

Ecological Early Warning Tools & Applications for FKNMS Management

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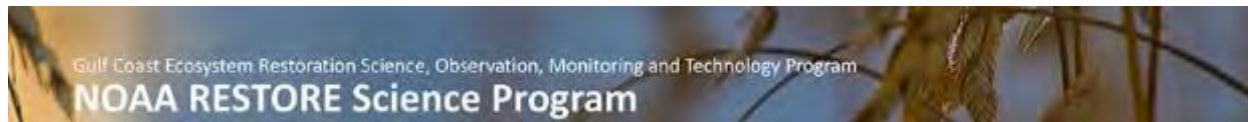
²University of Miami, CIMAS

³NOAA, Atlantic Oceanographic & Meteorological Laboratory (AOML)

⁴University of Miami, Rosenstiel School of Marine and Atmospheric Science

⁵Florida Fish and Wildlife Conservation Commission

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The Florida Keys are exposed to episodic phenomena such as:

- Harmful algal blooms
- Coral bleaching
- Coral disease
- Hypersaline waters
- Sediment resuspension
- Cold temperatures
- Etc.

We developed a tool to monitor and visualize such episodes

FKNMS monitoring tool

<http://grafana.marine.usf.edu:3000/dashboard/db/fk-nms-early-alert-dashboard?orgId=2>

Location selector for
extracted satellite data

Dates

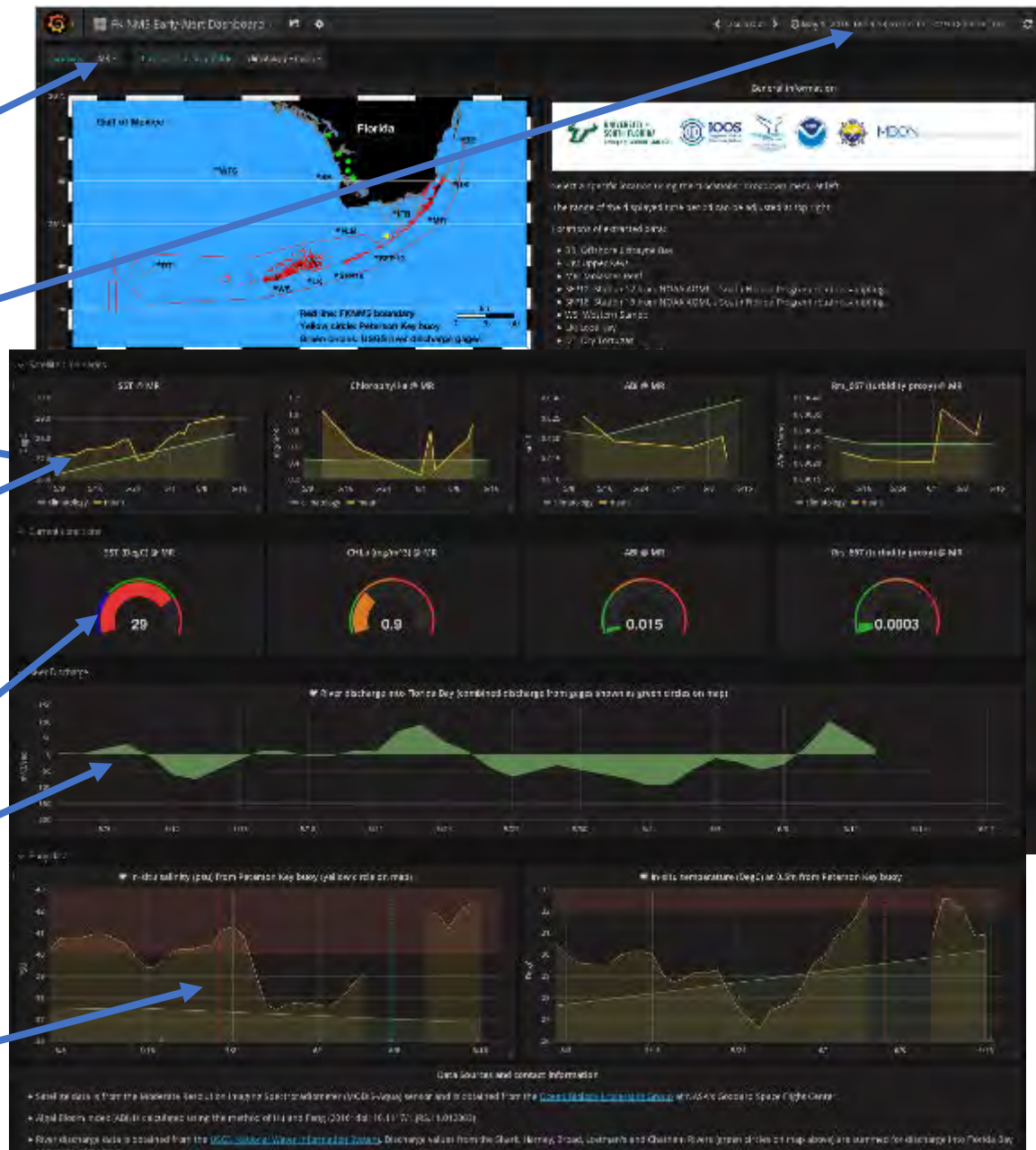
7-Day anomaly satellite images:
(Temperature, Chlorophyll, Algal
Bloom Index, turbidity)

Time-series of extracted
satellite data.

Color coded gages
representing current
conditions

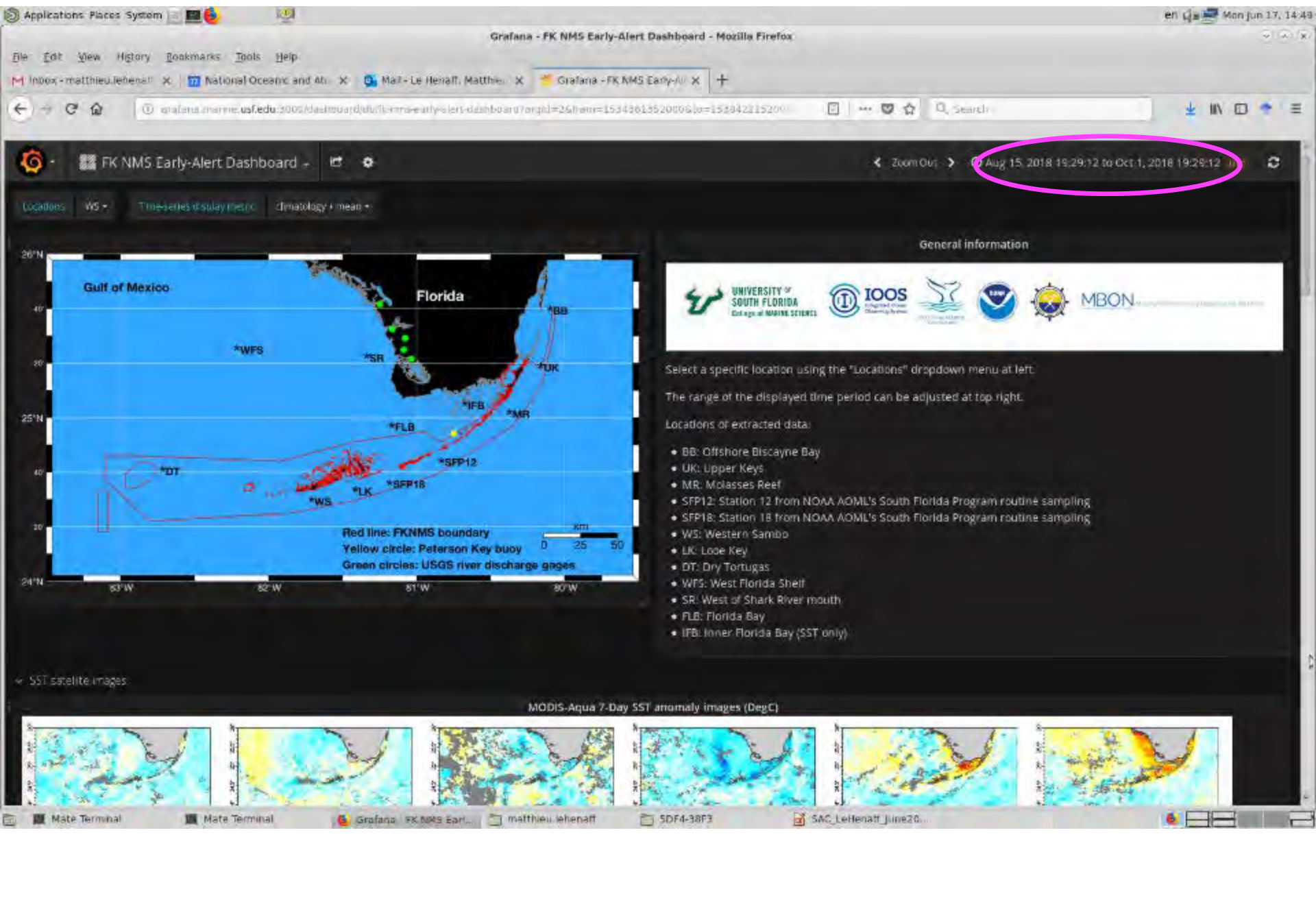
River discharge into Florida Bay
(corrected from tidal signal)

