Leaf Area Index and Fraction of Absorbed Photosynthetically Active Radiation Thematic Climate Data Record from AVHRR

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The Leaf Area Index (LAI) and Fraction of Absorbed Photosynthetically Active Radiation (FAPAR) Climate Data Record (CDR) is a long term data set derived from the Advanced Very High Resolution Radiometer (AVHRR) sensors onboard the NOAA 7, 9, 11, 14, 16, and 18 platforms. The data set code name is AVH15 and is hosted at NOAA NCDC. The data set relies on the 30-year data set of Surface Reflectance (SR) CDR (AVH09). The algorithm is based on a per-class neural network trained using AVHRR SR and MODIS LAI/FAPAR. We used the BELMANIP-2 sites network to calibrate the ANN and the DIRECT in situ measurement to assess the uncertainty of the retrievals.
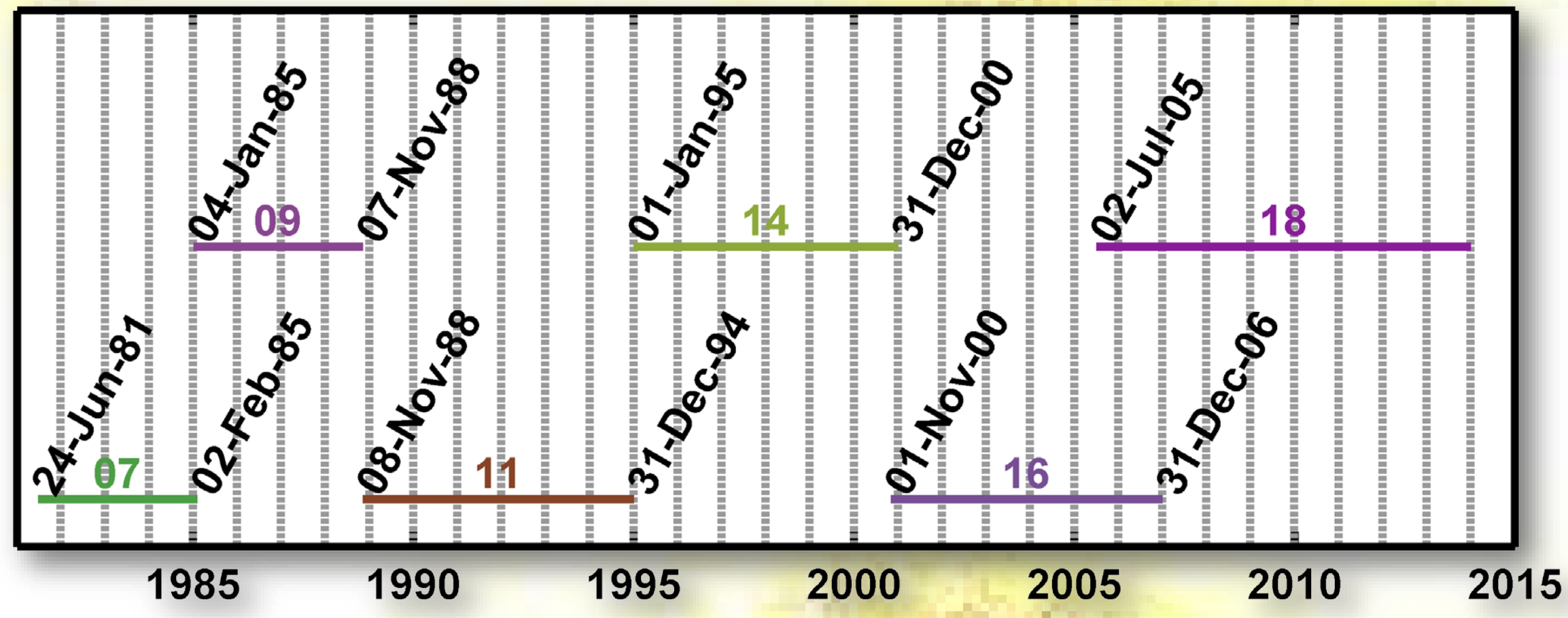

