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Scintec Flat Array Sodars

Site Preparation Manual

SFAS, MFAS, XFAS

including RASS RAE1
and windRASS

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1 SITE SELECTION

When setting up a sodar with optional (wind)RASS system, the following siting aspects should be considered:

1.1 Environmental noise

Since the sodar evaluates acoustic backscatter signals of very small amplitude, it is important to operate the instrument in a quiet environment. In particular, this refers to noise in the range of the frequencies sensed, i.e. the selected operation frequencies. Typical noise sources are: machines and engines (such as air conditioning units), traffic, airplanes, wind at obstacles (whispering trees), and birds or other wildlife.

Antenna enclosures reduce the susceptibility to noise sources close to the ground. Therefore noisy environments will require a large acoustic enclosure.

RASS and windRASS measurements are not sensitive to environmental noise.

1.2 Sound emitted by Sodar

A sodar emits strong audible sound pulses which might disturb persons in the vicinity of the antenna during operation or nearby residents. This should be kept in mind when selecting a site near buildings or public areas. The potentially disturbing noise generated by the sodar and (wind)RASS mainly stems from the antenna sidelobes. This noise can be significantly reduced by using an antenna enclosure or even more by using a freestanding enclosure. Also, an installation of the sodar on platforms several meters above the ground can reduce the emitted noise. In the shaded mode, due to sidelobe suppression, the antenna generally emits less noise than in the non-shaded mode.

1.3 Fixed echoes

Higher obstacles like buildings, trees or hills within the sensing range of the sodar may reflect sound pulses and disturb the measurements. This effect is called "fixed echo", "ground clutter" or "passive noise". It is the most common source of problems with sodar measurements in general.

Even though Scintec Flat Array Sodars have implemented fixed echo identifications and corrections, fixed echoes nevertheless may result in limitations of the measurement capability or accuracy. With fixed echoes, typically a reduction of the measured wind velocities is observed due to the (usually) zero velocity of the reflecting surfaces at the respective height or distance. In addition, increased backscatter values typically result.

The first choice to eliminate fixed echoes is the use of a large acoustic enclosure. In many cases, increasing the installation height of the antenna can also help. Generally, the antenna should be operated in shaded mode when there are fixed echoes. Rotating the antenna, using other emission angles or changing the operation frequencies are also standard procedures to reduce the fixed echo amplitudes (see Figure 1). This, however, requires a careful investigation of sodar returns with different antenna orientations and operation parameters.

RASS and windRASS measurements are not sensitive to ground clutter.

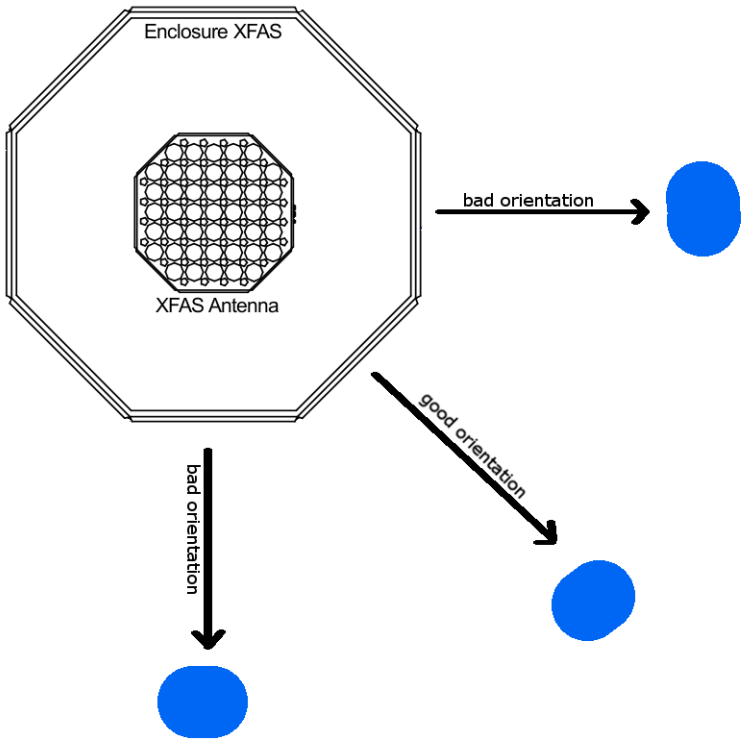

Figure 1: Orientation of the Sodar antenna to reduce interference from potential fixed echoe sources (marked in blue)