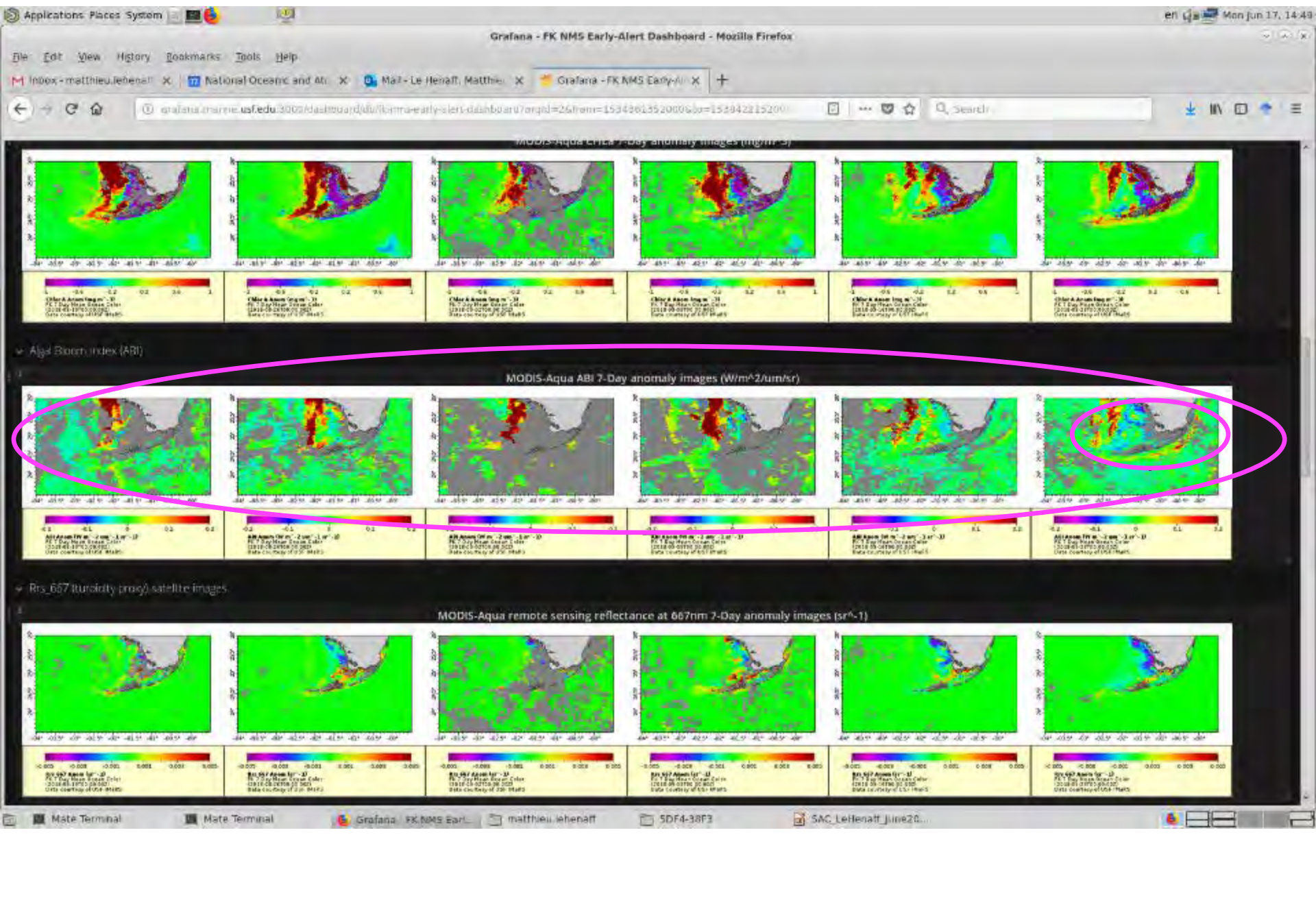
Temperature and salinity data from
buoy at Peterson Key (NDBC)