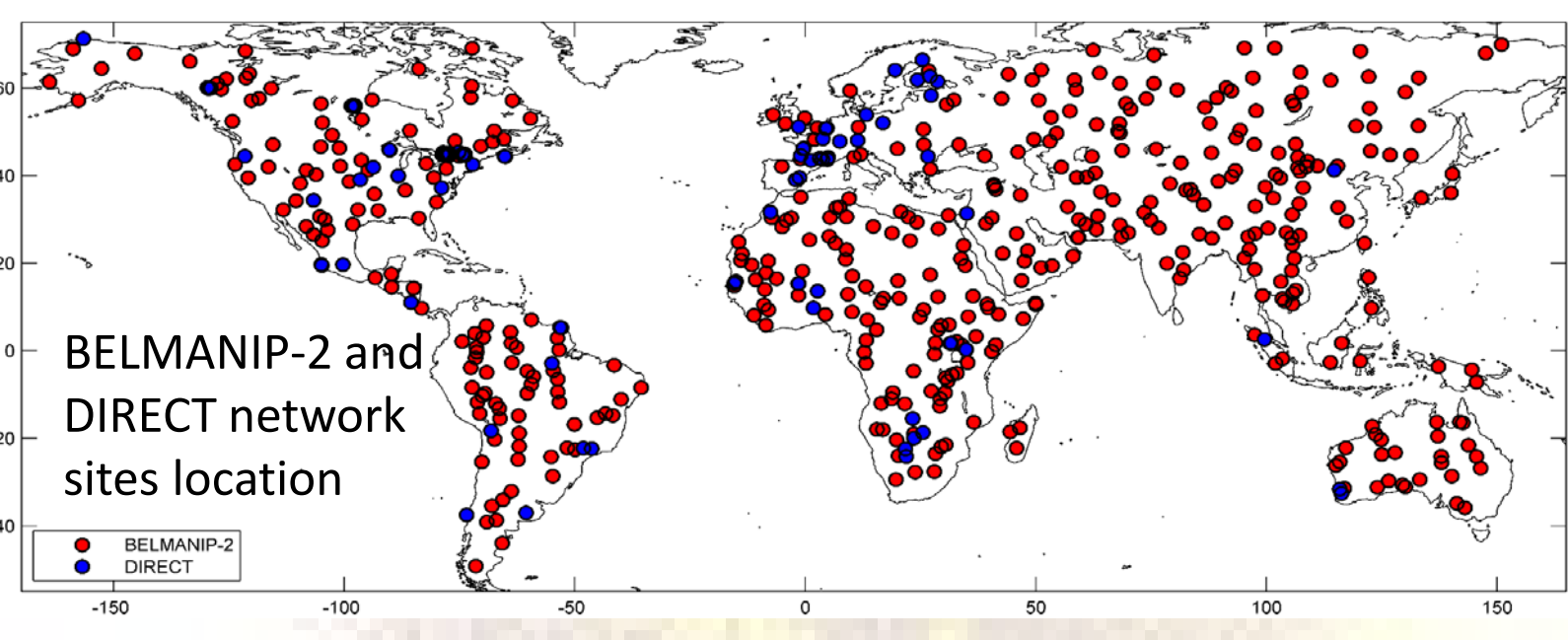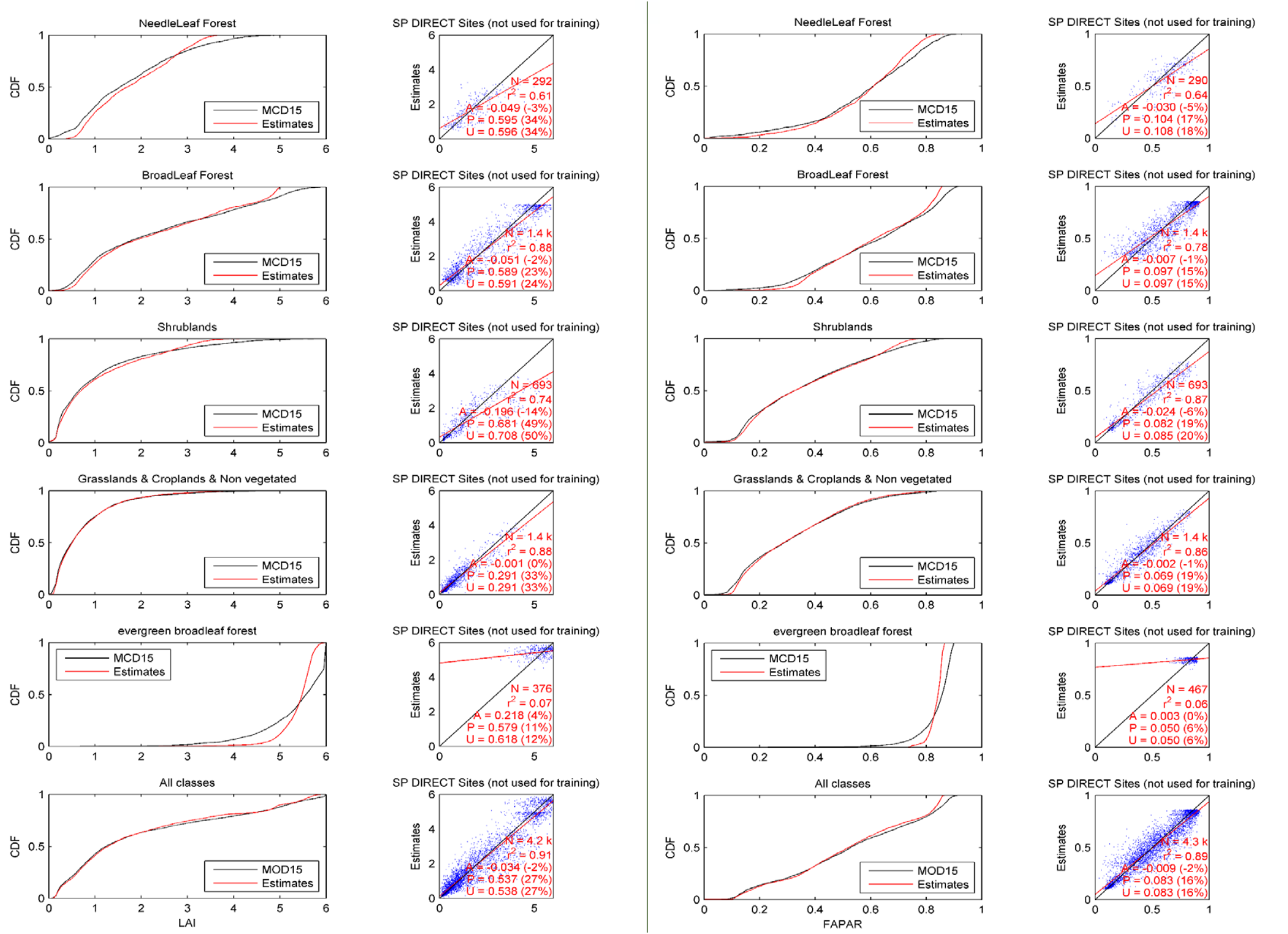Fig.: Timeline of the AVHRR constellation. The number report the number of the NOAA platform

