Earth observation wetlands

France Gerard

Material from UKCL H colleagues and literature



Wetlands ...

- Flooded or saturated with water, either permanently or seasonally
- with vegetation adapted to the unique hydric soil
- water is freshwater, brackish, or saltwater
- coastal or tidal and inland or non-tidal
- Iie between dry land and deep water and are often referred to as ecotones (a transitional habitat; part land, part water)

... monitoring vegetation or water or both

- > monitoring water quality
- > mapping vegetation types, mapping water bodies
- > monitoring vegetation dynamics
- > monitoring flood dynamics



Earth Observation or Remote Sensing

Spatial information collected using a sensor on a drone, aircraft or satellite that captures electro-magnetic radiation





Earth Observation





Visible NIR SWIR 50 45 40

2.2

Optical: reflectance spectra



_% 35

Earth Observation

There is always a compromise between type of data, spatial detail, temporal frequency, spatial coverage and cost



Examples...

- > monitoring water quality
- > mapping vegetation types, mapping water bodies
- > monitoring vegetation dynamics
- > monitoring flood dynamics
- ≻ ...





Smoothed Chl-a trend signals and cluster mean curves





IIWQ World Water Quality Portal, UNESCO / EOMAP



MERIS: 2002-2012

MSI - Sentinel 2: 2015

little change Cluster 1 generally Cluster 2 decreasing Cluster 3 Cluster 4 generally Cluster 5 Cluster 6 increasing Cluster 7 Cluster 8 UNIVERSITY of STIRLING University of Glasgow Jniversity University of Centre for Ecology & Hydrology Plymouth Marine Laboratory PML 😵 Reading of Dundee TURAL ENVIRONMENT RESEARCH COUNCI





Mapping and monitoring water bodies:

Rattich et al. Remote Sens. 2020, 12(4), 643; https://doi.org/10.3390/rs12040643

Example: Open water and floods in Mozambique combining radar and optical



(e) Flood mask (19/03/2019) (f) Flood mask (23/03/2019) (g) Flood mask (25/03/2019) (h) Flood mask (30/03/2019)



Optical suffers

from clouds

Dynamics:

Example: Great Lakes Basin

Battaglia et al. Remote Sens. 2021, 13(4), 599; https://doi.org/10.3390/rs13040599



Mapping vegetation types: Example: Great Lakes Basin

Battaglia et al. Remote Sens. 2021, 13(4), 599; https://doi.org/10.3390/rs13040599

Combining World View (optical) and multi-temporal radar

- high spatial resolution from optical,
- multi temporal from radar





Mapping vegetation types:

Example: Akrotiri (Cyprus) wetland Habitat map

Charles George



World View imagery, 2m, 2 different view angles, so classified separately. Multi-temporal: Combined 2 dates April and July 2019 to maximise class separation. Image shown is July 2019



Unclassified

Time series:

Pasquarella et al 2016 https://doi.org/10.1002/rse2.24

Time- series of 25m optical (Landsat TM) to monitor Beaver disturbance

B Beaver-impacted wetland 1995 5000 35 **U deenness x 1000** 2000 2000 1000 1000 30 25 8 since Aears 10 2000 5 1980 1985 1990 1995 2000 2005 2010 2015 200 0 100 300 1000 35 30 TC Wetness x 10 000 25 086 -1000 2012 since 20 -2000 Years -3000 10 Leaf-on observations -4000 ○ Spring/autumn transitions 5 Leaf-off observations -5000 1980 100 200 Day of year 1985 1990 1995 2000 2005 2010 2015 0 300 Year

Airborne:

Sadro et al 2007, https://doi.org/10.1016/j.rse.2007.02.024

Characterising Californian Saltmarsh inundation dynamics and vegetation using Lidar and hyperspectral





Lidar: topography and wetness

Thomas et al 2017: https://www.sciencedirect.com/science/article/pii/S0303243416301519

Topographic Wetness Index



https://www.gim-international.com/content/article/uas-lidar-for-ecological-restoration-of-wetlands



Lidar: Deriving illumination budgets

Nuria Bachiller-Jareno, M.G.Hutchins, M.J.Bowes, M.B.Charlton, H.G.Orr: https://www.sciencedirect.com/science/article/pii/S0301479718310363

Point cloud of trees and shrubs on river banks is used to derive an illumination budget (shading)



Including shading (black line) changes temporal predictions of water

- chlorophyll,
- biochemical oxygen demand,
- temperature





Drone imagery and structure from motion point clouds Mountain wetlands: mapping vegetation communi

Mountain wetlands: mapping vegetation communities using point clouds and RGB imagery for 1km² watersheds

Ciaran Robb and Charles George









UK Centre for Ecology & Hydrology

Thank You

Any questions?





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Lake Optical Types







MERIS: 2002-2012 MSI - Sentinel 2: 2015 OLCI -Sentinel 3: 2015(

SeaWifs: 1997-2010