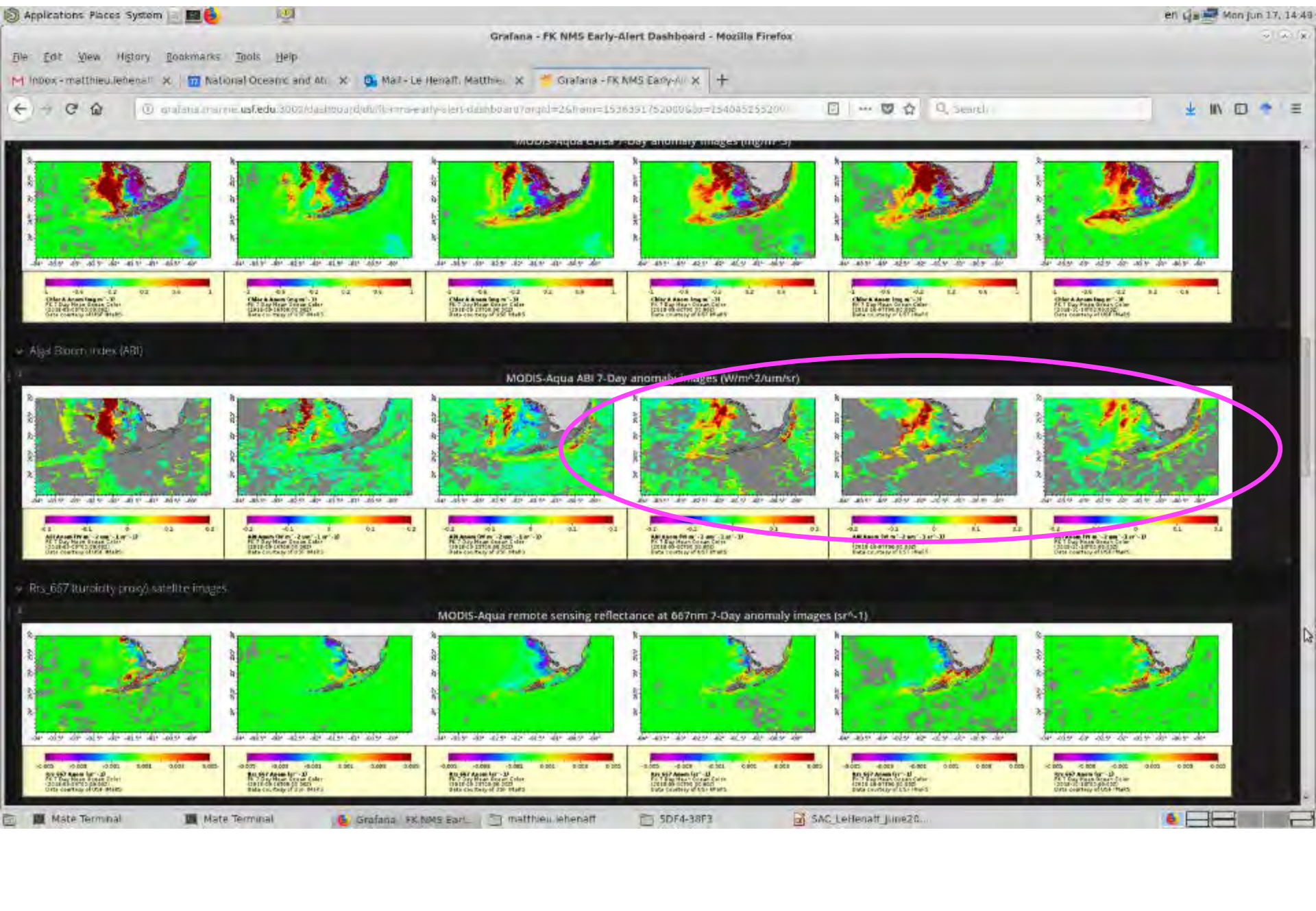


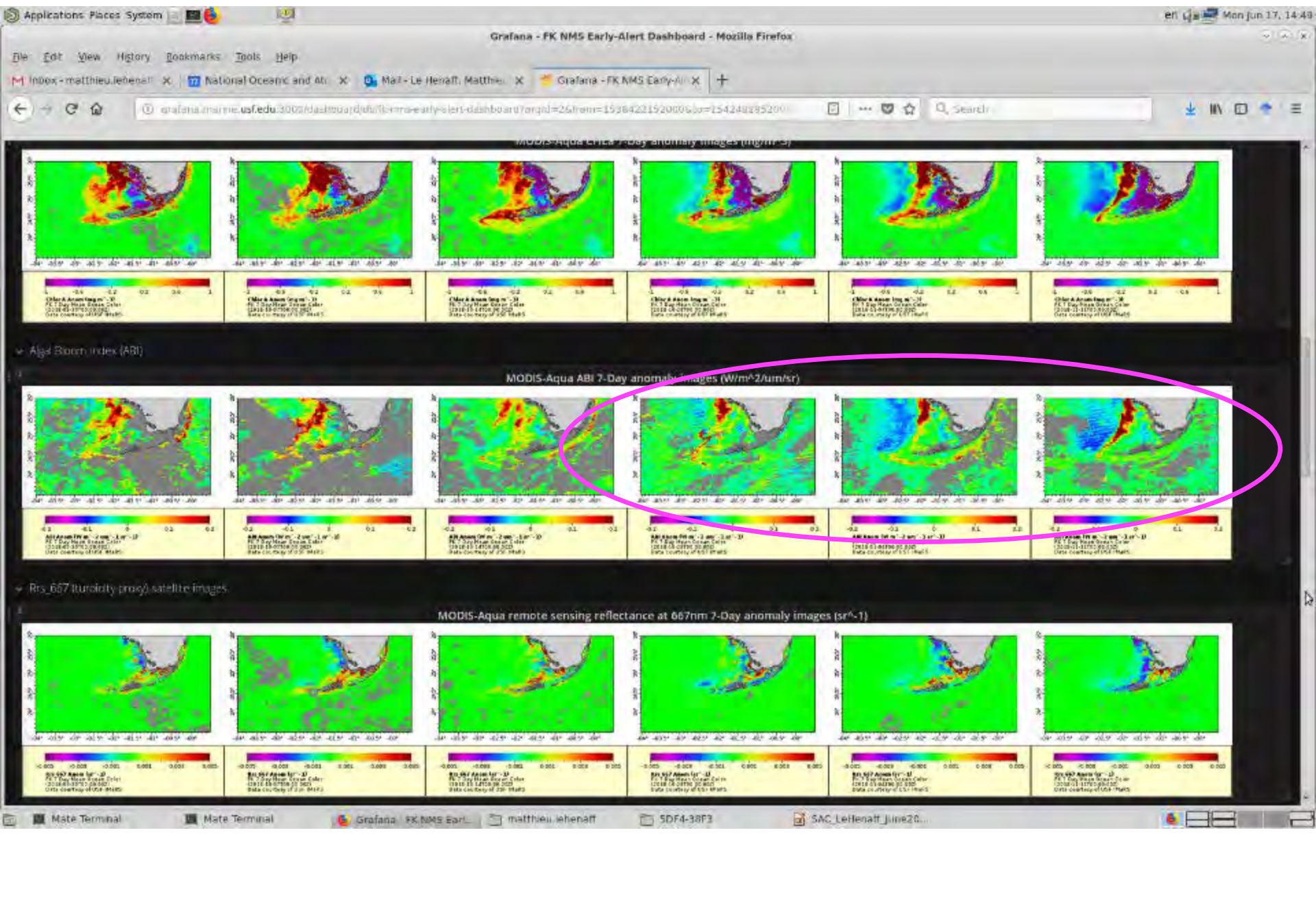
Examples:

- Harmful algal blooms: http://grafana.marine.usf.edu:3000/dashboard/db/fk-nms-early-alert-dashboard?orgId=2&from=1534377482618&to=1538352488830&var-region=fk&var-Locations=WS&var-timeseries_displays=climatology&var-timeseries_displays=mean
- Irma, September – October 2017: http://grafana.marine.usf.edu:3000/dashboard/db/fk-nms-early-alert-dashboard?orgId=2&from=1504310282618&to=1508026088830&var-region=fk&var-Locations=WS&var-timeseries_displays=climatology&var-timeseries_displays=mean
- Irma, July 2017 – June 2018: http://grafana.marine.usf.edu:3000/dashboard/db/fk-nms-early-alert-dashboard?orgId=2&from=1499039882618&to=1530490088830&var-region=fk&var-Locations=UK&var-Locations=WS&var-timeseries_displays=climatology&var-timeseries_displays=mean
- 2010 cold winter: <http://grafana.marine.usf.edu:3000/dashboard/db/fk-nms-early-alert-dashboard?orgId=2&from=1260901675000&to=1271346731000&var-Locations=SFP12&var-Locations=SR>