Fig.: Algorithm flowchart.

ANN Calibration

BELMANIP-2 and DIRECT network sites location

Fig.: Theoretical performances of the LAI (left) and FAPAR (right) retrieval.

Table: description of the Quality Control Layer

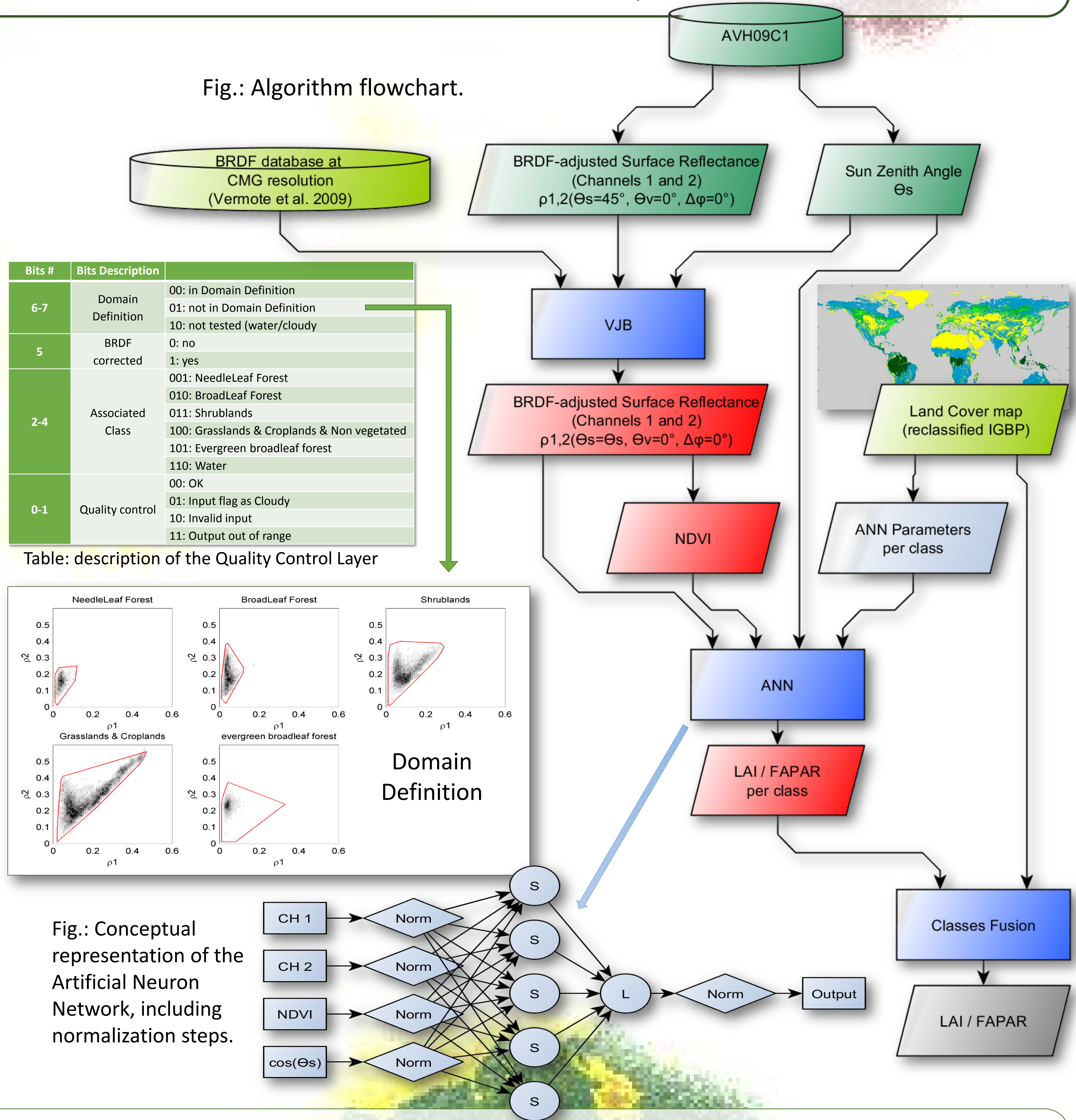| Bits #	Bits Description	
6-7	Domain Definition	00: in Domain Definition
		01: not in Domain Definition
		10: not tested (water/cloudy)
5	BRDF corrected	0: no
		1: yes
2-4	Associated Class	001: NeedleLeaf Forest
		010: BroadLeaf Forest
		011: Shrublands
		100: Grasslands & Croplands & Non vegetated
		101: Evergreen broadleaf forest
		110: Water
0-1	Quality control	00: OK
		01: Input flag as Cloudy
		10: Invalid input
		11: Output out of range

Domain Definition

Fig.: Conceptual representation of the Artificial Neuron Network, including normalization steps.

