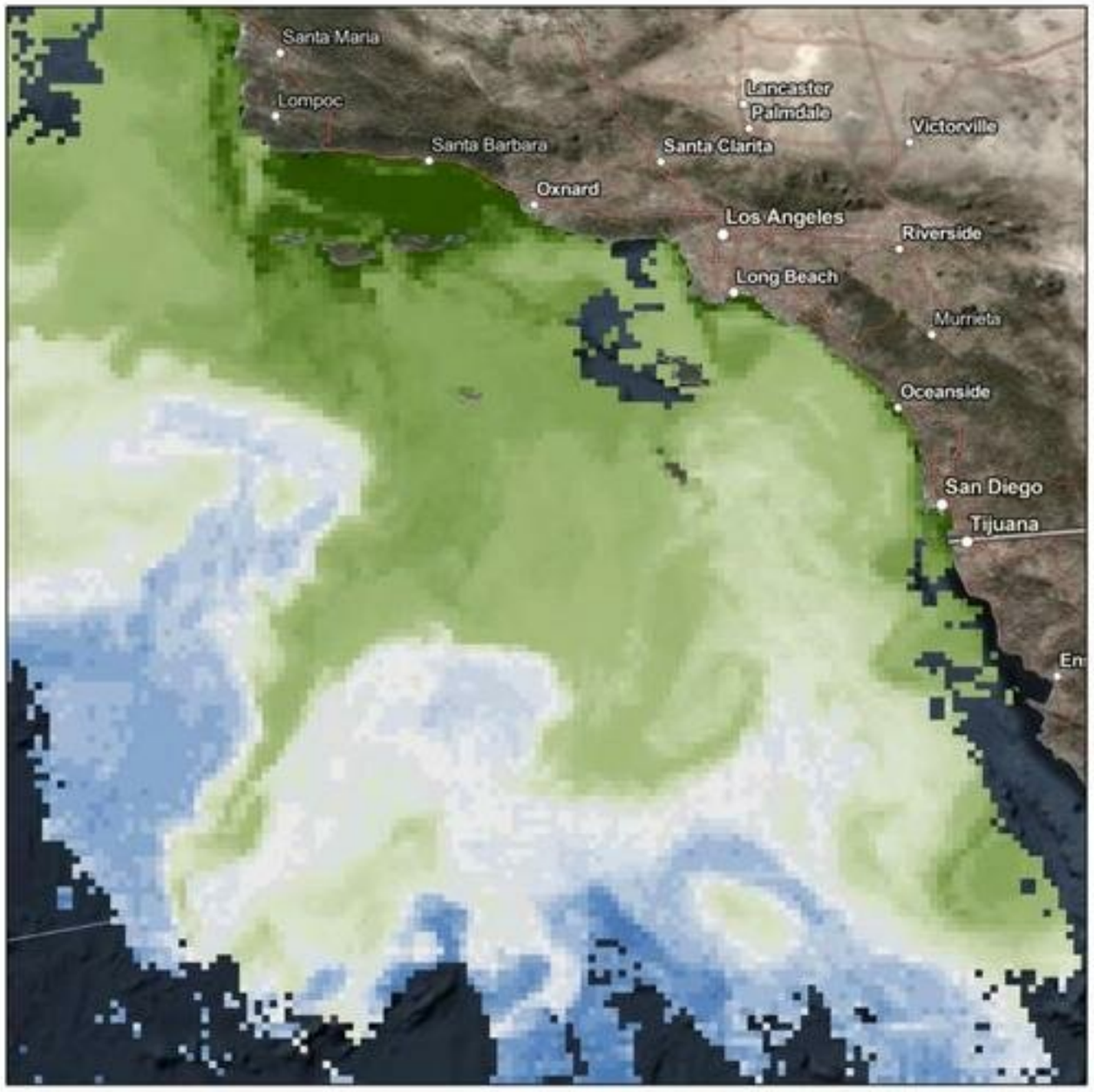
- **Sub-indicator 2: How often are blooms occurring?**
- **NOAA Chlorophyll-a Product**
  - **Monthly: Looking at daily anomalies between 2018 and present**
  - **classifying anomalies as moderate (90th percentile), high (95th percentile), or extreme (99th percentile)**
  - **Reporting frequency for each class within month**

Sub-indicator 2: Computing Daily Anomaly

January	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
February	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59			
March	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
April	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	
May	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151
June	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	
July	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212
August	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243
September	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	
October	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304
November	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	
December	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365