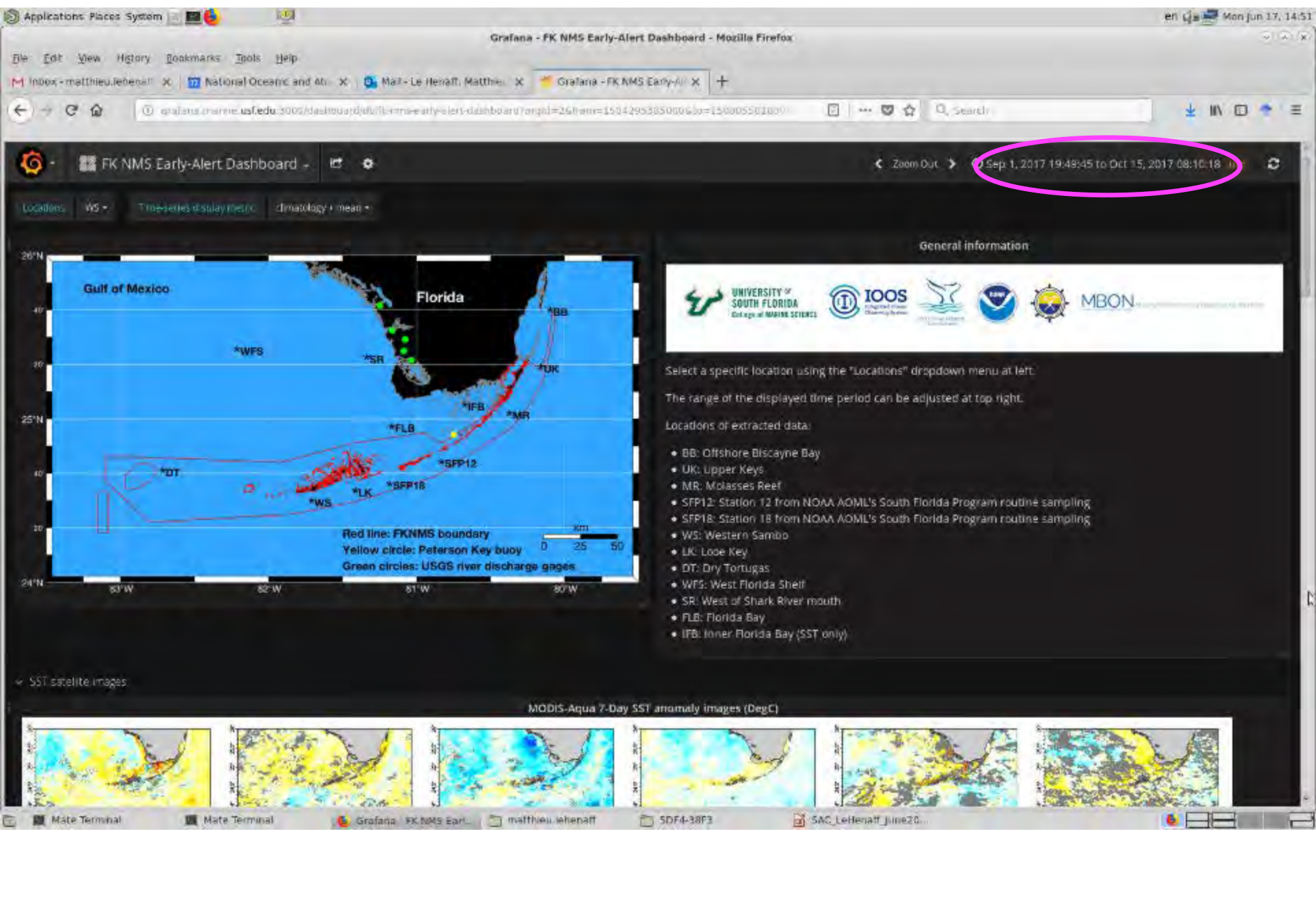


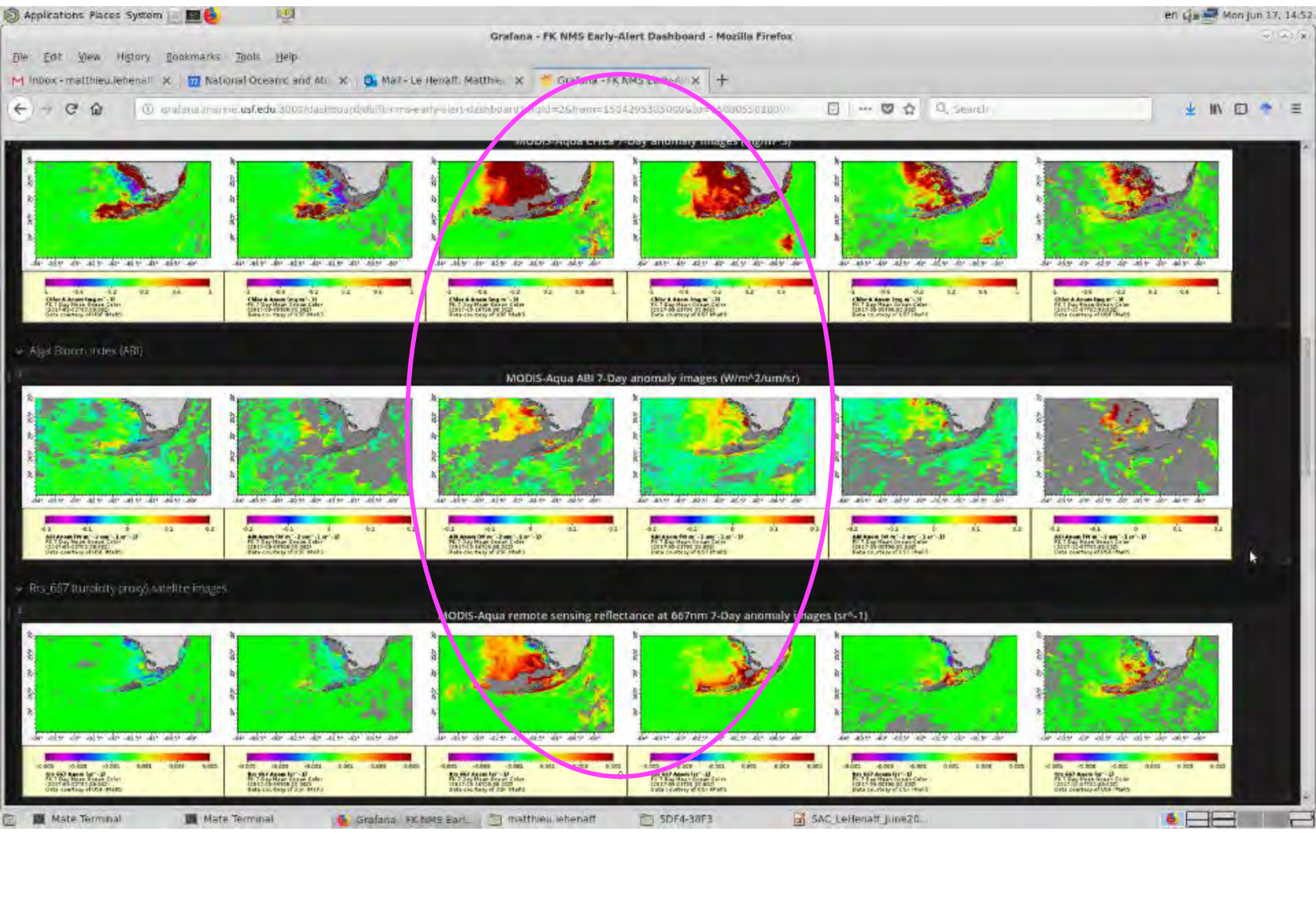


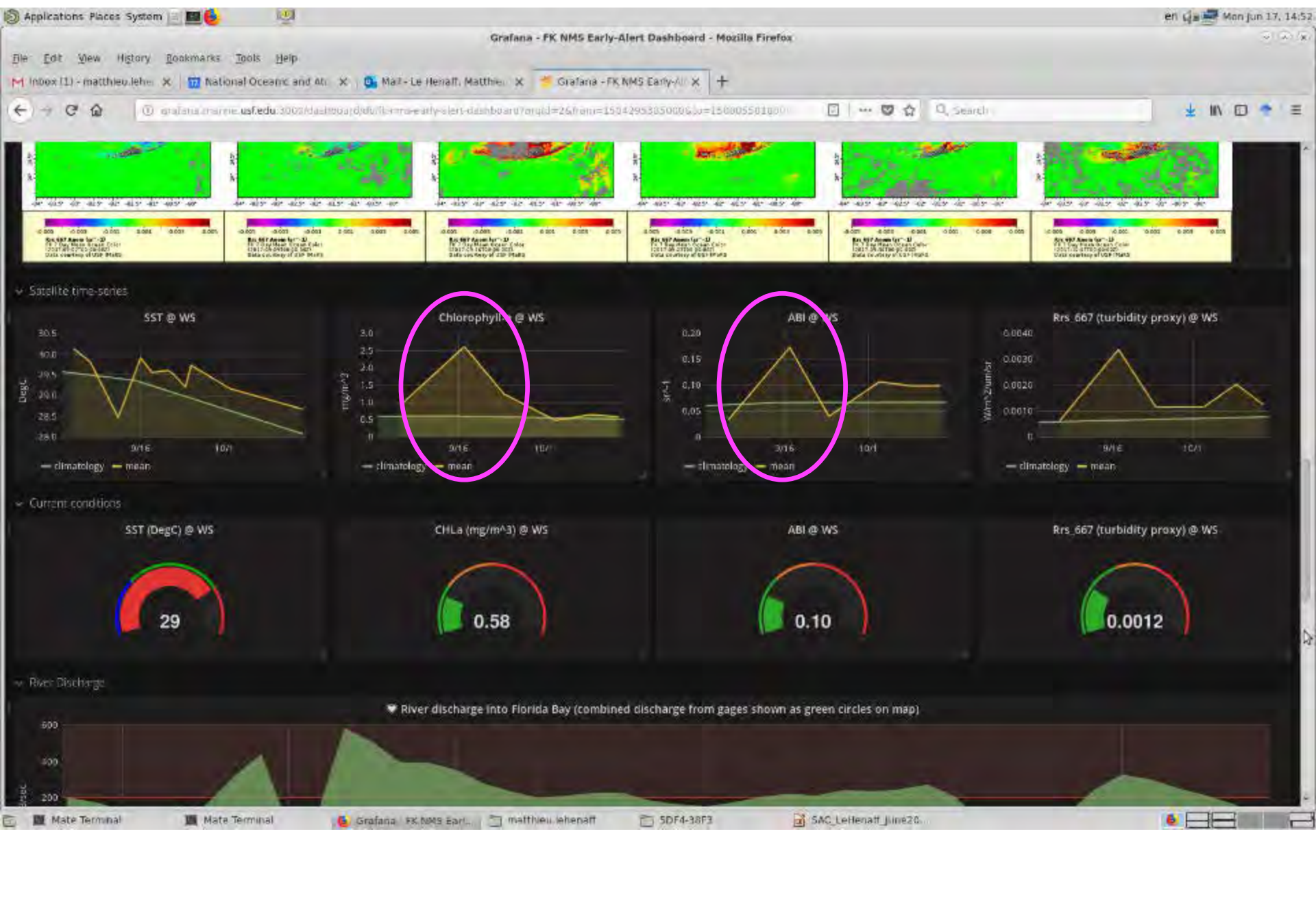


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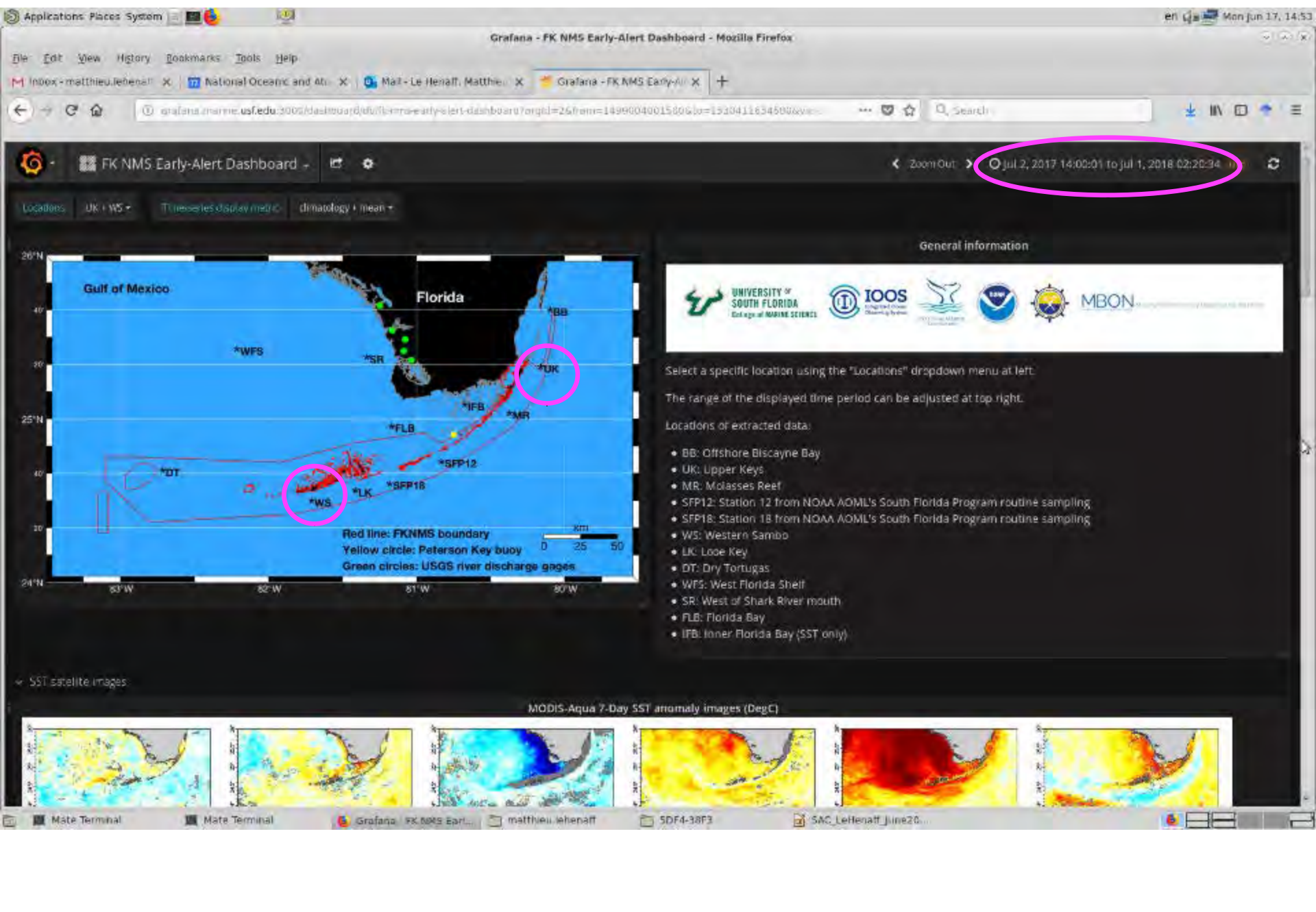






