1
00:00:07,340 --> 00:00:09,340
[Music]

2
00:00:10,516 --> 00:00:18,216
[Foreign Language Spoken]

3
00:00:20,400 --> 00:00:22,400
[Airplane Engine]

4
00:00:23,516 --> 00:00:36,500
[Background Conversations]

5
00:00:40,166 --> 00:00:42,366
>> We're trying to understand
the global carbon cycle,

6
00:00:42,676 --> 00:00:47,396
and we're trying to understand
climate change and the effect

7
00:00:47,396 --> 00:00:50,646
that climate change might have
on our planet in the future.

8
00:00:50,866 --> 00:00:52,436
>> The main question
we're trying

9
00:00:52,496 --> 00:00:55,786
to answer here is how
much carbon is stored

10
00:00:55,856 --> 00:00:57,196
in the forest ecosystems.

11
00:00:58,026 --> 00:01:01,586
We understand very well what's
happening in the atmosphere

12
00:01:01,686 --> 00:01:04,536
and the oceans but not
so much forested sites.

13
00:01:05,626 --> 00:01:08,736
>> And when it comes to forest
structure in particular,

14
00:01:08,736 --> 00:01:11,076
there is a huge hole
over Africa.

15
00:01:11,076 --> 00:01:14,896
We don't have the data that
we need anywhere in Africa.

16
00:01:16,216 --> 00:01:19,476
>> The one element that's
missing is us being able

17
00:01:19,526 --> 00:01:22,086
to map the vertical
structure of forests.

18
00:01:22,986 --> 00:01:26,086
When you look at an image, you
can tell there's forest there,

19
00:01:26,086 --> 00:01:29,846
you can tell it's green, but
we don't know how tall it is.

20
00:01:30,056 --> 00:01:33,996
If we can tell how tall it is,
then that's a very good proxy

21
00:01:34,366 --> 00:01:38,086
for how much it weighs and
with that you can infer biomass

22
00:01:38,806 --> 00:01:40,876
and with that you
can infer carbon.

23
00:01:41,756 --> 00:01:44,996
>> NASA has a few upcoming
missions to look at this,

24
00:01:44,996 --> 00:01:47,066
and so does the European
Space Agency.

25
00:01:47,426 --> 00:01:49,486
We have lots of different
things we're putting in space,

26
00:01:49,946 --> 00:01:52,126
but one of the main goals
of all of these missions is

27
00:01:52,166 --> 00:01:54,636
to count how much carbon is
stored in the earth's forests.

28
00:01:55,186 --> 00:01:58,636
So how we do that is essentially
measure how big the trees are.

29
00:01:58,736 --> 00:02:01,506
Especially here in the tropics,
most of the carbon is stored

30
00:02:01,606 --> 00:02:03,536
in the tree trunks
and above the ground,

31
00:02:04,016 --> 00:02:07,586
so we're measuring how fat the
trees are, how tall they are,

32
00:02:07,586 --> 00:02:11,170
and then comparing that to
our spaceborne measurements.

33
00:02:11,676 --> 00:02:12,966
>> 51.3.

34
00:02:13,686 --> 00:02:14,776
>> The picture is degraded,

35
00:02:14,826 --> 00:02:17,746
but it shows the carbon
cycling of the forest.

36
00:02:18,216 --> 00:02:22,106
The sun and the light would
actually shine on this forest

37
00:02:22,496 --> 00:02:24,976
and they absorb the
carbon from the atmosphere,

38
00:02:25,066 --> 00:02:27,816
from the photosynthetic
activities, and they grow.

39
00:02:28,446 --> 00:02:29,816
So as the forest grows,

40
00:02:30,266 --> 00:02:32,926
we capture more carbon
from the atmosphere.

41
00:02:32,926 --> 00:02:34,686
So the forests are
extremely important

42
00:02:35,136 --> 00:02:38,126
for global carbon cycle and

climate change because we --

43
00:02:38,516 --> 00:02:41,046
by having the forest,
we mitigate part

44
00:02:41,896 --> 00:02:45,206
of the carbon we put
in the atmosphere

45
00:02:45,206 --> 00:02:48,296
from our cars and our factories.