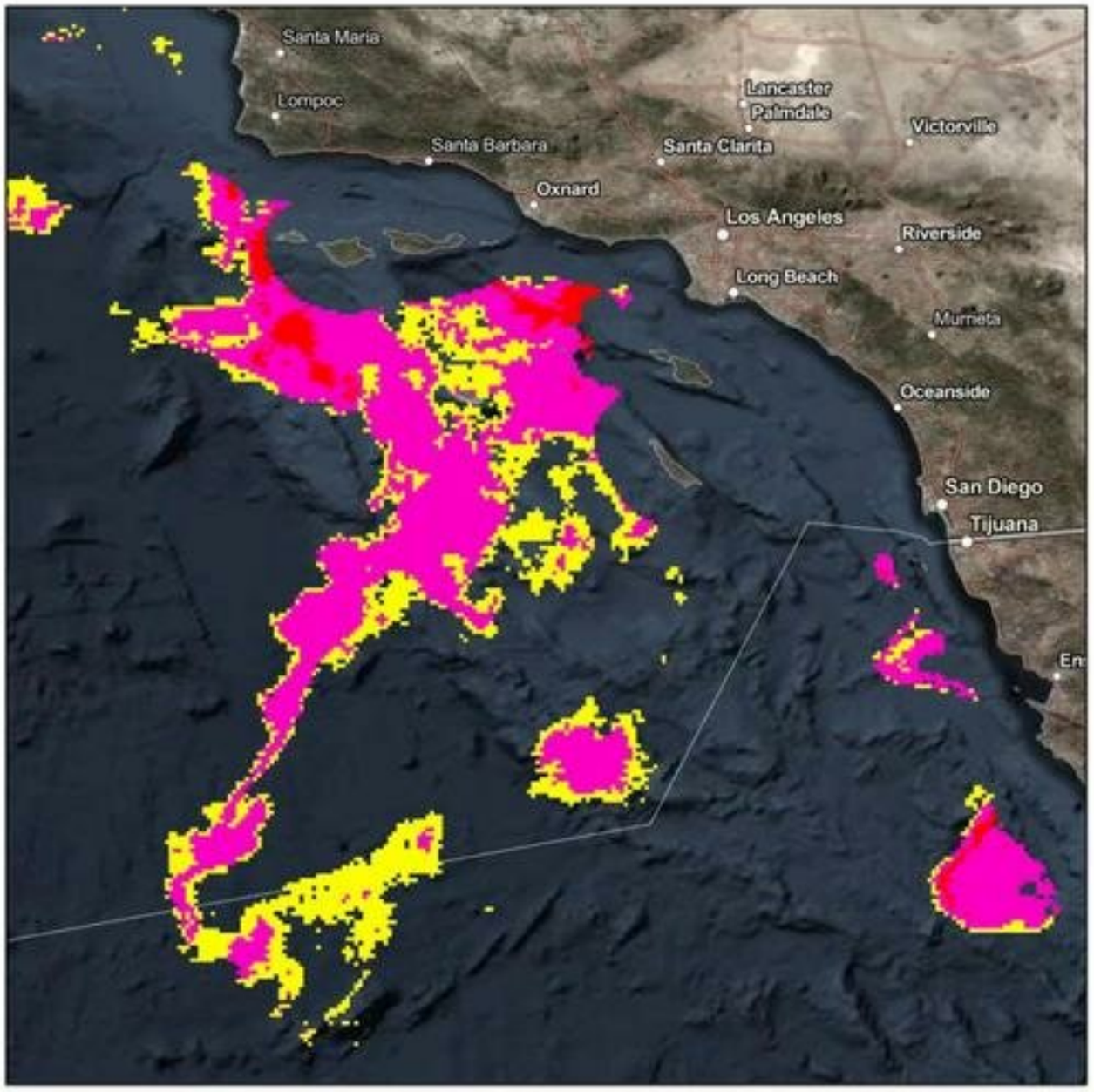
Sub-indicator 2: Daily Percentiles Histogram