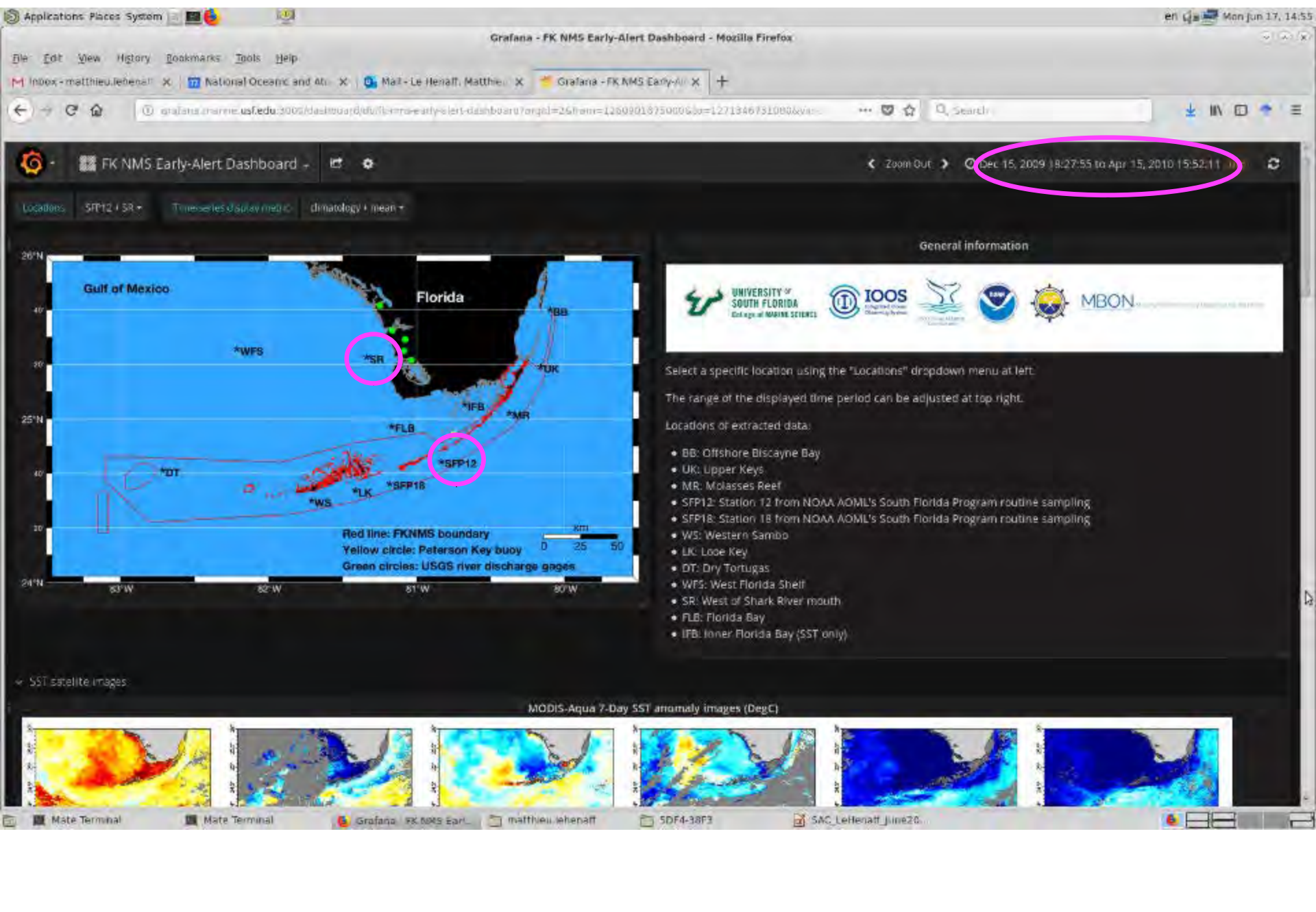
Examples:

