Claims

[1] A rice agriculture management apparatus, comprising:

a satellite data acquisition unit that acquires one or more types of satellite data of a paddy;

a water index calculation unit that calculates a daily water index for each of water management plots in the paddy based on the satellite data; and

a status classification unit that classifies a daily status of each of the water management plots as wet, dry, cloud-covered, snow, or no observation based on the water index and the satellite data.

[2] The rice agriculture management apparatus according to claim 1, wherein

the water index calculation unit includes

a first water index calculation unit that calculates a modified normalized difference water index (MNDWI) and a land surface water index (LSWI) based on optical bandwidth data being the satellite data, the optical bandwidth data including light band data of visible light, near infrared light, and shortwave infrared light, and/or

a third water index calculation unit that calculates the MNDWI and the LSWI based on optical bandwidth data being the satellite data by using a neural network, the optical bandwidth data including light band data of visible light and near infrared light, and

a second water index calculation unit that calculates the LSWI based on radar data being the satellite data, and

the status classification unit classifies the status

based on the MNDWI and the LSWI calculated by the first water index calculation unit and/or the third water index calculation unit and based on the LSWI calculated by the second water index calculation unit.

[3] The rice agriculture management apparatus according to claim 1, wherein

the one or more types of satellite data include Sentinel-2 data, LandSat-9 data, Sentinel-1 data, and/or PlanetScope data.

[4] The rice agriculture management apparatus according to claim 1, further comprising

a calendar generation unit that generates a calendar that displays a status of each of the water management plots on a daily basis separately.

[5] The rice agriculture management apparatus according to claim 4, wherein

the calendar displays days of wet, dry, cloud-covered, snow, or no observation separately for each day.

[6] The rice agriculture management apparatus according to claim 4, wherein

the calendar is a two-dimensional matrix of cells arrayed in a grid pattern, one cell indicates one day, the cells are continuous from a first day to a last day without omitting a single day, one axis of the two-dimensional matrix indicates weeks, and another axis continuously indicates a year without separating continuous months on an array.

[7] The rice agriculture management apparatus according to claim 6, wherein

the calendar displays different statuses in different

patterns by filling the cells in different patterns to display the statuses separately.

[8] The rice agriculture management apparatus according to claim 6, further comprising

an analysis unit that determines, as a drainage period, a period of a largest number of days among periods each including at least a predetermined number of continuous days during a specific time period, including no wet days, having a ratio of dry days in the period equal to or larger than a threshold value, and including both a first day and a last day being dry days.

[9] The rice agriculture management apparatus according to claim 8, wherein

the calendar generation unit further displays the drainage period superimposed on the calendar of the two-dimensional matrix.

[10] The rice agriculture management apparatus according to claim 8, wherein

the analysis unit analyzes one of continuous irrigation, mid-season drainage (nakaboshi in Japanese), or intermittent irrigation.

[11] The rice agriculture management apparatus according to claim 8, wherein

the analysis unit analyzes, by analyzing drainage periods of continuous years, a recommended start date of a future drainage period, a recommended number of days of a drainage period, a recommended remaining duration days of an ongoing drainage period, and/or whether or not a target is achieved after implementation of a drainage period.

[12] The rice agriculture management apparatus according to claim 1, further comprising

a water level estimation unit that estimates daily positive and negative water levels based on the satellite data, by machine learning the satellite data by using water level measurements by an IoT sensor and/or a water tube installed in the paddy as training data.

[13] The rice agriculture management apparatus according to claim 12, further comprising

an emissions estimation unit that estimates daily greenhouse gas emissions based on the daily positive and negative water levels.

[14] A rice agriculture management method, comprising:

by a computer,

acquiring one or more types of satellite data of a paddy;

calculating a daily water index for each of water management plots in the paddy based on the satellite data; and

classifying a daily status of each of the water management plots as wet, dry, cloud-covered, snow, or no observation based on the water index and the satellite data.

[15] A rice agriculture management system, comprising:

a plurality of information processing apparatuses,

the plurality of information processing apparatuses being configured to function as

a satellite data acquisition unit that acquires one or more types of satellite data of a paddy,

a water index calculation unit that calculates a daily water index for each of water management plots in the paddy based on the satellite data, and

a status classification unit that classifies a daily status of each of the water management plots as wet, dry, cloud-covered, snow, or no observation based on the water index and the satellite data.