Chlorophyll concentration

low — high



Algal bloom index

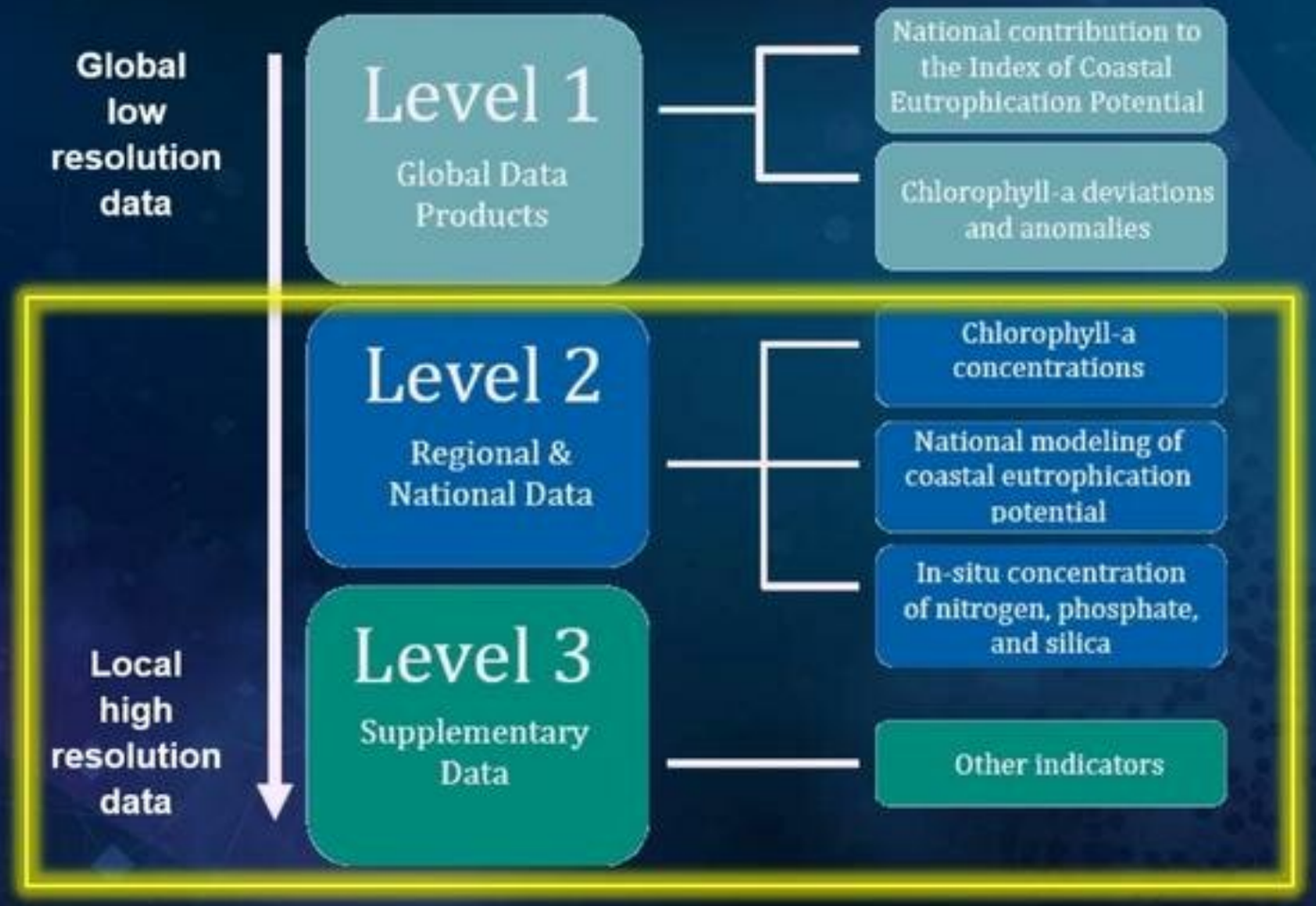
moderate high extreme

Sub-indicator 2

- **Frequency per pixel**
  - **Moderate**
    - $x = \frac{monthly\ moderate\ occurance}{total\ monthly\ occurance}$
  - **High**
    - $x = \frac{monthly\ high\ occurance}{total\ monthly\ occurance}$
  - **Extreme**
    - $x = \frac{monthly\ extreme\ occurance}{total\ monthly\ occurance}$

Summarize by Country EEZ (count and mean)

Scalable Methodology



Next Steps

- ArcGIS Living Atlas of the World
  - Host Sub-indicator 1 Results
  - Host Sub-indicator 2 Results
- Develop Web Application to review results and supporting data
  - Enable users to understand coastal eutrophication on a pixel by pixel basis within their respective countries

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