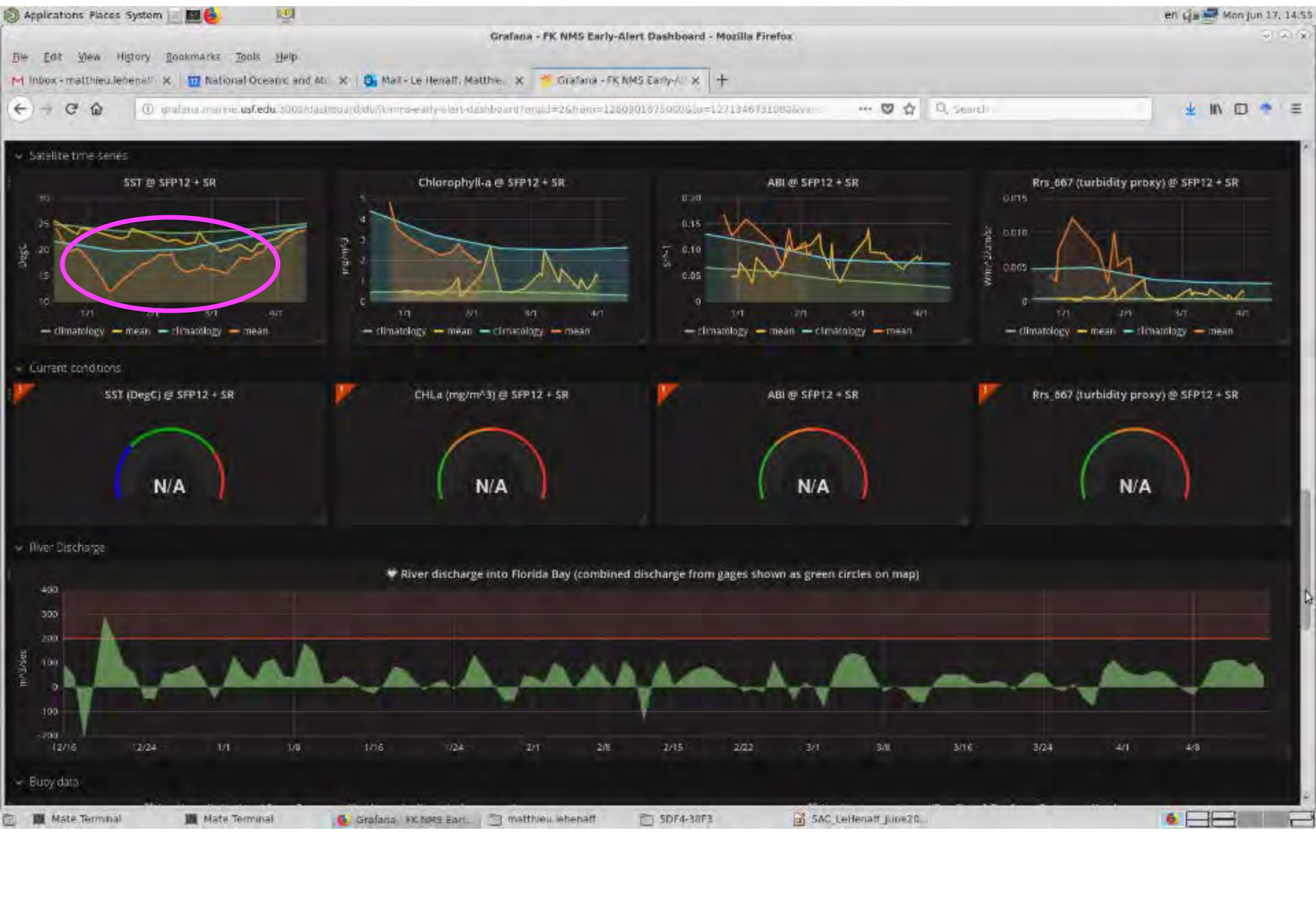
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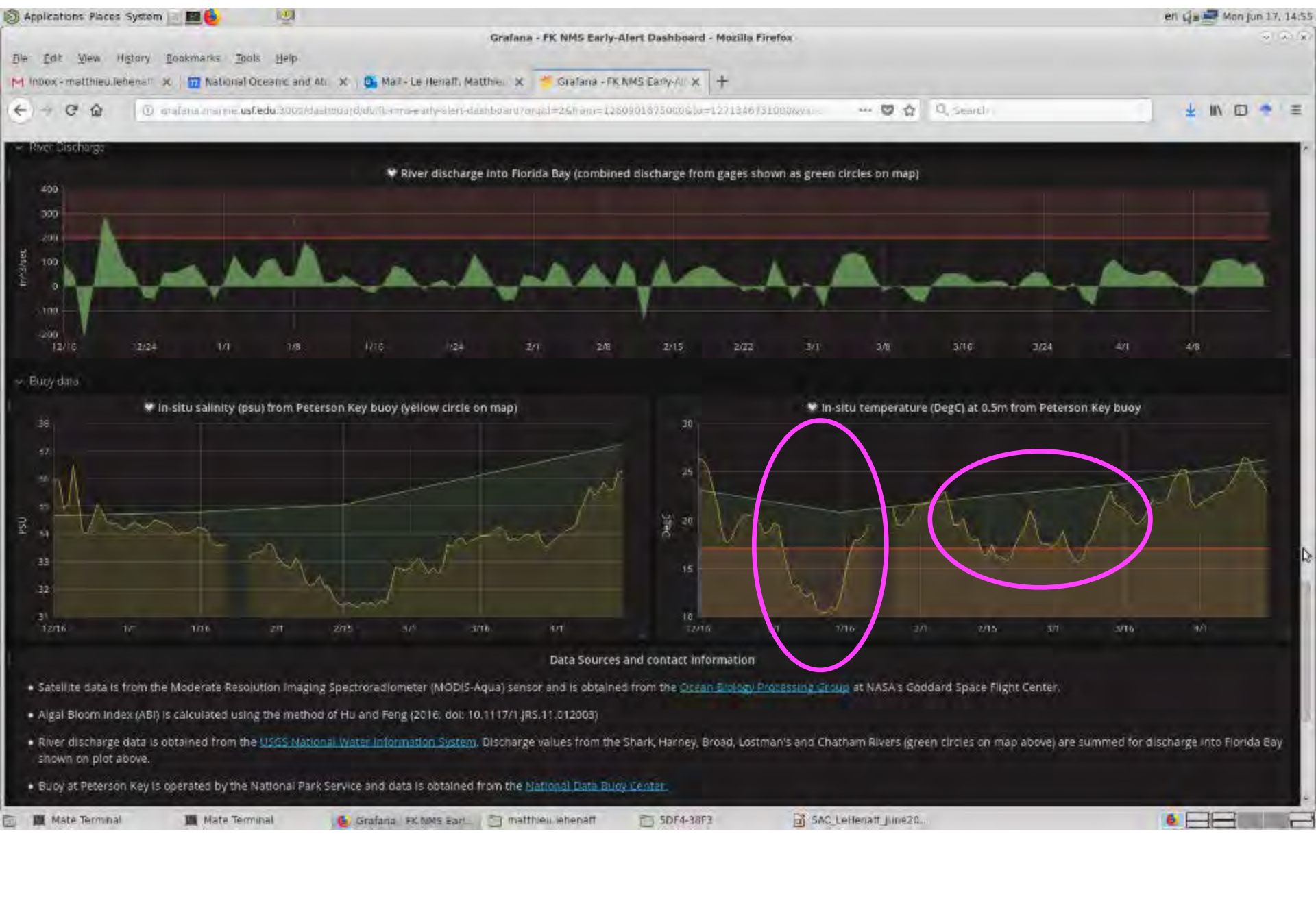


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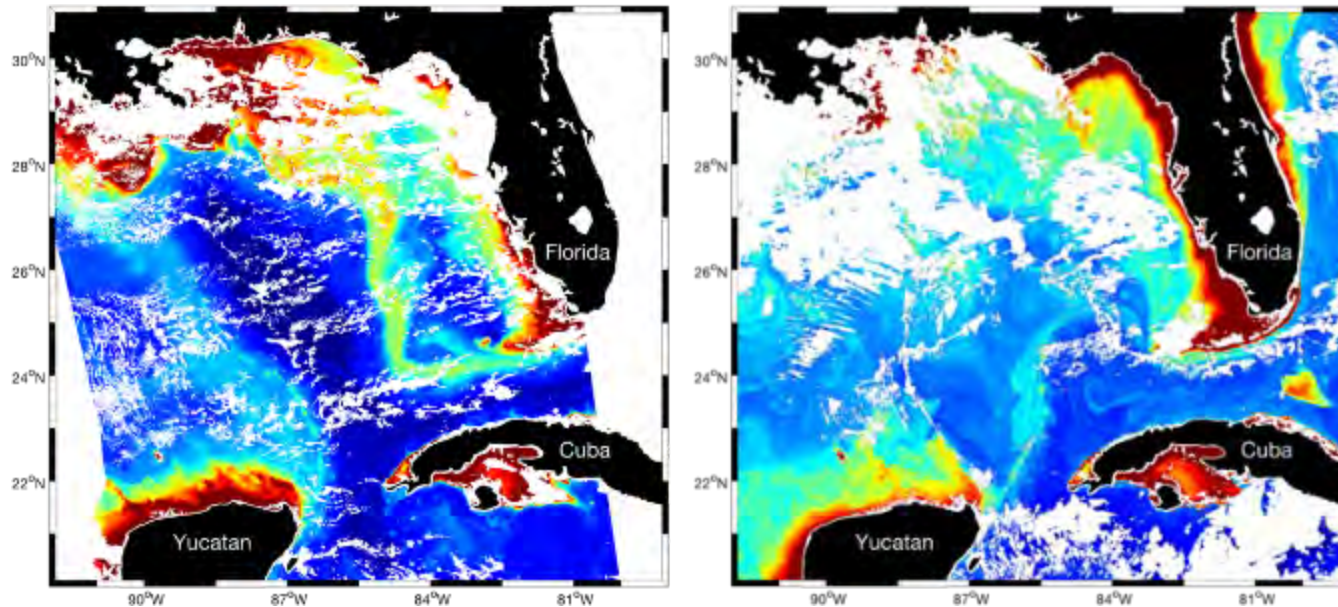




- **Conclusions:**
 - **Coastal processes** are important for **water quality**
 - (Hopefully) **easy-to-use tool** to monitor **ocean processes** and **water quality**
 - Provide relevant information to **managers, scientists** and **the public**
 - Help answer **Condition Report Questions**
- **Future work for the monitoring tool:**
 - **Feedback welcome** for improving the tool
 - Define and test **alert thresholds**: email **alerts** of anomalous conditions
 - **Add other products:**
 - Meteorological data
 - **Loop Current** position

The **Loop Current** sometimes carries water from **coastal origins**. 2 examples:

- **Mississippi River** waters (almost every year, for a few weeks at a time)
- Productive waters from Campeche Bank (unusual)