1.4 Resonant objects

Potentially disturbing resonances are caused by small (usually metal) objects close to the antenna. For example a tiny resonant antenna used for remote data transmission close to the acoustic beam may respond to an acoustic pulse for a fraction of a second and strongly deteriorate all sodar data below 100 m or 200 m measurement height.

Because resonances are strongest when stimulated with exactly the emitted frequency and the emitted frequencies vary during operation, a resonance tends to generate a too low wind speeds, as with fixed echoes. Therefore resonances and fixed echoes often have an identical appearance in measured data.

Even very weak resonances are potentially troublesome. Hence do not place any metal objects inside or above the acoustic enclosure. Sometimes you can check the resonances of a metal object by slightly hitting it with a pen. If you here the weakest tone afterwards, this object can be considered a potential cause of serious measurement errors.

Resonance problems are very common with metal platforms or trailers even if the resonance objects are outside the acoustic enclosure or below the antenna. The construction of a sufficiently damped trailer or platform is a major task and needs a careful design and testing procedure. Note that most trailers or metal platforms built for sodar applications fail the initial testing. This does not mean it is impossible to build a suitable trailer or platform but it will need more time and effort than you may have expected.

2 SITE PREPARATION

2.1 Area Size and Flatness

Choose an unobstructed area for the sodar system with at least the following size:

Sodar	Enclosure / extension	Area size
SFAS	with small enclosure	1.0 x 1.0 m
	with large enclosure	3.5 x 3.5 m
	with small/large enclosure and RASS	9.1 x 14.0 m
	with large enclosure and windRASS	9.0 x 9.0 m
MFAS	with small enclosure	2.0 x 2.0 m
	with large enclosure	9.0 x 9.0 m
	with small/large enclosure and RASS	9.1 x 14.0 m
	with large enclosure and windRASS	9.0 x 9.0 m
XFAS	with large enclosure	9.1 x 9.1 m
	with RASS	9.1 x 14.0 m

The surface must be flat and even (horizontal). The maximum deviations from the true horizontal for the following positions are:

- Anchor point of the guy wires +/- 20 mm
- Position of the large enclosure +/- 5 mm
- Position of the sodar antenna +/- 2 mm

If the installation is permanent, it is recommended to use a concrete base foundation for the sodar with optional (wind)RASS system. The thickness and concrete reinforcement required for this foundation must be engineered to adjust for the soils present at the site. Unstable soils like sand, tundra or expansive soils require special accommodations in foundation design.

2.2 Carrying and Hauling Capacity

The surface must be able to carry the load of the antenna and the large enclosure. The minimum carrying capacities are:

- Large enclosure 3 kg / cm²
- SFAS antenna 1 kg / cm²
- MFAS antenna 1 kg / cm²
- XFAS antenna 3 kg / cm²

The surface must be able to hold the guy wire anchors and to mount the enclosure base panels. The minimum hauling capabilities of the guy wire anchors and the enclosure base panel mounting points are:

- Guy wire anchors 500 kg (or 5000 N)
- Large enclosure base 200 kg (or 2000 N)

2.3 Additional Mounting Screws and Anchors

The tent pegs shipped with the enclosure are only for low wind speeds and temporary installation and will not provide sufficient stability in every kind of surface. For example, they cannot be used in sand or mud.

The customer must provide guy wire anchors fitting the ground surface. The guy wire anchors must hold the guy wires having a diameter of 5 mm. The guy wire anchors, when mounted to the ground by the customer, must provide the surface hauling capacity specified in the paragraph above.

The customer must provide enclosure base panel mounting screws fitting the type of ground surface. The screws must have a diameter between 8 mm and 10 mm. The screws, when mounted to the ground by the customer, must provide the surface hauling capacity specified above.