46
00:02:49,516 --> 00:02:54,546
[Airplane Engine]

47
00:02:55,046 --> 00:02:56,946
>> There is a very big effort

48
00:02:56,986 --> 00:03:00,446
to integrate the remote sensing
imagery with ground data.

49
00:03:01,196 --> 00:03:05,016
What we can get from remote
sensing is the vertical

50
00:03:05,106 --> 00:03:09,356
structure of the forest, but we
need people on the ground to tie

51
00:03:09,400 --> 00:03:12,410
that information to biomass.

52
00:03:12,826 --> 00:03:15,206
The biomass is what
we're really after.

53
00:03:15,756 --> 00:03:18,956

And with ground plots, we
can make that connection

54
00:03:19,026 --> 00:03:23,396
between a height in the
particular plot and the biomass.

55
00:03:26,536 --> 00:03:29,126
>> So when we are
looking at the forest,

56
00:03:29,126 --> 00:03:32,306
we are very much interested
in this trip to look

57
00:03:32,306 --> 00:03:33,926
at the structure of the forest.

58
00:03:34,046 --> 00:03:40,136
The trees have irregular shape,
but the volume of the trees

59
00:03:40,136 --> 00:03:42,556
and the size of the trees is
extremely important for us

60
00:03:42,556 --> 00:03:46,686
because that tells us what
would be the mass of the forest.

61
00:03:46,686 --> 00:03:50,026
So if we measure the diameter
of the trees and tree height

62
00:03:50,286 --> 00:03:54,086
and know the wood density of
the trees, we get an estimate

63
00:03:54,086 --> 00:03:56,746
of the mass of the

tree, and almost half

64
00:03:56,746 --> 00:03:58,976
of the mass is carbon.

65
00:03:59,046 --> 00:04:03,016
So by measuring the size,
we actually get an estimate

66
00:04:03,016 --> 00:04:05,896
of the carbon in the forest,
and that helps us a lot

67
00:04:06,406 --> 00:04:10,186
to use our measurements
from the airborne sensors

68
00:04:10,326 --> 00:04:12,786
and from the satellites
to calibrate

69
00:04:12,846 --> 00:04:14,676
with that carbon on the ground.

70
00:04:19,036 --> 00:04:23,196
>> The mangroves
in Gabon are one

71
00:04:23,466 --> 00:04:25,956
of the tallest mangroves
in the world.

72
00:04:27,136 --> 00:04:29,976
We are interested to know
how the water circulates

73
00:04:29,976 --> 00:04:33,716
within this ecosystem, how it
comes in and out of the system.

74
00:04:34,146 --> 00:04:36,566
So once we understand the
hydrology of these systems,

75
00:04:37,116 --> 00:04:42,776
it helps us also understand how
these ecosystem really work.

76
00:04:43,556 --> 00:04:45,516
And what drives their
productivity.

77
00:04:45,926 --> 00:04:48,426
These mangroves are some

78
00:04:48,426 --> 00:04:51,106
of the most productive
ecosystems on earth.

79
00:04:51,606 --> 00:04:54,716
They stock a huge amount
of carbon, of which most

80
00:04:55,016 --> 00:05:00,426
of it is located and
captured in the soils.

81
00:05:03,206 --> 00:05:07,106
The advantage of the
airborne campaign

82
00:05:07,106 --> 00:05:12,556
over any other observations,
like spaceborne observations,

83
00:05:13,706 --> 00:05:15,976
is with airborne you can
go wherever you want,

84

00:05:16,266 --> 00:05:16,976
whenever you want.

85
00:05:17,556 --> 00:05:22,646
You can have almost real time
and designated campaign just

86
00:05:22,746 --> 00:05:26,816
to observe a given
phenomenon, like this one here,

87
00:05:26,816 --> 00:05:28,196
which is a mangrove ecosystem.

88
00:05:29,006 --> 00:05:33,366
What happens in these systems,
which are driven by hydrology,

89
00:05:33,986 --> 00:05:37,926
is that you have tidal
impact that comes in and out

90
00:05:38,206 --> 00:05:39,836
of these ecosystems twice a day.

91
00:05:40,136 --> 00:05:41,336
It's extremely dynamic.