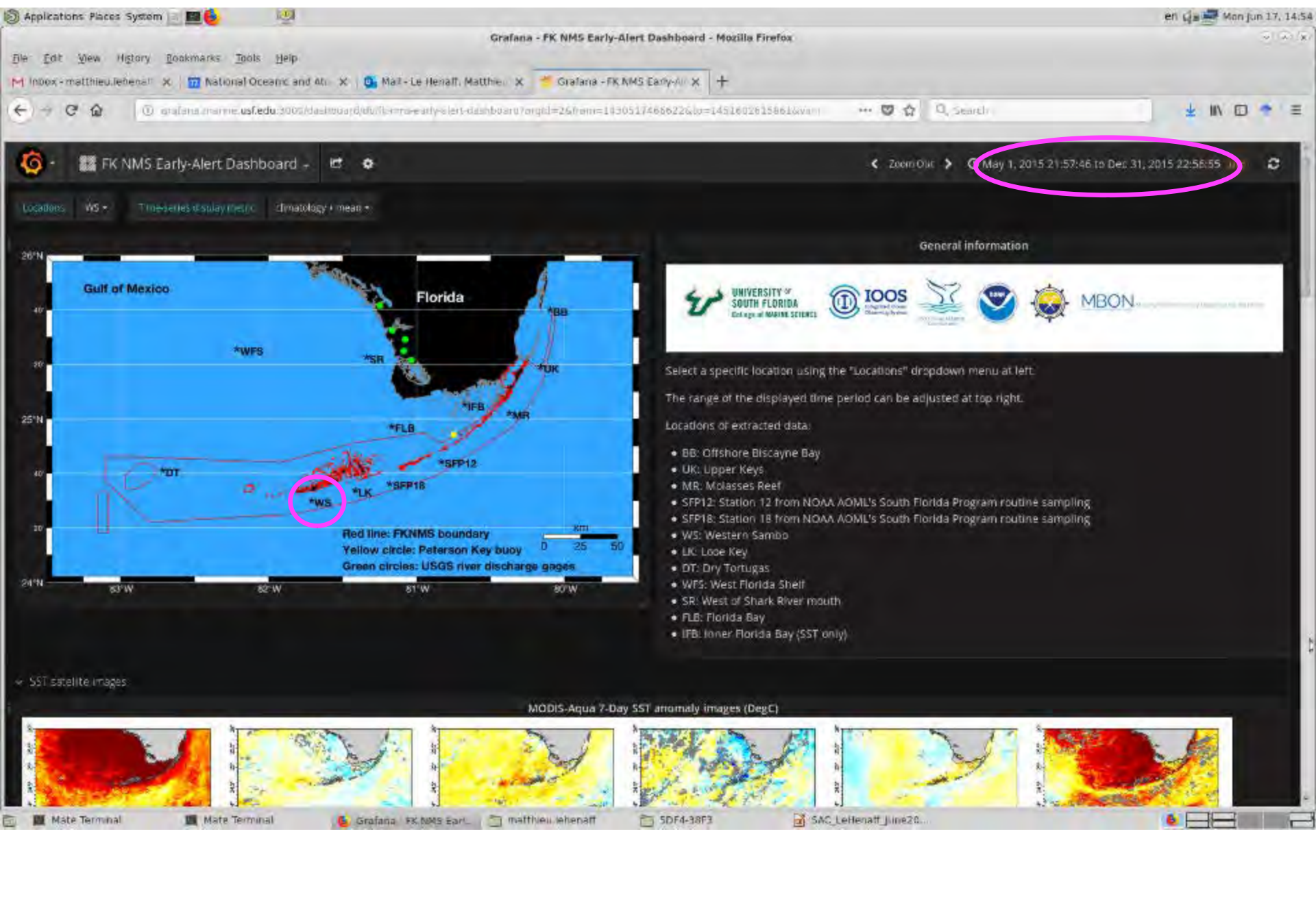


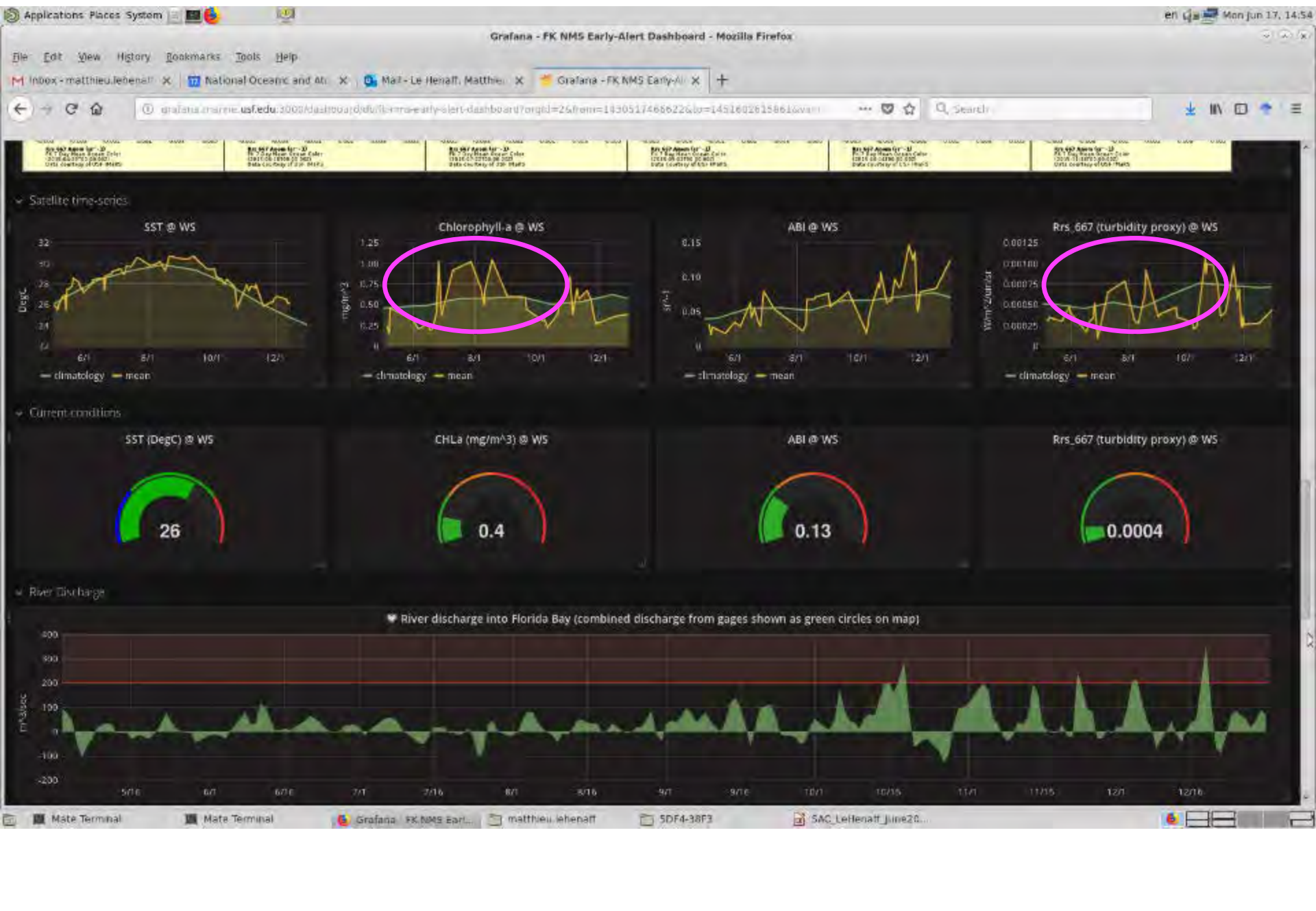
MODIS Chlorophyll-a concentration (mg/m^3) – 22 JUL 2015 (left) and 14 MAR 2002 (right)

- **Example:** Export of Mississippi Waters, May – December 2015:

<http://grafana.marine.usf.edu:3000/dashboard/db/fk-nms-early-alert-dashboard?orgId=2&from=1430517466622&to=1451602615861&var-region=fk&var-Locations=WS>

