estimating measurement data on scattered waves radiated from the measurement area in relation to waves that are incident on the measurement area when the condition in the measurement area is known is called a forward problem and is easy. However, obtaining the condition in the measurement area when measurement data on scattered waves is known is called an inverse problem and is not easy.

[0006]

When the measurement area is in the atmosphere, the density of the atmosphere differs depending on altitude, so waves incident on the measurement area may not travel straight. Therefore, when the measurement area is in the atmosphere, it is not easy to image an object using waves and scattered waves.

[0007]

In view of this, embodiments of the present disclosure provide an imaging device or the like that is capable of imaging an object in the measurement area in the atmosphere with high accuracy.

[Solution to Problem]

[0008]

According to a first aspect of the present disclosure, there is provided an imaging device including: a plurality of transmitters that each transmit a wave to a measurement area in an atmosphere; a plurality of receivers that each receive a scattered wave of the wave from the measurement area; and an information processing circuit that images an object in the measurement area using measurement data of the scattered wave. In imaging the object, the information processing circuit: derives, using the measurement data, a scattering field function that receives a transmission position of the wave and a reception position of the scattered wave as input and outputs an amount of the scattered wave at the reception position; derives an imaging function that receives an imaging target position as input and outputs an image intensity at the imaging target position, and is defined using an amount output from the scattering field function in response to inputting the imaging target position into the scattering field function as the transmission position and the reception position; and images the object in the measurement area using the imaging function. In deriving the scattering field function, the information processing circuit reflects in the scattering field function that a wavenumber of the wave changes as a refractive index in the atmosphere changes with height in the atmosphere.

[0008a]

According to a second aspect of the present disclosure, there is provided an imaging method including: transmitting, by each of a plurality of transmitters, a wave to a measurement area in an atmosphere; receiving, by each of a plurality of receivers, a scattered wave of the wave from the measurement area; and

imaging an object in the measurement area using measurement data of the scattered wave, wherein the imaging of the object includes: deriving, using the measurement data, a scattering field function that receives a transmission position of the wave and a reception position of the scattered wave as input and outputs an amount of the scattered wave at the reception position; deriving an imaging function that receives an imaging target position as input and outputs an image intensity at the imaging target position, and is defined using an amount output from the scattering field function in response to inputting the imaging target position into the scattering field function as the transmission position and the reception position; and imaging the object in the measurement area using the imaging function, and the deriving of the scattering field function includes reflecting in the scattering field function that a wavenumber of the wave changes as a refractive index in the atmosphere changes with height in the atmosphere.

[0009]

These general or specific aspects may be implemented as a system, a device or apparatus, a method, an integrated circuit, a computer program, or a non-transitory computer-readable recording medium such as a CD-ROM, or any combination thereof.

[Advantageous Effects of Invention]

[0010]

According to embodiments of the present disclosure, it is possible to image an object in the measurement area in the atmosphere with high accuracy.

[Brief Description of Drawings]

[0011]

[FIG. 1]

FIG. 1 is a conceptual diagram showing a one-dimensional multistatic array antenna.

[FIG. 2]

FIG. 2 is a conceptual diagram showing the relationship between a transmission point and a reception point in a plane.

[FIG. 3]

FIG. 3 is a conceptual diagram showing an example of coordinates relating to a semi-two-dimensional array antenna.

[FIG. 4]

FIG. 4 is a simulation diagram illustrating the trajectory of a 1 GHz electromagnetic wave radiated at a radiation angle of 1° from the ground surface.

[FIG. 5]

FIG. 5 is a simulation diagram illustrating the trajectory of a 1 GHz electromagnetic wave radiated at a radiation angle of 2.56° from the ground surface.

[FIG. 6]