92
00:05:42,026 --> 00:05:44,366
>> So you see where
the roots are dark,

93
00:05:44,546 --> 00:05:45,956
that's how high the tide goes.

94
00:05:46,406 --> 00:05:50,206
>> And you can only monitor
this kind of ecosystem

95

00:05:50,276 --> 00:05:51,476
with airborne sensors.

96
00:05:52,136 --> 00:05:56,046
The spaceborne sensors have
repeat pass periods in the order

97
00:05:56,046 --> 00:05:57,436
of weeks to months,

98
00:05:57,896 --> 00:06:02,246
so the airborne campaign
is optimum for that.

99
00:06:02,706 --> 00:06:06,936
In particular, the UAVSAR, we
are not only using it to try

100
00:06:07,036 --> 00:06:09,176
to estimate forest canopy height

101
00:06:09,786 --> 00:06:12,936
but we are also developing this
new technique whereby we can

102
00:06:13,176 --> 00:06:17,916
measure water level with
repeat pass interferometry.

103
00:06:17,916 --> 00:06:22,246
So we cover the same area
during a full tidal cycle

104
00:06:22,866 --> 00:06:26,856
as the water rises and
retreats from the ecosystem,

105
00:06:27,576 --> 00:06:33,616
and the UAVSAR can actually give
you this sort of measurement.

106
00:06:33,616 --> 00:06:36,606
We will be able to measure
the relative change in height

107
00:06:36,866 --> 00:06:38,946
of the water within
the ecosystems.

108
00:06:39,196 --> 00:06:42,706
And here we're setting up
probes in these systems

109
00:06:43,426 --> 00:06:49,286
that will be used in the
validation of the data sets

110
00:06:49,406 --> 00:06:51,156
and the measurement
from the UAVSAR.

111
00:06:53,606 --> 00:06:57,106
>> We use these data
to get a feeling

112
00:06:57,106 --> 00:07:00,976
for what the radar
images, the final product,

113
00:07:01,036 --> 00:07:04,896
is going to look like, and
we also provide these images

114
00:07:05,156 --> 00:07:08,956
to researchers on the ground
so they can decide where to go

115
00:07:08,956 --> 00:07:10,006
to do their field work.

116
00:07:10,626 --> 00:07:15,306
This is a region that's very
hard to do field work at,

117
00:07:15,556 --> 00:07:19,446
so the researchers have to be
smart about deciding a place

118
00:07:19,616 --> 00:07:21,876
to establish their field plots.

119
00:07:22,380 --> 00:07:24,800
Music

120
00:07:26,360 --> 00:07:29,360
We want to map forest
biomass globally,

121
00:07:29,726 --> 00:07:34,616
and the ultimate goal is to tie
that into the carbon cycles.

122
00:07:35,156 --> 00:07:37,976
It's important to understand
how that changes in space

123
00:07:38,136 --> 00:07:41,566
and in time, because this
will have consequences

124
00:07:41,796 --> 00:07:43,496
for management and policy.

125
00:07:44,086 --> 00:07:48,776
And in order to do that, we
need to see what the biomass is

126
00:07:49,466 --> 00:07:52,766
in different places of the

world and how forests respond

127
00:07:53,326 --> 00:07:56,206
to changes in climate and
changes in management.

128
00:07:57,636 --> 00:07:59,516
>> And now that we're,
you know, very interested

129
00:07:59,516 --> 00:08:02,706
in doing carbon accounting,
we've also found

130
00:08:02,706 --> 00:08:06,026
that mangroves store
large amounts of carbon,

131
00:08:06,026 --> 00:08:09,456
not only in the trees, and these
trees here in Gabon are huge,

132
00:08:09,516 --> 00:08:13,186
so they have a lot of carbon
in their trunks and their

133
00:08:13,186 --> 00:08:15,626
above ground biomass,
but there's also a lot

134
00:08:15,626 --> 00:08:18,416
of carbon that's stored
in the soils here.

135
00:08:19,746 --> 00:08:25,036
It's really, I think, important
to be able to try to account

136
00:08:25,036 --> 00:08:29,606
for that, so that we can

continue protecting them

137
00:08:31,136 --> 00:08:33,506
and just get a better
understanding