- Possibility to include the position/shape of the LC in the tool



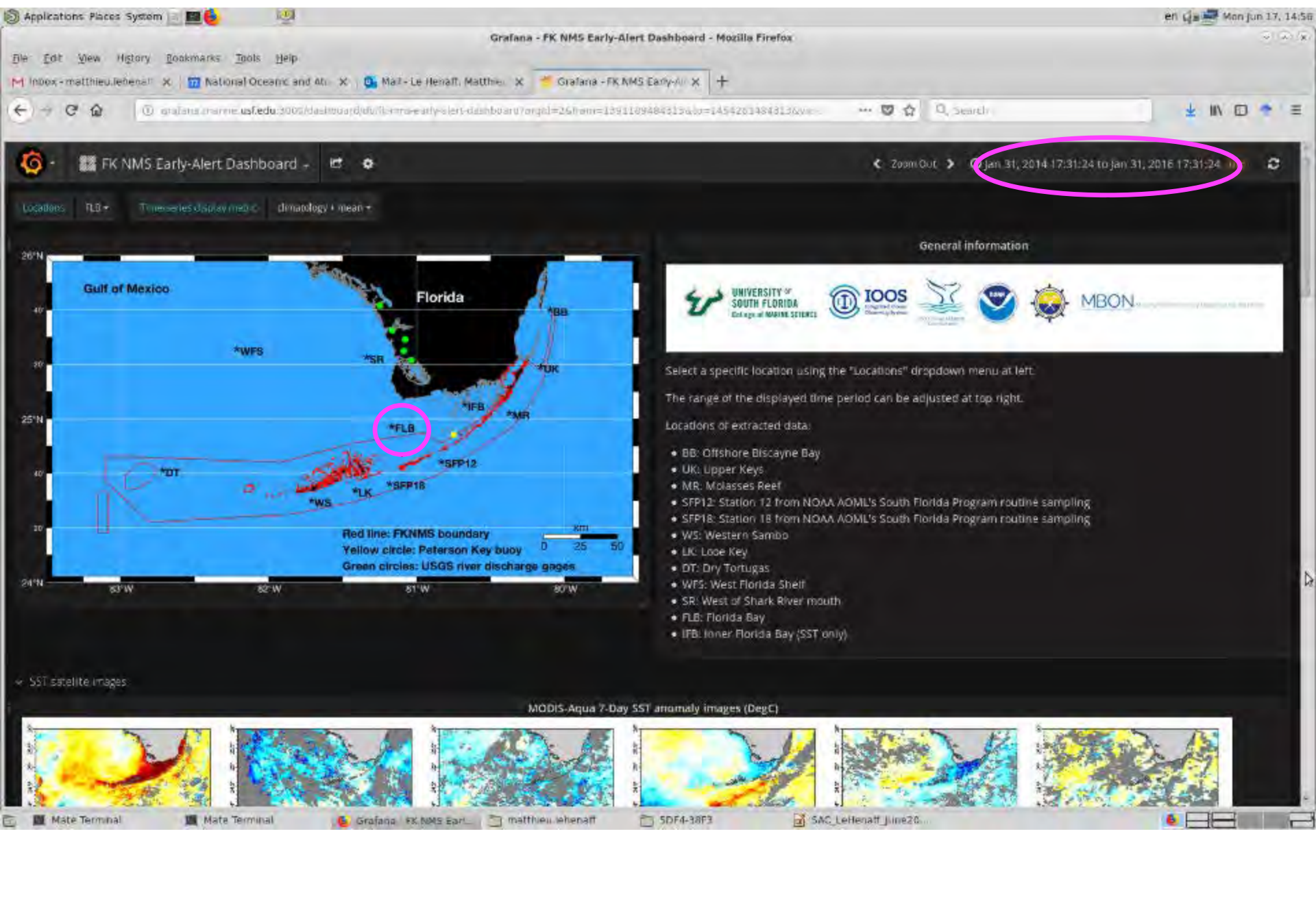


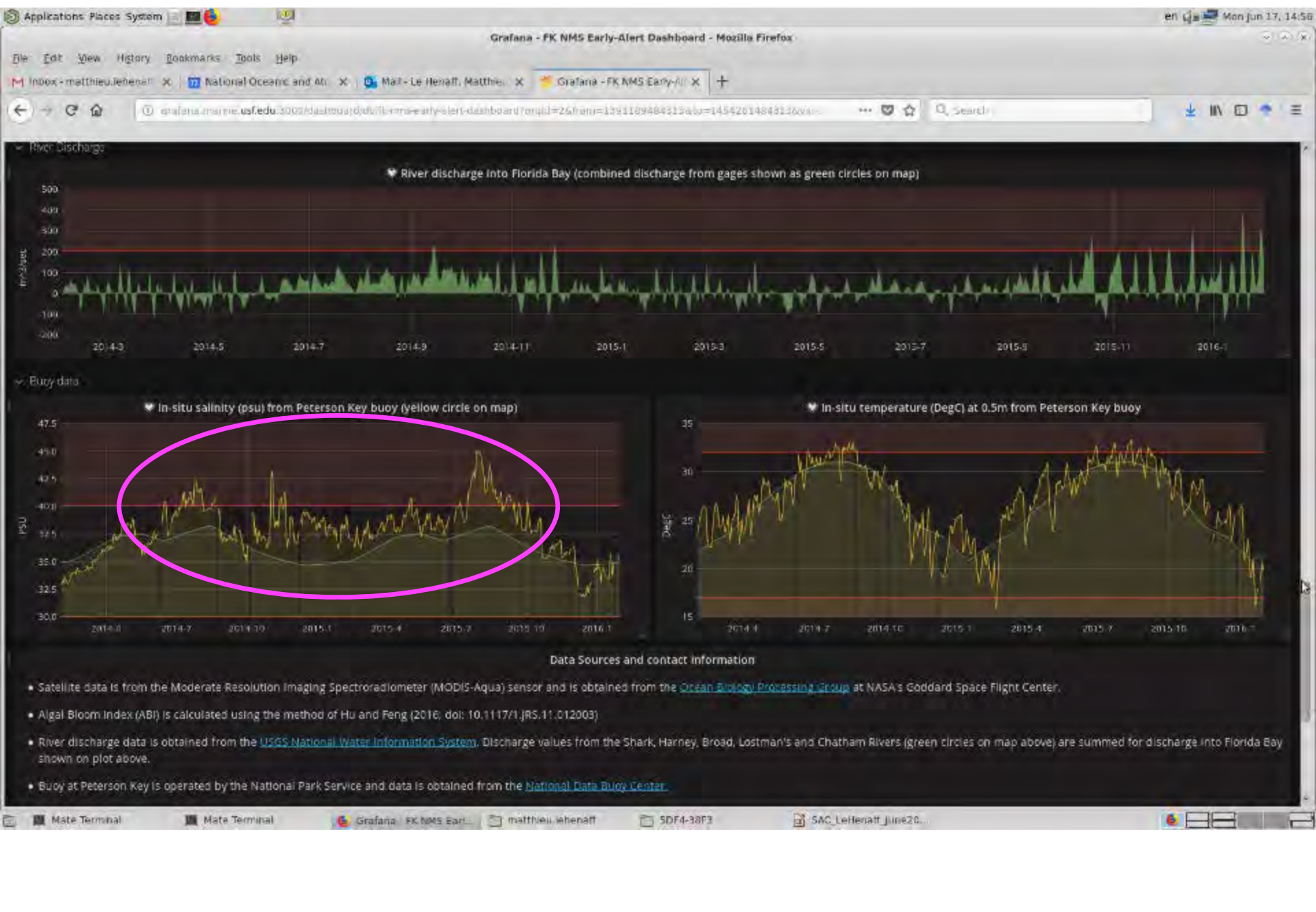
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- **Future work for the monitoring tool:**
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 - **Add other products**:
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 - **Loop Current** position
- **Current effort from the research community:**
 - Part of large effort: Marine Biodiversity Observation Network (**MBON**) and NOAA's Integrated Ecosystem Assessment (**IEA**) Program
 - Development of **indicators** (presented by Chris Kelble)

Thank You!

Other example:

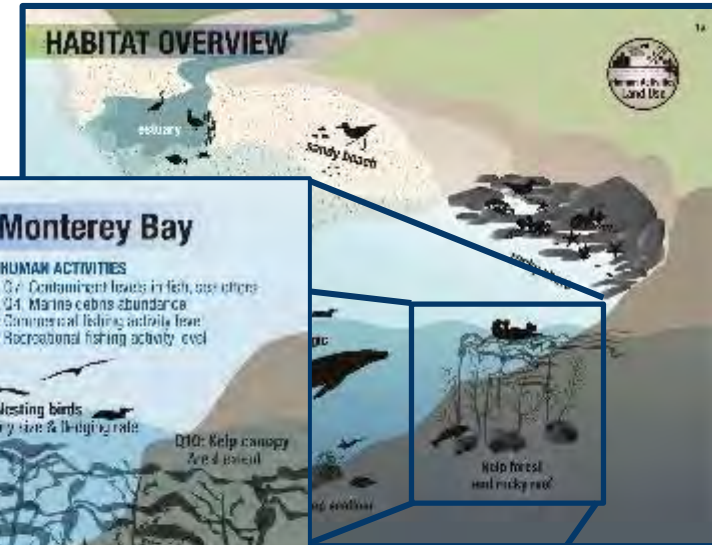
- 2014-2015 high salinity episode and seagrass die-off:
<http://grafana.marine.usf.edu:3000/dashboard/db/fk-nms-early-alert-dashboard?orgId=2&from=1391189484313&to=1454261484313&var-Locations=FLB>





Condition Report Questions are Targets

The screenshot shows the StatCrunch web interface. At the top, there is a navigation bar with 'StatCrunch' and 'Data' tabs. Below the navigation bar, there is a header section with 'Each question answered with StatCrunch Reporting System' and a 'Key' section. The 'Key' section contains a color-coded legend for 'Year' (Green, Yellow, Red) and 'Sales' (Blue, Green, Red). Below the legend, there is a table with columns for 'Year' and 'Sales'. The table contains data for the years 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2471, 2472, 2473, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 2494, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2507, 2508, 2509, 2510, 2511, 2512, 2513, 2514, 2515, 2516, 2517, 2518, 2519, 2520, 2521, 2522, 2523, 2524, 2525, 2526, 2527, 2528, 2529, 2530, 2531, 2532, 2533, 2534, 2535, 2536, 2537, 2538, 2539, 2540, 2541, 2542, 2543, 2544, 2545, 2546, 2547, 2548, 2549, 2550, 2551, 2552, 2553, 2554, 2555, 2556, 2557, 2558, 2559, 2560, 2561, 2562, 2563, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2574, 2575, 2576, 2577, 2578, 2579, 2580, 2581, 2582, 2583, 2584, 2585, 2586, 2587, 2588, 2589, 2590, 2591, 2592, 2593, 2594, 2595, 2596, 2597, 2598, 2599, 2600, 2601, 2602, 2603, 2604, 2605, 2606, 2607, 2608, 2609, 2610, 2611, 2612, 2613, 2614, 2615, 2616, 2617, 2618, 2619, 2620, 2621, 2622, 2623, 2624, 2625, 2626, 2627, 2628, 2629, 2630, 2631, 2632, 2633, 2634, 2635, 2636, 2637, 2638, 2639, 2640, 2641, 2642, 2643, 2644, 2645, 2646, 2647, 2648, 2649, 2650, 2651, 2652, 2653, 2654, 2655, 2656, 2657, 26



and habitat- based conceptual models