CDR Validation

NOAA16 vs NOAA18 retreivals comparison

In situ validation using the DIRECT network

Table: Validation Scores based on the DIRECT in situ measurement network
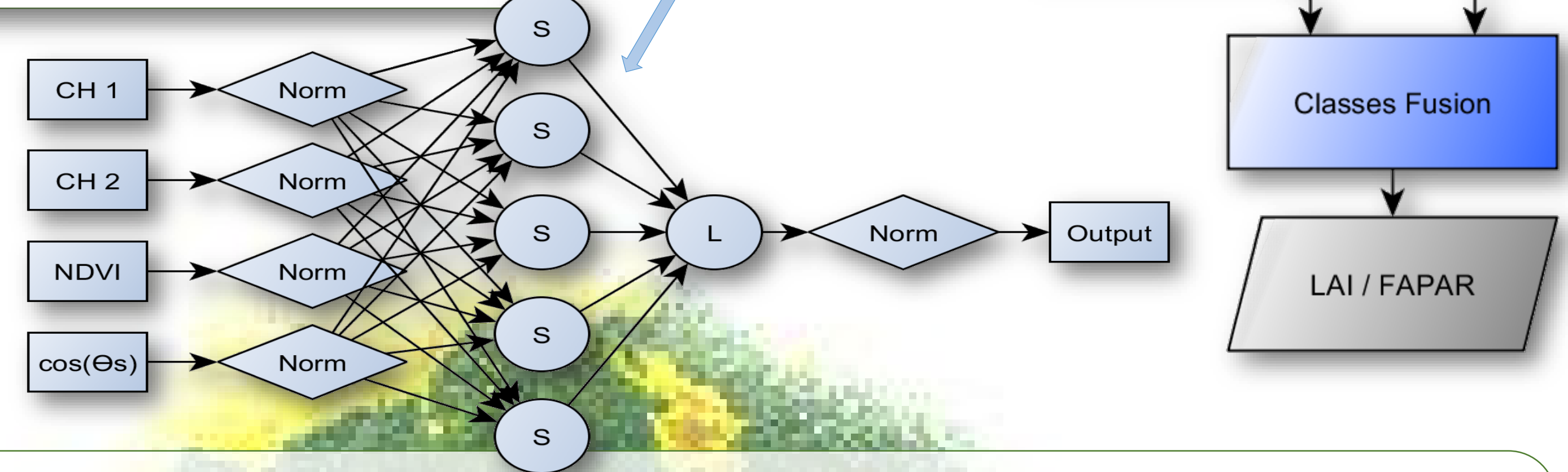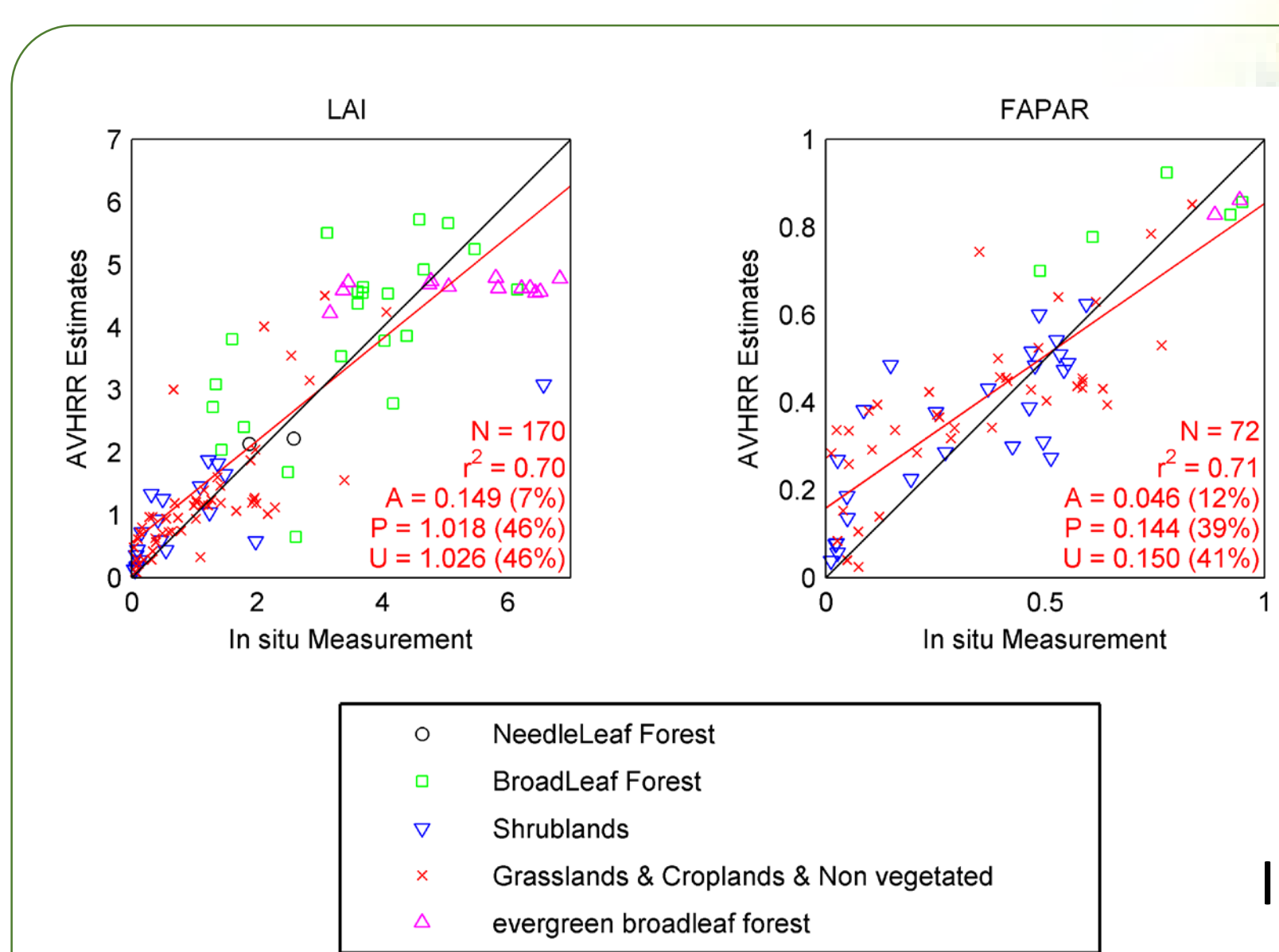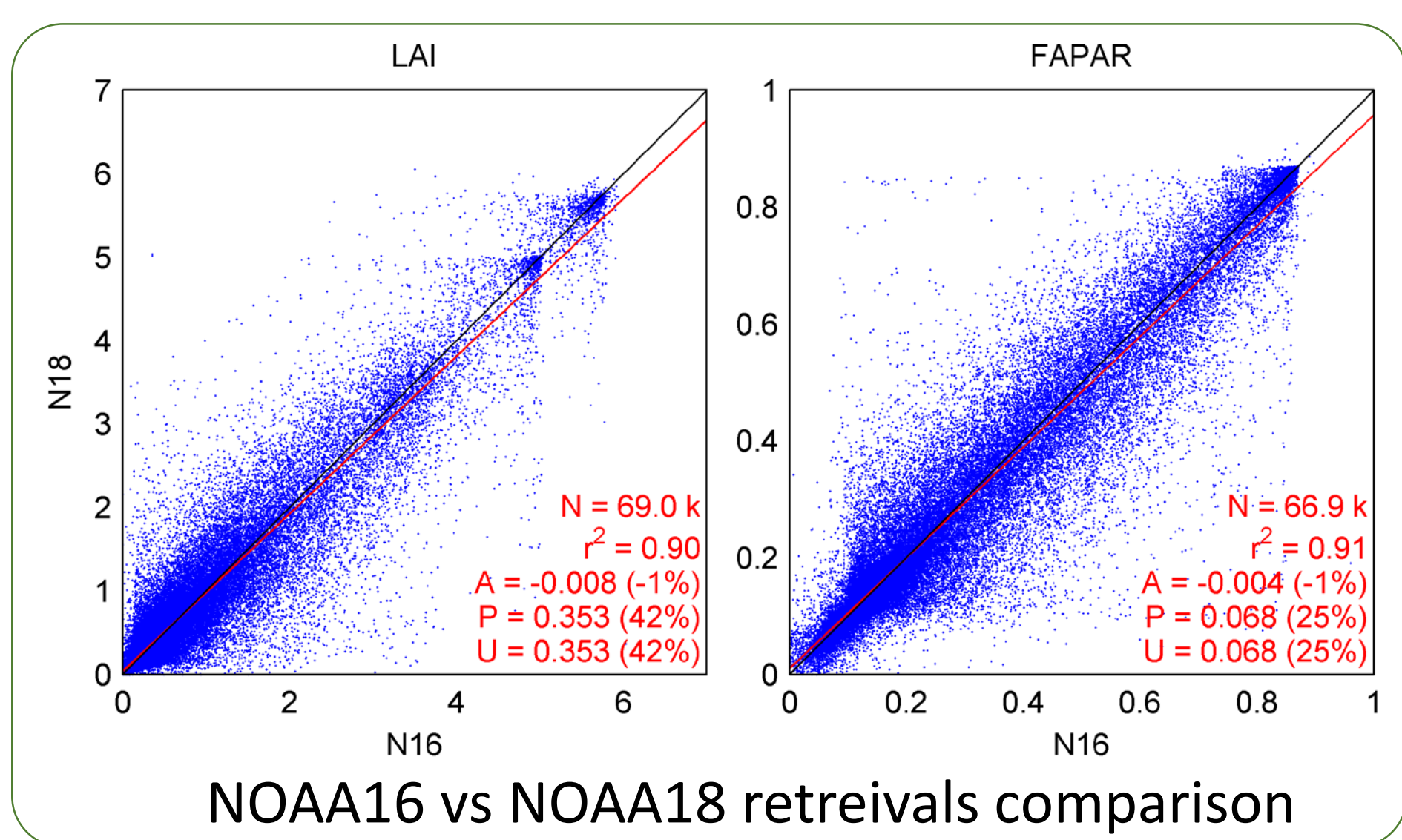
Class	LAI				FAPAR			
	A	P	U	N	A	P	U	N
NeedleLeaf Forest	-0.04	0.44	0.31	2				0
BroadLeaf Forest	0.39	1.15	1.18	22	0.07	0.15	0.15	5
Shrublands	0.02	0.96	0.93	20	0.04	0.13	0.13	25
Grasslands & Croplands & Non vegetated	0.11	0.69	0.69	51	0.05	0.15	0.16	40
evergreen broadleaf forest	-0.81	1.35	1.53	14	-0.07	0.02	0.07	2
All	0.13	1.04	1.05	171	0.05	0.14	0.15	72

http://www.ncdc.noaa.gov/cdr/operationalcdrs.html

1982

1992

2002

2012

Annual Maximum LAI